BEFORE THE NATIONAL GREEN TRIBUNAL, NEW DELHI
(PRINCIPAL BENCH)

OA no 1118/2024

IN THE MATTER OF:

"News Item titled "Clean Ganga Mission head flags, extremely slow, pace of project expenditures" appearing in The Hindu dated 19.08.2024"

I N D E X

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Place: New Delhi

Date: 17th February, 2026

For

Through Counsel

Gigi.C.George

Advocate & CGSC

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(1)

BEFORE THE NATIONAL GREEN TRIBUNAL,
(PRINCIPAL BENCH) NEW DELHI

OA no 1118/2024

IN THE MATTER OF:

"News Item titled "Clean Ganga Mission head flags, extremely slow, pace of project expenditures" appearing in The Hindu dated 19.08.2024"

Reply Affidavit on behalf of Respondent National Mission for Clean Ganga (NMCG) and Department of Water Resources, River Development and Ganga Rejuvenation Ministry of Jal Shakti, (Respondent No 3 & 4 respectively)

Most Respectfully, I, Brijendra Swaroop, son of Late Shri M.P Srivastava, aged 58 years, Resident of D-1 , Tower –I, New Moti Bagh, New Delhi-110021, working as Executive Director (Projects) in the National Mission for Clean Ganga (NMCG), D/o WR, RD&GR, Ministry of Jal Shakti do hereby solemnly affirm, and declare as under:

1.That I, the deponent is working as Executive Director (Projects) in the NMCG and well conversant with the facts and circumstances of the present case on the basis of the information derived from the official records, and competent to submit this affidavit on behalf of the answering Respondent, NMCG.

2. That it is submitted that in the instant matter this Hon'ble Tribunal is considering, amongst other, the issue of the pace of projects, being executed under the "Namami Gange Programme(NGP) "in the development of sewage-management infrastructure. This Hon'ble Tribunal vide order dated 10.11.2025, has inter-alia directed NMCG, Respondent no 3, to file a report on the following aspects:

3.(a) if the tapping of storm water drains is permissible as a permanent measure because such tapping will not only affect the storm water discharge network but will also result in over flowing of these storm water drains if the sewage drains are connected with the same and it will also violate the orders of the court prohibiting discharge of sewage to the storm water drain and will result in over flooding of the STPs during the rainy season and consequential flowing of untreated sewage in the rivers and natural water course;

(b) . If any STP has been permitted on the flood plain zones of River Ganga or its tributaries and if any such STP has been financed by the NMCG;

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App. By Delhi High Court
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To 31-03-2026
Patiala House Courts (New Delhi)

बृजेन्द्र स्वरूप/Brijendra Swaroop
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जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
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भारत सरकार, नई दिल्ली/Govt. of India, New Delhi

(2)

(c) The stretches of River Ganga and its tributaries where the flood plains have been demarcated.

4 That in the above context it is submitted for consideration of this Hon'ble Tribunal in seriatim as under:

(1) That as regards 3(a), it is submitted that the national frameworks, guidelines, and knowledge documents which supports that the Interception & Diversion (I&D) approach is a widely recognized as an interim and unavoidable measure for mitigating the need for an urban wastewater management and river rejuvenation. In the lean flow conditions of the river that prevail for nearly 9 to 10 months in a year, the I&D approach ensures that the untreated water is not discharged directly to the river thereby giving relief to the river. The STPs are designed for certain influent pollutant concentration (mg/l) and hydraulic flow (l/d), jointly referred to as pollution load (kg/d), which allows them to have certain elasticity/flexibility to address 'partially increased hydraulic flow with weak sewage as the actual pollution load would still be under the designed pollution load.

The answering respondent in this regard further refers to the following historical background and the documents collectively to establish that Interception & Diversion (I&D) is an accepted transitional solution with a view to pursuing the sewerage and treatment systems as an interim arrangement. Namami Gange Program (NGP) succeeded Ganga Action Plan (1985). Meanwhile, multiple national frameworks (MoHUA, CPCB, NITI Aayog, World Bank, and technical organizations (CSE(, (IWA) have been recognizing the tapping of drains and diversion of these drains to the Sewage Treatment Plants (STPs) as interim measure because of unavoidable situations to address the sanitation issues. In this regard, reference may be invited to the Schemes/guidelines.

a) AMRUT 2.0 Operational Guidelines- These guidelines/schemes emphasize not only universal sewerage coverage but acknowledge that in dense or complex urban areas, interim solutions such as; |&D, pumping, and conveyance to centralized STPs are required until full sewer connectivity is achieved. Thus, "AMRUT", promotes non-networked, short-term sanitation arrangements to reduce direct discharge into waterbodies before full sewer networks are built-up and /or laid in the areas. (Reference is invited to Sl no. 2 at Para 4.1; pg-10 of the Guidelines-Annex-1)

b) Central Pollution Control Board (CPCB), under the Water Act, 1974, as amended from time to time, is mandated to take measures for the prevention, control and abatement of pollution at national level. The CPCB has framed Indicative Guidelines on Restoration of Water Bodies, identify drain interception,

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जल शक्ति मंत्रालय
भारत सरकार, नई दिल्ली
09.02.2026

(3)

screen installation, diversion structures, and provisional pumping as critical first steps for preventing pollutant loads from entering rivers. Further, it is submitted that it recommends preparation of DPR based on I&D approach for Sewage management. (Reference is invited to Para 3.c; table at para 5.6 D pg-34 of the Guidelines-Annex-2)

c) NITI Aayog: "Urban Wastewater Scenario NITI Aayog: "Urban Wastewater Scenario in India" (2022)- The document acknowledges that in the States large proportion of cities lack full sewer networks; therefore, transitional measures like I&D feeding into existing or new treatment facilities are essential to reduce BOD load. It has been highlighted that drain-by-drain strategies are effective approaches in cities with fragmented sanitation infrastructure where laying of sewerage pipe line is not feasible. (Reference to Para 4.3.3, pg-48 of the Document-Annex-3)

d) Swachh Bharat Mission Operational Guidelines, 2021- The document emphasizes the need for immediate interventions—including drain diversion, de-silting, and pumping—to protect water bodies while long-term infrastructure is created. This approach promotes citywide inclusive sanitation, where all pathways of wastewater (including flowing drains) need to be managed. (Para 7.5-ii, pg-56; Para 7.6.1 (2), pg- 57; Para 7.6.2 (2), pg 58 of the Guidelines-Annex-4)

e) NMCG/World Bank — Second National Ganga River Basin Project duly considered the concept of the |&D for tackling the problem arising from the

major drains, as key transitional interventions in Ganga Basin towns. The World Bank-supported basin studies stress that flow diversion, pumping, and temporary routing to STPs is needed where network capacity is yet to be realized. (Para 56, pg-25; Para 115, pg- 41-Annex-5)

f) It is not out of place to mention that in some of the reputed and well-known journals/studies including (i) CSE (Mar 2025) report published in Down to Earth, demonstrates field evidence that intercepting drains, temporarily diverting flow, and capturing solids/floatable significantly reduce river pollution during urban sewerage build-out. Thus, it shows suitability of 1&D concept in high-density, morphologically constrained areas similar to many towns along the Ganga Basin. (Annex-6) (ii) IWA Technical Paper (Interceptor Sewer for Abatement of Pollution in Surface Water) indicates international support for interceptor sewer systems as proven engineering solutions for (a) Immediate pollution reduction (b) Managing dry-weather flow (c) Preventing sewage discharge in rivers when sewer networks lag(d) It reinforces that I&D aligns with global best practice for cities upgrading their sanitation networks. (Annex-7)

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...Swaroop
...2024
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भारत सरकार, नई दिल्ली / Govt. of India, New Delhi

(4)

g) Guidelines for preparation of Project Reports under National River Conservation Plan (NRCP) and National Ganga River Basin Authority, 2010- Under this report one of the activities covered under NRCP talks about Interception and Diversion works to capture the raw sewage flowing into the river through open drains and divert them for treatment. (Para 3, pg-112; Annex-8)

h) Environmental and Social Management Framework (ESMF)- In this framework, sewerage scheme, among other things, also involve laying f sewers (both gravity and pressure lines), provision of sewer connections _-to individual houses, gravity based interception and _ diversion '.°. arrangements to drains carrying sanitary sullage/dry weather flow, etc. (Para 81, pg-20; Annex-9)

i) The issue 'whether drains should be intercepted and diverted for . treatment?' has been dealt with in great detail by the Hon'ble NGT in its judgement dated 13th July 2017 in the matter OA 200 of 2014. The Hon'ble NGT at para 65 on page 183 has held that "... We have dealt with the end of the pipe treatment in great detail, the need of the hour is to clean the river as a priority and for that, treatment of the drains which are meeting the river and are carrying mixed effluents should be of antecedence. This also fits in with the river basin approach where entire river basin along with the tributaries and storm drain joining the river; being treated as one organic entity. The Tribunal had discussed in great detail with all the stakeholders and the only rational conclusion that emerges and is most appropriate is that the drain wise treatment should be adopted in preference to cleaning of cities, particularly when the cities consists of all kind of planned, unplanned, haphazard development and slum areas. Even the drains of a particular city can hardly be counted with certainty....". Copy of the Judgement is placed at Annex- 10.

j) The NMCG recognises the importance of developing a sewerage network and accordingly, while approving the projects, the States, through Administrative Approval and Expenditure Sanction (AA&ES) order, are advised to suitably align the project with the 'Strategic Sanitation Plan' / "City Sanitation Plan' / 'Master plan' for the town and ensure synergy with other central/State-sponsored programs like AMRUT etc. A sample copy of an AA&ES order for the project "Interception, Diversion & Sewage Treatment Plants (STP) Works for Naini (District G) & Phaphamau (District F) in Allahabad City and Jhunsi Area of Allahabad district" is placed at Annex-11. Please refer to para 1.0 (iv) on page 7 of AA&ES order.

k) The Ministry of Housing and Urban Affairs (MoHUA), GOI has dealt with the question of whether wastewater and storm water should be disposed of separately. MoHUA in its publication "A Guide to Decision-making: Technology Options for

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(5)

Urban Sanitation in India', at page 50, has indicated as 'Another consideration is whether to design on the assumption that wastewater and storm water are disposed of separately. The accepted view is that separate systems should be the norm but there are likely to be situations in which it is very hard to separate flows on-plot, in which case the possibility of a combined system should not be 5 counted. Pl refer to Annexure-12.

That it is humbly submitted for consideration of this Hon'ble Tribunal that:

i, Urban sewerage networks in India are incomplete;

ii. Cities have multiple un-sewered pockets;

iii. Immediate and directly discharge of untreated wastewater requires to be prevented;

iv. 1&D, as an interim, is an acknowledged engineering intervention

4(2). In consideration of prevailing urban sanitation conditions within the Ganga River Basin, wherein a substantial proportion of cities lack adequate sewerage infrastructure resulting in the unchecked discharge of untreated sewage into the river system; it is both expedient and necessary that immediate abatement measures, such as the interception and diversion (I&D) of sewage from open drains to treatment facilities, be implemented as an interim strategy. This aligns with the core mandate initially set forth under the Ganga Action Plan and National River Conservation Plan, which prioritize 1&D schemes to prevent the pollution load entering the river.

4(3). It is further submitted that the development, augmentation, and long-term management of comprehensive sewage networks within these cities rests with the Ministry of Housing and Urban Affairs (MoHUA) in cooperation with Urban Local Bodies (ULBs), as mandated under current statutory and executive instruments, to ensure sustainable and permanent abatement of riverine pollution. In this transitional period, the 1&D approach stands as an enforceable and essential provision until such time that robust sewerage infrastructure is achieved and made operational accordance with national urban and river management policies.

4(4). Moreover, given the explicit recognition in national frameworks and programmatic guidelines—such as those issued by the National Mission for Clean Ganga (NMCG) under the Namami Gange Programme—of the urgent need for city-specific and scalable wastewater management solutions, it is substantiated that the 1&D approach is a legally and technically sound response for rapid pollution reduction.

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4(5) That in view of the above submissions, schemes and documents, mentioned supra the answering respondent while do not subscribing to the principle of storm water diversions towards the STP, however, supports that I&D is a necessary and unavoidable 'interim measure, till the laying of the sewerage network is achieved by the state governments, their municipalities and ULBs. In this regard the efforts of the National Mission for Clean Ganga (NMCG)towards the abatement of the pollution of the river Ganga and its tributaries, it Is submitted that most of the towns located along the rivers in India are old towns having very small-town area covered with a comprehensive sewerage network, while in most cases, large town area is still not covered with a comprehensive sewerage network. The laying a comprehensive closed sewerage network in towns requires significant time, often more than 5 years. The adoption of I&D approach as an interim does not mean that the work on the development of closed comprehensive network is abandoned but the same is also continuing with Government of India providing support by the MoHUA to the States under schemes such as AMRUT/Swatch Bharat Mission.

5(1). The wastewater interventions in Ganga basin are based on the detailed project report (DPR) prepared and submitted by the concerned State Governments. The various components of the waste water interventions of a DPR like interception & diversion (I&D) structures, conveyance sewers, pumping stations, and sewage treatment plants are based on engineering considerations like hydraulic flow, invert levels, natural ground profile, high flood level, energy cost, end-of-pipe treatment, available land parcels, cost optimisation, convergence with the existing & future sewerage network, and several other considerations. Based on these factors, the optimum site for the sewage treatment plant (STP) site is identified and proposed by the State Government in the DPR. Though all the efforts are made to avoid locating the site in the flood plain of the river but in consideration of the above referred factors, if the identified STP site falls within the active flood plain of the river, the DPR also envisages flood protection measures with due considerations to avoid constriction of flow to ensure that river as well as the investment in the public utility infrastructure are safe. The provisioning of the land and its cost for wastewater interventions is the responsibility of the State Government.

5(2). That as regards para 3(b), it would be pertinent to mention that the process of approval of any DPR prepared by the State Government in National Mission for Clean Ganga is as per the para 36 of the River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 wherein approval is through Executive Committee

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and prior third party appraisal of the detailed project report is mandatory. The appraisal of wastewater interventions has been carried out by the eminent institutions like Indian Institute of Technology, National of Institute of Technology etc. Further the wastewater interventions are with long term operation and maintenance that also entails sustainable cost of operations and minimum energy consumption.

6 That as regards para 3(c), the demarcation of the flood plains, in the concerned stretches of River Ganga and its tributaries, the guidelines evolved by the Central Water Commissions (CWC) have been duly sent to the State Governments/UTs Administration, and the action taken by the State Governments /UT Adman is under progress and being periodically monitored. This State Governments/UT Admn are also submitting the progress in this regard before this Hon'ble Tribunal.

7.That the answering respondent craves leave of this Hon'ble Tribunal to make any other submissions or furnish other details, if so warranted in the matter.

09.02.2026

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Deponent

Identified The Deponent who has signed & thumb in my presence

VERIFICATION:

Verified at New Delhi on --- 10 FEB 2026 February, 2026 that the contents of the above affidavit are true and correct to my knowledge based on official record and no part of it is false and nothing material has been concealed therein.

09.02.2026

Deponent

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CERTIFIED that the DEPONENT Shri/Smt./Km. Brijendra Swaroop S/o W/o D/o ... R/o ... identified by ... has solemnly affirmed before me on ... at Delhi on ... that the contents of the ... which have been read & explained to him are true and correct.

10 FEB 2026

Oath Commissioner, Delhi

Azadi Ka Amrit Mahotsav

Ministry of Housing and Urban Affairs
Government of India

AMRUT 2.0
Atal Mission for Rejuvenation and Urban Transformation

Atal Mission for Rejuvenation and Urban Transformation 2.0

Operational Guidelines

October 2021

"…In the next stage of AMRUT, country targets to have access to clean water for all urban citizens, increase coverage of sewerage & septage management, make our cities water secure and ensure that no dirty water falls into the rivers from drains. The journey of AMRUT and Swachh Bharat Mission so far is a pride for citizens. It is not only Mission, but also denotes honour, modesty & aspiration of the nation and love for the Motherland …"

- Hon'ble Prime Minister in his address during launch of AMRUT 2.0, on 1 October, 2021

हरदीप एस पुरी
HARDEEP S PURI

आवासन और शहरी कार्य मंत्री
पेट्रोलियम एवं प्राकृतिक गैस मंत्री
भारत सरकार
Minister of
Housing and Urban Affairs; and
Petroleum and Natural Gas
Government of India

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

Message

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) launched in 500 selected cities across the country in June 2015 by the Hon'ble Prime Minister has been successful in enhancing liveability in AMRUT cities. AMRUT made states equal partners in planning and implementation of projects, thus actualizing the spirit of cooperative federalism.

AMRUT 2.0 launched by Hon'ble Prime Minister on 1 October 2021, with a total outlay of ₹2,99,000 crores – nearly 3 times of the AMRUT - is the outcome of confidence gained during implementation of AMRUT scheme and our resolve to extend the basic services to every household. The Mission envisages providing water tap connections to households in all statutory towns through 2.68 crore new household tap connections and providing universal household coverage of sewerage/septage services in 500 AMRUT cities through 2.64 crore new sewer connections/coverage with septage management. Rejuvenation of water bodies and green spaces and parks are other components of the Mission. Outcome based funding is a major feature of AMRUT 2.0.

In this context, I am happy to see the operational guidelines for AMRUT 2.0 issued by the AMRUT Mission Directorate. I am hopeful that AMRUT 2.0 will go a long way in improving the quality of life for all urban dwellers, especially the poor and the disadvantaged and make our cities water secure.

(Hardeep S Puri)

New Delhi
26 October, 2021

Office:- Room No. 104-C, Nirman Bhawan, New Delhi-110011; Phone: 011-23061166, 23061162, 23062089 (Fax)

कौशल किशोर
KAUSHAL KISHORE

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

आवासन और शहरी कार्य राज्य मंत्री
भारत सरकार
Minister of State, Housing & Urban Affairs
Government of India

संदेश

घरों के लिए बुनियादी सेवाएं (जैसे जल आपूर्ति, सीवरेज) प्रदान करना और शहरों में सुविधाएं उपलब्ध कराना, जो सभी के जीवन की गुणवत्ता में सुधार करें, राष्ट्रीय प्राथमिकता रही है। इसी उद्देश्य से अमृत योजना को 500 शहरों में 25 जून 2015 को प्रारम्भ किया गया था। मिशन के सफलता को देखते हुए तथा इसे सभी वैधानिक शहरों में क्रियान्वित करने के उद्देश्य से माननीय प्रधानमंत्री जी ने अमृत 2.0 मिशन का शुभारम्भ 1अक्टूबर 2021 को किया है।

अमृत 2.0 सभी वैधानिक शहरों में सभी को नल कनेक्शन प्रदान करने का लक्ष्य रखता है। साथ ही, इसमें सभी 500 अमृत शहरों में सीवरेज/सेप्टेज सेवाओं का सार्वभौमिक घरेलू कनेक्शन प्रदान करने का प्रस्ताव है। जल निकायों का नवीकरण, हरित स्थान और पार्क इस मिशन के अन्य घटक हैं। परिणाम आधारित वित्तपोषण इसकी प्रमुख विशेषता है।

इन सब को ध्यान में रखते हुए आज मै गर्व से कहना चाहता हूँ कि अमृत 2.0 मिशन की परिचालन दिशानिर्देश, जोकि अमृत मिशन निदेशालय द्वारा जारी किया गया है, सभी वैधानिक शहरों को जल सुरक्षित बनाएगा और आत्मनिर्भर भारत के स्वप्न को साकार करने में मदद करेगा।

जय हिन्द।

(कौशल किशोर)

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Foreword

Hon'ble Prime Minister launched AMRUT 2.0 on 1 October, 2021. It aims to develop water secure cities in the spirit of **AatmaNirbhar Bharat.** It targets to provide reliable **2.68 crore** new water tap connections to all in about **4,800 statutory towns.** Also, it proposes to get universal household coverage of sewerage/ septage services in **500 AMRUT cities through 2.64 crore** new sewer connections. Rejuvenation of water bodies, green spaces and parks are other components of this Mission. Outcome based funding is its major feature. Total indicative outlay for AMRUT 2.0 is **₹ 2,99,000 crore** which includes allocation for projects of ongoing AMRUT Mission to the tune of **₹ 22,000 crore** for **two years** from FY 2021-22 to FY 2022-23 and the rest is for five years. Total indicative central share is **₹86,760 crore** including **₹10,000 crore** for AMRUT projects.

I am pleased to share AMRUT 2.0 guidelines with the stakeholders. Guidelines gives way forward for implementing the Mission. To begin with, cities are expected to prepare and submit City Water Balance Plans (CWBPs) online on a robust Mission Portal of MoHUA. CWBPs will give the status of water sources, quantum of water available, water demand and supply in the city culminating in gaps in services. These gaps will lead to formulating projects with target of filling these gaps. Mission mandates implementation of 10% worth of funds allocated to million plus cities under PPP mode. Projects on 24x7 water supply in 500 AMRUT cities are encouraged. Mission management will be paperless on an online platform.

All projects proposed by State will aggregate to State Water Action Plan (SWAP) which will be submitted in three tranches for approval of Apex Committee. Mission will provide central assistance for implementing projects in three instalments. Third instalment will be released only on the basis of achieved outcomes. Notification of Property Tax and User charges by States are mandatory reforms to be implemented in first two years for continuity of central funding. Aquifer Management Plans of cities are to be submitted by States. Mission will provide funds separately for outcomes achieved through sources not funded through AMRUT and AMRUT 2.0. Central funding will be admissible for Administrative and Other Expenses (A&OE) to the States.

Pey Jal Survekshan, Information Education & Communication (IEC) and Technology sub-Mission are key components of Mission. Start-ups in water sector will also be encouraged through sub-Mission. Reform agenda of Mission has reforms on municipal governance and water security of cities. Major reforms are reducing non-revenue water to below 20%; recycle of treated used water to meet at least 20% of total city water demand and 40% for industrial water demand at State level; 24x7 water supply with 'Drink from tap' facility; GIS based master plans of the cities & efficient town planning; raising funds through issuance of municipal bonds and rejuvenation of water bodies. Successful implementation of reforms will be incentivized.

I hope these guidelines will be used extensively by the States/UTs and ULBs to implement the Mission in the field. I look forward to whole heartedly participation to achieve the Mission outcomes in a time bound manner.

Durga Shanker Mishra

New Delhi
25TH October, 2021

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Preface

The AMRUT 2.0 guidelines have been formulated with the aim of assisting States/ UTs for making our cities **Aatma Nirbhar** and '**water secure**'. Several stakeholder consultations across 36 States/ UTs have been conducted as well as inputs from the key players such as development banks, private sector players, water sector consultants as well as NGOs have been taken into consideration.

MoHUA in partnership with States aims to achieve functional tap connections to all households, undertaking water source conservation/ augmentation, rejuvenation of water bodies and wells, recycle/re-use of treated used water and rainwater harvesting. Mission will extend the ease of living by upscaling universal coverage in water supply from 500 cities to about 4,800 statutory towns and universal coverage of sewerage and septage management to 500 AMRUT cities.

City Water Balance Plan will help cities to identify scope for projects focusing on the objectives of Mission stated above. Based on the projects identified in City Water Balance Plans, City Water Action Plan (CWAP) will be devised. These CWAPs will be aggregated in the form of State Water Action Plans (SWAP).

Another significant shift in the running the national Mission will be to attain data equity - AMRUT 2.0 will be a paperless mission with complete digital monitoring of projects progress and its funding. Funding to States will be predominately outcome based.

Mission has a reform agenda with focus on strengthening of urban local bodies and water security of the cities. Major reforms are reducing non-revenue water to below 20%; create a 'new tap of water' through recycle of treated used water to meet at least 20% of total city water demand and 40% for industrial water demand at State level; electric vehicle charging points; 24x7 water supply; reforms on property tax and user charges; GIS based master plans of the cities; raising funds through issuance of municipal bonds and rejuvenation of water bodies.

Further, to encourage start-ups involved in water sector, Technology Sub-Mission will be launched. Under the gig economy model, Mission will co-opt women and youth for concurrent feedbacks about its progress. Women SHGs will be involved in water demand management, water quality testing and water infrastructure operations. Pey Jal Survekshan will instill healthy competition among cities and act as a monitoring tool and Mission accelerator. Capacity building programs will be extended to various stakeholders.

We welcome this grand Mission launched by the Hon. PM and we wish to contribute to his vision of making this Mission a Jan Aandolan (people's movement).

Jai Hind.

Sd/-
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Abbreviations:

A&OE	Administrative and Other Expenses
AC	Apex Committee
ACA	Admissible Central Assistance
ADB	Asian Development Bank
AFD	Agence Française de Dévelopement
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AMRUT 2.0	Atal Mission for Rejuvenation and Urban Transformation 2.0
BCC	Behavioural Change Communication
C&AG	Comptroller and Auditor General of India
CA	Central Assistance
CGWB	Central Ground Water Board
CMMUs	City Mission Management Units
CPHEEO	Central Public Health and Environmental Engineering Organisation
Cr	Crore
CWAP	City Water Action Plan
CWBP	City Water Balance Plans
DLAMC	District Level Advisory and Monitoring Committee
DM	District Magistrate
DMA	District Metered Area
DPIIT	Department for Promotion of Industry and Internal Trade
DPR	Detailed Project Report
FA	Financial Advisor
FC	Finance Commission
FSSM	Faecal Sludge and Septage Management
FSSTP	Faecal sludge and Sewage treatment plant
FY	Financial Year
GIS	Geographical Information System
GoI	Government of India

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HAM	Hybrid Annuity Model
HH	Household
I&D	Interception and Diversion
IEC	Information, Education and Communication
IRMA	Independent Review and Monitoring Agency
LAP	Local Area Planning
MD	Managing Director
MLD	Million Liter per Day
MoHUA	Ministry of Housing and Urban Affairs
MoU	Memorandum of Understanding
NEHU	North Eastern Hill University
NGO	Non-Governmental Organization
NIUA	National Institute of Urban Affairs
NRSC	National Remote Sensing Centre
NRW	Non revenue water
NUDM	National Urban Digital Mission
NULM	National Urban Livelihood Mission
O&M	Operation and Maintenance
PDMC	Project Development and Management Consultant
PFMS	Public Financial Management System
PHE	Public Health Engineering
PIU	Project Implementation Units
PMIS	Programme Management Information System
PMU	Project Management Unit
PPP	Public Private Partnership
RWH	Rain Water Harvesting
SBM	Swachh Bharat Mission
SCADA	Supervisory Control and Data Acquisition System
SCM	Smart City Mission
SDG	Sustainable Development Goal

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SHG	Self- Help Groups
SHPSC	State High Powered Steering Committee
SLB	Service Level Benchmarks
SLTC	State Level Technical Committee
SMMU	State Mission Management Unit
SNA	Single Nodal Agency
SOI	Survey of India
SOP	Standard Operating Procedure
STP	Sewage Treatment Plant
SWAP	State Water Action Plan
TCPO	Town and Country Planning Organisation
TPS	Town Planning Scheme
UAV	Unmanned Aerial Vehicle
UC	Utilization Certificate
UD	Urban Development
ULB	Urban Local Body
UT	Union Territory
VG	Viability Gap

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1 Introduction

1.1 Hon'ble Prime Minister, during his address to the nation on 15 August 2019 stated, "… nearly half of the households do not have water…women have to travel two to three km to fetch water…we need to work in the field of water conservation, irrigation, rainwater conservation, rejuvenation of water bodies, desalination of sea water and treatment of wastewater...". To holistically address these issues, he announced the launch of Jal Jeevan Mission.

1.2 Earlier, to facilitate ease of living to citizens, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), was launched in 500 cities on 25 June 2015, as a first focused national water Mission.

1.3 AMRUT aimed to provide universal coverage of water supply by providing 1.39 crore household tap connections. Likewise, coverage of sewer/ septage connections were proposed to increase from 31% to 62% by providing 1.45 crore connections. So far, 1.12 crore tap connections and 87 lakh sewer connections have been provided. Sewage treatment plants of capacity 1,800 MLD have been created; out of this 907 MLD is being reused. This Mission has decreased disease load and improved quality of life of all, especially women in terms of time and energy saved to be put to constructive use.

1.4 Sustainable Development Goal 6.4 aims to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity, by 2030. In order to meet (SDG 6), and to extend ease of living in water sector from 500 to all statutory towns, Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0) has been launched. This will also ensure 100% coverage of sewerage/ septage management in 500 AMRUT cities.

2 Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0)

2.1 AMRUT 2.0 is a step towards **AatmaNirbhar Bharat** with aim of **making the cities 'water secure'** and providing functional water tap connections to all households. This will be achieved through circular economy of water by effecting water source conservation, rejuvenation of water bodies and wells, recycle/ reuse of treated used water, and rainwater harvesting by involving **community at large.** This Mission will be run as people's program i.e. **Jan Aandolan**. Mission also targets to provide 100% sewage/ septage management in 500 AMRUT cities.

2.1.1 Mission will focus on empowering States/ UTs and cities for efficient implementation of projects in the spirit of cooperative and competitive federalism by providing flexibility to the States/ UTs to formulate, plan and implement the projects. CA released can be utilized for projects in any of the ULBs as per physical/ financial progress of the projects.

2.2 **Ensuring community participation:**

Mission will co-opt women and youth for concurrent feedbacks about its progress. Women SHGs will be involved in water demand management, water quality testing and water infrastructure operations. A concerted effort will be made to train women to test water quality in all the cities. This training program will be spearheaded by PHEDs or water and sewerage boards under the overall guidance of urban development department at the State level.

2.3 Mission has a reform agenda focused towards financial sustainability and water security of ULBs. Meeting 20% of water demand through recycled water, reducing non-revenue water to less than 20% and rejuvenation of water bodies are major water related reforms. Reforms on property tax, user charges, and enhancing credit worthiness of ULBs and urban planning are other important reforms.

2.4 Mission will encourage smart elements to be incorporated in every project. Mission will have a sub-Scheme on well rejuvenation.

2.5 Capacity building programs will be conducted for all stakeholders including contractors, plumbers, plant operators, students, women and citizens. Technical institutions will be roped in for assessment of Mission outcomes. Students will be engaged for survey of projects and outputs through **gig economy model**.

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2.6 Technology Sub-Mission will help in identifying the proven and potential global technologies in water sector. Entrepreneurships / start -ups involved in low-cost indigenous equipment and processes will be encouraged.

2.7 **Mission will be paperless and monitored on a robust technology-based monitoring & evaluation platform.**

3 Components of AMRUT 2.0

3.1 Projects

ULBs will submit detailed City Water Balance Plans (CWBPs) and City Water Action Plans (CWAPs) through online portal covering proposed projects in the thrust areas. The projects will be prioritized based on following outcomes with the focus on improving sustainability and efficiency in water sector:

i. Universal coverage of water supply;
ii. Sewerage, septage management and recycle/ reuse of treated used water; and
iii. Rejuvenation of water bodies (including urban wetland) and creation of green spaces.

Detailed information on project formulation and funding is in **Article 4, 6 and 7**.

3.2 Administrative & Other Expenses (A&OE)

A&OE will be fully funded by the Centre and shall be utilized to cover the cost of preparing CWBPs, Program Management Units (PMUs), Detailed Project Reports (DPRs), Project Implementation Units (PIUs), Project Development and Management Consultants (PDMCs), development of Aquifer Management Plans and Independent Review and Monitoring Agencies (IRMAs). It will also be used for capacity building. Detailed information on A&OE funds is in **Article 7.4**

3.3 Reforms

Mission has a reform agenda on ease of living of citizens through reduction of non-revenue water, recycle of treated used water, rejuvenation of water bodies, augmenting double entry accounting system, urban planning, strengthening urban finance etc. Successful implementation of reforms will be incentivised. Reforms are described in **Article 7.5 and Article 8.**

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3.4 **Technology Sub-Mission**

Technology Sub-Mission will encourage start-up ideas and private entrepreneurship, and commissioning them into the pilot projects after screening of expert committee. Sub-Mission will also encourage innovative light house projects which will be partly funded. This component is detailed further in **Article 10**.

3.5 **Information, Education and Communication**

Information Education and Communication (IEC) including **Behavior Change Communication** under AMRUT 2.0 is envisaged as a key strategy for spreading awareness on conservation of water and enhancing water use efficiency among the masses. This component is detailed further in **Article 14**.

3.6 **Pey Jal Survekshan**

Pey Jal Survekshan is proposed in cities as a challenge process to assess the compliance of service level benchmarks with respect to quality, quantity, and coverage of water supply, sewerage & septage management, extent of reuse & recycle of used water, and conservation of water bodies in the city. Pey Jal Survekshan will instill healthy competition among cities and act as a monitoring tool and Mission accelerator. This component is detailed further in **Article 9**.

3.7 **Community Participation with focus on woman self help groups** to be co-opted in management of water infrastructure and quality assensement. This will be facilitated through National Urban Livelihood Mission (NULM) management unit.

3.8 **Outcome based funding is the most important defining feature of this Mission.** The cities will submit roadmap for outcomes to be achieved by them during the mission period.

3.9 **Evidence based evaluation of outcomes using online monitoring platform** combined with citizen feedback through gig economy will enable **community partnership**.

3.10 **Public Private Partnership (PPP) projects are mandatory in million plus cities** and at least a minimum of **10% of total fund allocation** at the city level shall be committed to PPP projects.

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4 Projects

4.1 Mission will focus on achieving functional outcomes through project implementation under Amrut 2.0 as one of the means. While formulating the projects, it should be ensured that households of **informal settlements and low-income groups** are duly considered. These admissible projects/ need to be prioritized as per functional outcomes envisaged in the table below:

Sl. No.	Functional outcomes	Admissible elements of Projects
1	Providing universal piped water supply with household water tap connection	• Water source improvement and augmentation in the city • Fresh Water treatment • Water distribution system in uncovered areas • Augmentation of existing water distribution system • Sustainability of quality and quantity of water supply • Reuse of treated used water • Provision for 24x7 water supply# • Smart solutions like SCADA • Last mile connectivity to households (Not exceeding ₹ 3,000 per HH)
2	Providing universal coverage of sewerage and septage management in 500 AMRUT cities and promoting circular economy of water	• Sewerage network • Interception and Diversion (I&D) infrastructure • Sewage Treatment Plants (STPs) • Tertiary Treatment with end-to-end reuse plan (preferably in PPP mode) • Faecal sludge and Septage management (FSTP cum STP Plant & collection mechanism) • Provision/ augmentation and rehabilitation of sewerage systems with end-to-end treatment and reuse • Tapping of used water for recycling • Identifying the bulk users of recycled used water and facilitating sale of used water to potential users (e.g. industrial clusters such as textile/ leather/ paper/ power plants/ railways, etc.) • Smart solutions like SCADA • Last mile connectivity to households (Not exceeding ₹ 3000 per HH)
3	Rejuvenation of water bodies to	• Rejuvenation of wetlands, water bodies by desilting, strengthening the embankments, and stone packing.

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	augment water and enhance amenity value and development of green spaces	• Diverting the polluting drains to treatment plants • Harvesting the rain water through storm water drains into water body (which is not receiving sewage/ effluent) • Strengthening/ rejuvenation of the aquifers/ community wells • Creation/ strengthening of storm water drains around water body • Provision of STP to treat inflow into water body. • Development of the community green spaces linked to a clean water body • Funds for the projects of this sector shall not exceed 5% of total project allocation (4% for rejuvenation of water bodies and 1% for development of green spaces & parks).
	Outcome based funding	• Functional outcomes in terms of functional water tap and sewer connections to households beyond baseline and not covered by AMRUT, implemented on or after 1 Nov 2021, shall be considered for funding. (Note 3)

In AMRUT cities, **projects on 24x7 water supply** with drink from tap facility may be taken up. These projects should cover at least one ward or DMA with at least 2,000 households in the contiguous manner. Projects costing up to 20% of the project fund allocation for water supply projects in AMRUT cities may be taken up for 24x7 water supply. **Additional funding for such projects will be admissible in form of reform incentive.**

Note 1: All admissible projects should have at least five-year O&M for infrastructure, which may be duly incorporated through the tender process.

Note 2: All water supply and sewerage projects will have smart elements.

Note 3: Outcome based funding is to be considered for the outcomes achieved with respect to sewer and water connections after the launch of AMRUT 2.0 by projects taken up by States/ UTs and achievement beyond baseline established for the city as on 1 November 2021.

4.2 Tentative distribution of central fund allocation among project components of Mission is as under:

#	Description	Central Share (₹ Cr)
1	Water supply projects	35,250
2	Rejuvenation of water bodies and developing green spaces & parks projects	3,900
3	Sewerage and septage management projects	27,600
	Total	**66,750**

*The above table provides a broad picture of fund allocation. At city level, if universal water supply is achieved, then other components which are admissible can be taken up to achieve Mission objectives. The State Mission directorate shall ensure that universal water supply and sewage/ septage treatment is achieved in all cities as the first priority in that order.

5 Fund allocation

5.1 The total indicative outlay for AMRUT 2.0 is ₹ 2,77,000 crore including central share of ₹ 76,760 crore for five years from FY 2021-22 to FY 2025-26.

5.2 The central budgetary allocation for various Mission components will be as under:

S.no	Mission component	Central Allocation (₹ Cr)
1	Projects	66,750
2	Incentive for Reforms (8% of project CA allocation)	5,340
3	Administrative & Other Expenses (A&OE) for States/ UTs (3.25% of project CA allocation)	2,169
4	Administrative & Other Expenses (A&OE) for MoHUA (1.75% of project CA allocation)	1,168
5	Technology Sub-Mission (1% of project CA allocation)	667
6	IEC Activities (1% of project CA allocation)	667

5.3 Ongoing AMRUT projects will be funded with central assistance up to 31 March 2023. **No funds will be released for any AMRUT project incomplete by that date and it will become the responsibility of the State/ UT to complete them from their own resources**.

5.4 **Funding for projects**

Funding for the projects will be shared by Centre, States/ UTs and ULBs. Central share for various classes of ULBs will be as under:

ULBs	Central share
Union Territories	100% project funds by Centre
North eastern States and Himalayan States	90% of the project funds by Centre
With less than one lakh population	50% of the project funds by Centre
With population one lakh to ten lakh (both included)	1/3rd of the project funds by Centre
With population more than ten lakh	25% of the project funds by Centre (except for projects taken up under PPP mode)

5.5 **Public Private Partnerships (PPP): Projects amounting to at least 10% of total project allocation for all cities with population above ten lakh in a State will be mandatorily taken up in PPP mode.** Projects with focus on selling treated water to industries and other users may be the potential projects for implementing under PPP mode. Such projects can be taken up in Hybrid Annuity Model (HAM) or any other suitable model. **Viability gap funding for such projects will be provided through CA**. CA will be 50% of the **viability gap subject to maximum of 30% of the project cost**. Balance viability gap will be borne by State/ ULB. Total viability gap will not exceed 60% of project cost.

5.5.1 States/ UTs and ULBs may augment their share of funding through alternative sources like raising municipal bonds, accessing capital markets, loans/ credits, State grants and central finance commission grants etc.

5.5.2 States/ UTs may avail loan from the funds earmarked by multi-lateral/ bilateral agencies like ADB, KFW, AFD and World Bank etc.

6 Mission Implementation

6.1 Memorandum of Understanding (MoU):

States/ UTs and ULBs have accepted a tripartite Memorandum of Understanding (MoU) with MoHUA. This MoU represents collective intent of MoHUA, State/ UT, and ULBs towards making urban India 'Water-secure' by effecting water source conservation, rejuvenation of water bodies and wells, recycle/ reuse of treated used water, and rainwater harvesting by engaging the community at large. MoHUA, States/ UTs and ULBs shall align themselves to the roles and responsibilities as per the MoU.

6.2 The implementation of Mission will be **paperless**. Preparatory steps (CWBP, CWAP, SWAP, reform roadmap), project planning, reform outcome achievement reporting, functional outcome reporting, evidences reporting, progress reporting and claims will be made on a robust online technology platform. Industry, community and implementing agencies will be onboarded on a colloborative platform.

6.3 City Water Balance Plans (CWBPs):

6.3.1 CWBPs will comprise details of water sources including water bodies, water treatment and distribution infrastructure, area-wise water coverage, status of NRW and sewerage network including STPs etc. **(Annex- 1 illustrative**). ULBs will compile baseline data on household water tap and sewer/ septage connections, and gaps in service delivery will be worked out. Based on assessed gaps, potential projects will be identified targeting functional outcomes.

6.3.2 State and ULBs will target to achieve universal coverage of water supply to all households in all ULBs and sewer/ septage connections in 500 AMRUT cities through projects proposed under AMRUT 2.0, ongoing AMRUT projects and projects/ initiatives funded by State/ ULB funds, XV FC grants, funding from external sources and PPP etc. The extent of gaps proposed to be filled through each of aforementioned sources will be clearly identified. CWBPs will be filled on the online formats provided for this purpose on the portal. CWBP should also be published on respective ULB and State websites.

6.4 **City Water Action Plans (CWAPs):**

6.4.1 CWAP will comprise the list of projects proposed by the ULB in the priority sectors of water supply; sewerage/ septage management; rejuvenation of water bodies including green spaces & parks. It will be ensured that projects are taken up with a view to meet 20% of city water demand through recycle/ reuse of treated used water. The projects proposed under AMRUT 2.0 and ongoing/ proposed projects through sources other than AMRUT 2.0 in three sectors will be provided **(Annex-2a, Annex 2b & Annex 2c are illustrative**). CWAPs will be submitted to SHPSC by State Mission Director online on Mission portal.

6.4.2 Projects amounting to **at least 10%** of total project allocation for all cities with population above ten lakh (**million plus cities**) in a State will be mandatorily taken up in **PPP mode**. Such projects maybe identified in the CWAPs.

6.4.3 ULBs will furnish year-wise roadmap of providing household water tap connections with a view to achieve universal coverage of water supply **(Annex- 2d illustrative).** Likewise, roadmap of achieving universal coverage of household sewer/ septage connections in 500 AMRUT cities will also be furnished **(Annex-2e illustrative).**

6.5 **State Water Action Plans (SWAPs):**

6.5.1 SWAPs will be prepared by State Mission director by aggregating CWAPs submitted by the ULBs. SWAPs will comprise entire list of projects, city-wise and sector-wise, proposed to be undertaken by States/ UTs. Cost of projects taken up will exclude cost of land acquisition. SWAP will include project wise number of proposed new household water tap connections, sewer connections and coverage of existing water tap and sewer connections to be augmented, which shall be outcomes of such projects. The projects to be implemented in PPP mode will be clearly identified. It will be ensured that projects are taken up only when land is available with clear title without any disputes. SWAPs will be submitted on portal to Apex committee in three tranches as per **Annex-3 (illustrative)**.

The first tranche will be submitted within five to nine months, second tranche within twelve to sixteen months and third tranche preferably within twenty-four months of launch of Mission. It can be submitted in advance also.

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6.5.2 SWAPs will be approved by SHPSC before progressing to Apex Committee. State High Powered Steering Committee (SHPSC), while approving the SWAP will consider the following:

i. SWAP is oriented towards achieving desired functional outcomes such as universal coverage of water supply and sewerage/ septage management,

ii. Water body rejuvenation and parks & green spaces parks have been taken in specified proportion,

iii. Water supply projects oriented towards 24x7 water supply in AMRUT cities have been taken,

iv. There is no duplication of projects with AMRUT or any other government schemes,

v. Low economic and informal settlements are duly included in SWAP,

vi. At least meeting 10% of fund allocation in PPP projects as mandated have been included for million plus cities,

vii. Projects facilitating Rural-Urban Synergy have been taken up wherever feasible,

viii. Every city should achieve universal coverage and become water secure through either AMRUT 2.0 or any other funding. State assures that all the cities are moving in this direction,

ix. It will also be ensure that used water (waste water) is treated and put to reuse to meet 20% of cities water demand and 40% of Industry water demand in aggregate at the state level.

x. Projects being proposed in SWAP will have O&M for atleast five years to be funded by way of levy of user charges or other revenue streams. Project cost will exclude O&M. ULBs shall fund O&M through an appropriate cost recovery mechanism in order to make them self-reliant and cost effective.

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6.6 **Urban Aquifer Management Plan**

6.6.1 The Aquifer Management Plan will focus on maintaining positive groundwater balance in urban aquifer systems. The cities will strategize groundwater recharge augmentation by developing a roadmap for improving rainwater harvesting within city limits. Cities will conduct aquifer mapping with technical support from Central Groundwater Board (CGWB)/ State Groundwater Board/ other agencies to identify recharge and discharge zones and integrate aquifer management into urban planning. Cities will develop an annual groundwater balance report to ascertain the current and future availability of groundwater.

6.6.2 The template for aquifer mapping shall be made available to the ULBs along with a technical guidance manual on urban aquifer management following the Mission launch. Urban Aquifer Management Plan shall be submitted within 24 months from the launch of Mission by 500 AMRUT cities.

6.7 **Implementation of projects**

Projects as per approved SWAP will be planned, tendered, awarded and implemented by ULBs. Where ULBs do not have adequate capacity, specialized parastatal agencies will implement the projects. In order to ensure efficient implementation of projects, the States/ UTs, ULBs should follow an approach wherein end-to-end support for project design, development, implementation and management is provided to ULBs/ States/ UTs by external entities (PDMCs). Maintenance and upkeep of the assets created will be responsibility of the State/ UT/ ULB. Smart elements will be part of the projects.

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6.8 **Monitoring of projects**

The achievement of mission objectives will be monitored through an online module. This module will directly be the precursor for availaing funds. Therefore, the portal needs to be regularly updated by State/ UT/ ULB functionaries for flow of information and sanctioning of funds. The fields to be updated will include physical progress, financial progress, documents required for seeking central assistance, photographs, videos, third party reports, etc. The progress reported on portal will be randomly verified through citizen/ third party feedback. Implementing agencies and community stakeholders will also be facilitated to access the portal and upload the progress and feedback.

6.9 **Replacement of projects**

6.9.1 The projects approved by the Apex committee will not be replaced in normal course. However, in case some projects are required to be replaced due to unavoidable circumstances, State Mission Director will submit such proposal to SHPSC along with justification. The SHPSC will be competent to approve replacement of projects costing up to 10% of respective tranche of SWAP in admissible project components of AMRUT 2.0. Replacement of projects beyond 10% of respective tranche of SWAP, if approved by SHPSC shall be sent to the Apex committee with proper justification for consideration and approval. No expenditure shall be booked against any project proposed to be replaced.

6.9.2 The SHPSC, while considering replacement of projects, shall ensure that there is no duplication of projects through replacement, overall State allocation is not exceeded, new proposed projects are in line with Mission objectives.

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7 Release of funds

7.1 General conditions for release of project funds

7.1.1 Central assistance will be processed through online claims and settlement system, which will emerge from the actual progress updated on portal through physical/ financial data, photos and videos obtained through citizen feedback and third-party assessment.

7.1.2 Fund flow under Mission will be as per instructions issued vide Ministry of Finance OM No. F. No. 1(13) PFMS |FCD/2020, dated 23 March 2021, which is explained in **Article 7.6**.

7.1.3 **Central fund allocation** to States/ UTs for projects will be worked out by distributing entire central project funds (₹ 66,750 crore) among States/ UTs giving weightage to urban population (Census 2011) and area of States/ UTs in ratio 90:10.

7.1.4 States shall ensure that the further allocation to cities is oriented towards achieving universal coverage of water supply in all ULBs and universal coverage of sewerage/ septage management in 500 AMRUT cities through AMRUT 2.0. If a city has already achieved universal coverage of water and sewerage, it will be clearly brought out in CWBP and further actions can be taken to make the city water secure through AMRUT 2.0. In case of a city where all indicated outcomes are planned to be achieved from other sources of funding (not through AMRUT 2.0), these may be clearly indicated in the format provided for the same purpose in CWAP.

7.1.5 Project funds will be released for implementation of AMRUT 2.0 projects. Functional outcomes achieved beyond baselines (as on 1 Nov 2021) through funding from sources other than AMRUT/ AMRUT 2.0 will also be funded. These other sources of funds can be XV Finance Commission grants, State Funds, ULB funds or funds from external agencies.

7.1.6 **Admissible Central Assistance (ACA)** will be worked out based on total amount of SWAPs submitted and applying proportion for the category of the State/ City as per Table in **Article 5.4**.

7.1.7 Total project fund release to a State/ UT through all instalments will not exceed the central fund allocation**.**

7.1.8 CA released for a particular tranche of SWAP can be utilized for implementation of approved projects of another tranche. Similarly, States/ UTs can utilize CA for projects in any of the ULBs as per physical/ financial progress of the projects.

7.2 **Release of project funds (other than PPP)**

Central assistance (CA) to the States/ UTs has been divided in two components as under:

7.2.1 **Component-1:** This component will comprise of CA for projects approved under SWAPs. This will be provided in three instalments of 20:40:40 as under.

7.2.1.1 **First instalment under component-1**

i. This will be 20% of CA admissible against SWAP submitted by the State/ UT and approved by Apex Committee.

ii. First instalment for component-1 shall be claimed in three (almost equal) tranches against submission and approval of each of three tranches of SWAP.

7.2.1.2 **Second Instalmentunder component-1**

i. Second instalment will be 40% of the total CA for the State/UT.

ii. AMRUT 2.0 projects for which contracts have been awarded will be eligible for consideration for release of second instalment.

iii. Approved cost of projects will be the basis for working out instalment. Approved cost will be lower of appraised cost and contract award cost.

iv. Following should be achieved before claiming second instalment:

a) Second instalment will be applicable to projects which have achieved 15% physical and financial progress. The work should have been started on site.

b) Submission of City Aquifer Management Plan (At least 20% AMRUT cities of the State with first tranche of SWAP, 30% AMRUT cities of the State with second tranche and remaining 50% AMRUT cities of the State with third tranche of SWAP). States having less than ten AMRUT cities may submit City Aquifer Management Plan with third tranche.

c) Submission of UC of A&OE grants and reform incentive.

d) Submission of assessment report of AMRUT 2.0 by IRMA (to be appointed by MoHUA) and ATR by the State/ UT thereon and compliance report by IRMA.

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e) Citizen feedback.

7.2.1.3 **Third instalment under component-1**

i. Third instalment will be 40% of admissible CA to the State/UT. It will be released entirely on achieving functional outcomes through AMRUT 2.0 projects. Third instalment will be worked out as per following Table:

#	Outcome	Formula for working out 3rd instalment
1	Tap connections (both new and serviced through augmentation)	(0.4) X (ACA for water supply projects) X (WA/ WT)
2	Sewer/ septage connection (both new and serviced through augmentation)	(0.4) X (ACA for sewerage/ septage projects) X (SA/ ST)
3	Water body rejuvenation projects	(0.4) X (ACA for Water body rejuvenation projects) X (WBA/ WBT)
4	Parks & green spaces	(0.4) X (ACA for Parks & green spaces projects) X (PA/ PT)
Sum of all above will be the admissible amount of third instalment. This is an illustration. Actual apportionment of third instalment for projects will be based on achievement of actual outcomes pertaining to those projects.		

Description of terms in the Table

Outcomes	Achievement through AMRUT 2.0	Cumulative target under AMRUT 2.0
Number of new household water tap connections provided + number of tap connections serviced through augmentation + tap connections provided with 24x7 water supply as per real outcomes.	WA	WT
Number of new household sewer connections provided + sewer connections serviced through new sewerage network + households covered with septage management + households covered with tertiary treatment	SA	ST
Number of water body rejuvenation projects completed under AMRUT 2.0	WBA	WBT
Number of parks projects completed under AMRUT 2.0	PA	PT

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ii. Targets in the last column will be submitted through Tables 3(b), 3(c) and 3(d)

iii. Third instalment can be claimed in three tranches against approved tranches of SWAPs.

7.2.2 **Component-2**: **Funding at the rate of ₹ 3,000 (Rupees three thousand) per new household water tap connection** provided in ULBs beyond the baseline as on 1 November 2021 will be awarded. Similarly, **funding at the rate of ₹ 3,000 (Rupees three thousand) for each new household sewer connection** provided in all 500 AMRUT ULBs beyond the baseline as on 1 November 2021 will be provided. Only those new connections, which are not funded under AMRUT and AMRUT 2.0 will be considered for the above funding. Funds against these outcomes can be claimed once every quarter in tranches from launch of Mission after baseline is firmed up. Funds will be released after due verification through citizen feedback and third-party. Funds provided under component-2 will be used by the State/ UT/ ULB on components of AMRUT 2.0 only.

7.3 **Funds for projects implemented in PPP mode:**

For the projects planned for implementation under PPP mode in cities with population above ten lakh, State/ ULB will prepare appropriate financial model and work out viability gap of such projects. Total viability gap for a project shall not exceed 60% of the project cost. 50% of the viability gap not exceeding 30% of project cost will be admissible to be funded as CA.

For such projects, CA worked out as above will be released in three instalments like non-PPP projects. First instalment worth 20% of the admissible CA will be released on approval of DPR and finalization of financial model of PPP project. While claiming first instalment, details of the PPP projects will be submitted online as under:

Sl. No.	**Name of PPP project**	**Total cost of project (₹ crore)**	**Total Viability Gap (VG)**		**Viability gap to be funded**		**Brief detail of financial model adopted**
			Amount (₹ crore)	VG as % of project cost	By Centre(₹ crore)	By State(₹ crore)	

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Second instalment worth 40% of admissible CA for PPP project will be released on achieving 15% of physical as well as financial progress of the project. Third instalment will be released on achievement of functional outcomes as described in **Article 7.2.** Payment of annuity over the agreed period of time as per financial model will be done by the State/ ULB. To bring in confidence for PPP projects, States may facilitate ULBs to operate Escrow accounts for ensuring seamless fund flow.

7.4 **Administrative and Other Expenses (A&OE) for States & MoHUA:**

7.4.1 3.25% of annual budget allocation will be earmarked for States/ UTs. State A&OE funds will be allocated among all States/ UTs/ ULBs depending on their urban population and area in the ratio 90:10.

7.4.2 A&OE funds will be released to the State in the beginning to kickstart the Mission. Some funds will be provided to the State for establishing State Mission Management Units like PDMC. To enable ULBs to prepare City Water Balance Plans (CWBPs), ₹ 20 lakh will be provided per AMRUT City to the State, to be passed on to each AMRUT ULB based on their claim in SNA account and ₹ 10 lakh each for rest of the ULBs. This can also be used to establish dedicated unit for Mission management in ULBs. The States may initiate immediate action to onboard resources for assisting the cities/ parastatals for operationalizing Mission.

7.4.3 A&OE action plan will be submitted by States/ UTs along with SWAPs as per **Annex-4**. Annual A&OE allocation to a State/ ULB will be released in two instalments. First instalment for the first year will be released on receipt of A&OE action plan. Second instalment will be released on receipt of online claims and UC worth at least 75% of central assistance already released. In subsequent years, first instalment will be released on receipt of action plan and UC worth 75% of all the A&OE fund released in previous years. Eligible A&OE funds will be restricted as per proportion of actual expenditure.

7.4.4 State A&OE funds can be spent on following:

i. Capacity building, preparation of CWBPs, Programme Management/ Implementation Unit (PMU/ PIU),

ii. Project Development and Management Consultant (PDMC), State Mission Management Unit (SMMU),
iii. City or City cluster Mission Management Unit (CMMU),
iv. Preparation of Detailed Project Reports (DPRs),
v. Publications like e-Newsletter, guidelines, brochures etc., promotional activities for Mission,
vi. Display of the logo and tagline of AMRUT 2.0 prominently on all projects,
vii. Reform implementation.

7.4.5 Due to smaller size and fewer ULBs, North-Eastern and Himalayan States may need specialized handholding for efficient project implementation. On their written request MoHUA may deploy additional support/ experts/ institutions to augment capacities. Representatives from local technical institutions, colleges and universities may be employed in these PDMCs/ PMUs.

7.4.6 In addition to water sector experts, hydrogeologists and data analysts may be part of Mission management units at State, regional and city level. Model guidance document for procurement of these team members will be provided by MoHUA, if required.

7.4.7 The A&OE funds for MoHUA will be utilized at the National Mission Directorate level on following:

i. Capacity building,
ii. Convening national & regional workshops,
iii. Conferring awards and recognition, up-scaling and replication of best practices & smart solutions,
iv. Commissioning of research and applied studies through Center of Excellence and other institutions,
v. Independent Review and Monitoring Agency (IRMA) to be positioned at State/ sub-State/ regional level,
vi. Feedback using gig economy model,
vii. International cooperation for capacity building and technology development, etc.,
viii. Pey Jal Survekshan components

7.4.8 Following is the indicative (not exhaustive) list of **inadmissible** components under A&OE:

i. Purchase of land for projects or project related works,

ii. Regular staff salaries of State Governments/ULBs,

iii. Any other purpose not oriented towards achieving Mission objectives.

7.5 **Reform Incentive:**

7.5.1 Funds totaling ₹ 5,340 Crore has been earmarked as reform incentive. Eight percent of the annual budget allocation will be given as reform incentive to States/ UTs every year for achievement of Reforms from second year of Mission onwards. Incentive for reforms implemented in a year will be awarded in the succeeding financial year. States/ UTs will submit reform roadmap along with SWAPs. Reforms covered under AMRUT 2.0 under various categories have been brought out in **Article 8.**

7.5.2 A toolkit for marking system will be issued before commencement of financial year. Procedure of assessing reforms and working out of incentive to the States/ UTs will be described in toolkit.

7.5.3 The incentive can be used in Mission cities on admissible components of the AMRUT 2.0 as additionality for achieving the objectives of Mission as an untied fund. The State High Power Steering Committee (SHPSC) will decide the use of the incentive amount.

7.5.4 UCs against incentive released shall be submitted in time as per guidelines of Ministry of Finance (MoF). Unutilized funds for reform incentives will be transferred to project fund every year.

7.6 **Fund flow**

Adoption of Public Financial Management System stipulated by Ministry of Finance will be the pre-condition to submit CWBPs. To receive funds under AMRUT 2.0, all transactions will have to be made through Single Nodal Agency (SNA) by using EAT as applicable, as per revised procedure for fund release stipulated in Department of Expenditure (GoI)'s OM No. F. No. 1(13)PFMS |FCD/2020, dated 23 March 2021, as updated from time to time.

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8 Reforms

8.1 Mission has a reform agenda to enhance city water security, financial health of ULBs and ease of living of citizens. Reforms will be implemented in first four years of Mission. Reform milestones to be achieved, criteria for evaluation along with timelines will be released in reform toolkit. The evaluation will be done through third party, citizen feedback and interview with officials.

There will be two type of reforms:

1) Mandatory reforms
2) Incentive based reforms

8.2 **Mandatory reforms**

Mandatory reforms will be on property tax and user charges. The States will have to implement these reforms in first two years from launch of Mission to be eligible for central assistance from third year onwards.

8.2.1 **Property tax reform** will be focused on notifying property tax calculation containing guidance value/ circle rate along with provision for its periodic increase. The increase in property tax will be ensured through this notification and increase in coverage, & collection efficiency.

8.2.2 **Reforms on User Charges** will be focused on notification by State on user charges for water supply and sewerage, resolution of its adoption by all ULBs. User charges will offset O&M expenses substantially and a periodic increase mechanism has to be put in place.

500 AMRUT cities where water supply coverage has improved substantially shall submit road map for achieving 90% billing and collection. The status of billing and collection efficiency will be verified by IRMA or in any other manner decided by MoHUA.

8.2.3 **Effective system for grievance redressal** will be put in place in ULBs.

8.3 **Incentive based reforms**

Incentive based reforms will be on water conservation, urban governance and energy efficiency.

(A) Reforms on water conservation:

8.3.1 **Reduction in non-revenue water to below 20%:**

The ideal target for non revenue water of any ULB will be 20%. Cities will submit roadmap including regularization of illegal connections and minimizing leakage in distribution system due to damages of pipes. The system in place for leakage detection and grievance redressal will be evaluated based on its effectiveness. Measuring stations at source, storage and distribution as well as number of metered connections will be the criteria for evaluation. Proactive approach to train the plumbers and infrastructure managers to ensure minimal leakages will also be assessed. Development of mobile application for reporting of pipe leakages will be the criteria for evaluation for incentive to States. MoHUA may also facilitate the mobile application development. When ULBs adopt this mobile application and implement the successful leakage detection and repair system, they will be incentivized through this reform.

8.3.2 **Recycle of treated used water to meet at least 20% of total city water demand and 40% of industrial water demand at State level**

Issue of Policy Guidelines by State for Recycling and Reuse of treated used water and its resolution by ULBs will be a **State level reform.**

Mechanism of institutionalisation to check the quality, treatment capacity of STP, treated used water recycled, percentage of recycled water used by city, industrial, agriculture and other demand, whether the treated used water is released in water bodies will also be assessed.

8.3.3 **Rejuvenation of water bodies with area preferably one acre**

ULBs which take up projects for rejuvenation of water bodies will be incentivised based on the number of water bodies taken up for rejuvenationas per the city population, DPR prepatration, award of contract and execution of work.

City population	Number of water bodies to be rejuvenated
above 40 lakh	5
10 lakh to 40 lakh	3

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1 lakh to 10 lakh	2
less than 1 lakh	1

ULBs will be evaluated based on improvement of quality of water in water body, diversion of drain/ sewer from water body and quality public spaces around water body.

8.3.4 **24x7 water supply with 'Drink from tap' facility in the selected wards**

24x7 water supply can be taken up in the form of projects. Successful implementation of such projects will be incentivized. 24x7 water supply with 'Drink from tap' facility will be evaluated on parameters of quality, accessibility and availability of water.

8.3.5 **Development of green spaces and parks**

ULBs will implement projects on divyang friendly green spaces and parks. Reform evaluation will be based on progress of implementation of these projects. Each park preferably will not be below 0.5 acre area. Park projects will be taken up as under:

City population	Number of green spaces and parks to be developed/ augmented
50,000 to 1 lakh	2
less than 50,000	1

(B) Reforms on governance:

8.3.6 **Ease of getting water and sewer connections**

ULBs will endeavour to simplify the procedure for getting sewer/ water connections for the households. The ease in getting these connections with respect to SLB achieved in getting connections, documents required and cost incurred will be evaluated under this reform.

8.3.7 **Credit rating and issuance of municipal bonds**

This reform will involve Credit rating of Tier-2 cities (population 50,000 to 99,999), enhancing credit worthiness of AMRUT ULBs and issuance of municipal bonds. Credit rating will be a **State level reform**.

8.3.8 **Online municipal services system**

Online delivery of municipal services by ULBs will be evaluated for the services such as Property tax, Death and Birth certificate, Shop license, Health license and Grievance redressal. The SLB targeted and achieved for municipal services will also be evaluated. Similarly, the

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online extent of ULB's grievance redressal system will be also be evaluated for water, sanitation, solid waste, street lights and drainage services. The guidelines issued under National Urban Digital Mission (NUDM) will be adopted for the same.

8.3.9 **Electrical Vehicle Charging Points in cities with population above 50,000**

Preparing and issuing notification and guidelines by State for providing electric vehicle charging points in specified class of buildings/ areas and resolution by ULBs for adoption of guidelines will be the evaluation criteria.

8.3.10 **Augmenting double entry accounting system**

Double entry account system shall be adopted for all the ULBs. Complete migration to double entry accounting system and obtaining audit certificate will be evaluated.

8.3.11 **PPP project in non-million plus cities**

Planning and implementation of projects in PPP mode in water sector in cities with population below ten lakh will be evaluated.

8.3.12 **Involvement of community** including women SHGs in water demand and water infrastructure management will be incentivised.

(C) Reform on energy efficiency:

8.3.13 **Reform on energy efficiency**

Effective O&M SOPs for water supply and sanitation infrastructure will be evaluated. Energy efficiency of pumps and cleaning procedures for filters will also be evaluated.

(D) Reforms on urban planning and unlocking land value through urban planning

Land monetization, unlocking land value and improving land use efficiency will be undertaken through sub-schemes as under:

8.3.14 **GIS based master plans of Class-II Towns with population of 50,000 - 99,999 - sub Scheme**

A sub Scheme is proposed to be launched for GIS based master plans of Class-II Towns with population of 50,000 - 99,999. The Sub Scheme will be in line with AMRUT GIS sub Scheme, which will comprise three major components i.e. Geo-database creation, formulation of GIS based master plans and capacity building. The Geo-database will be created as per the design & standards approved by MOHUA namely "Design & Standards for Formulation of GIS based

Master Plans for AMRUT Cities" and "Design & Standards for Application of Drone/UAV technology for Formulation of GIS based Master Plans for Small and Medium Towns". The creation of Geo-database will be taken up in-house or through out-sourcing. The MoUs for Geo-database will be signed with National Remote Sensing Centre (NRSC) for Satellite based geo-data creation or Survey of India (SOI) for drone/ UAV based geo-data creation, based on requirement of State/UTs Governments.

The GIS based Master Plans will be formulated by State Governments in-house or through out-sourcing as per the State Town Planning Acts using the Geo-database created through above mentioned State of Art technologies.

8.3.15 **Sub-Scheme on Local Area Plan (LAP) and Town Planning Scheme (TPS)**

The sub-Scheme will encourage implementation of LAP and TPS in select cities targeting optimum land utilisation. It will help States and cities in preparing LAP/ TPS plans through stakeholder consultation. Handholding will be provided for the same.

9 Pey Jal Survekshan

9.1 Pey Jal Survekshan will foster healthy competition among ULBs, wherein following parameters will be assessed:

i. Water supply management & innovative practices,
ii. Compliance of water supply service level benchmarks w.r.t. coverage, quality, quantity, and user charges reforms,
iii. Reduction in Non-Revenue Water (NRW) through District Metered Areas (DMAs) and training to check leakages,
iv. Operational efficiency of sewage and water treatment plants,
v. Rejuvenation of water bodies and wells,
vi. Evaluation of collection, treatment, and reuse of treated used water.

9.2 Feedback will be taken from citizens and municipal officials to assess above parameters. Water samples will be collected and their laboratory testing will be carried out.

9.3 The results of the survey will be the basis of ranking the ULBs in terms of water sector services and water security at city and household level.

10 Technology Sub-Mission

10.1 Technology Sub-Mission will facilitate identification of innovative, proven and potential environment friendly technologies in the fields of water & used water treatment, distribution and water body rejuvenation. Following are the major initiatives to be taken under Technology Sub- Mission:

10.1.1 **Start- ups entrepreneurs:**

i. Start- ups will be encouraged in water/ sewerage sector. The Start-ups fulfilling the definition given by "Start-up India" initiative of DPIIT[1] shall be eligible to participate. Start-ups can apply to the State Mission Director by submitting a brief proposal online comprising details of the project, technology proposed, cost and intended benefits. Projects costing up to ₹ 20 lakh will be approved by a **State Water Start-Up Screening Committee** consisting of State Mission Director, representative of technical institute and/ or practitioners in water sector. Approved projects can be taken up for which necessary assistance will be provided by the concerned ULB.

ii. Start-up projects with path breaking technologies, costing more than ₹ 20 lakh will be approved by **National Water Start-Up Screening Committee** consisting of representatives of MoHUA, CPHEEO and experts in water sector.

iii. Funds will be released in three instalments of 50:40:10. First instalment (50%) will be released after approval of project by **State/ National Water Start-Up Screening Committee** as per cost of the project.

iv. Second instalment (40%) will be released on receiving the claim for the same after having achieved progress of the project and reported online.

v. Third instalment (10%) will be released after the project is completed and intended outcomes are achieved.

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[1] https://www.startupindia.gov.in/content/sih/en/startupgov/startup-recognition-page.html

vi. The first shortlisting of start-ups projects for funding should be completed within six month of launch of mission and first instalment should be released within seven months from start of mission.

10.1.2 **Technology Melas**:

Mission will support innovative, low-cost indigenous technologies including equipment, through technology challenge and melas at National/ State level.

10.1.3 **Light house projects**:

National and international agencies/entrepreneurs will be encouraged to take up lighthouse projects and demonstrate the results in water sector. Interested agency can apply to the State Mission Director for such projects with clearly defined objectives and outcomes. MoHUA will approve such projects on recommendation of SMD. Initially, such projects will be funded by the concerned agency, however, on achieving the intended outcomes within Mission period, 20% of project cost, restricted to ₹ 50 Lakhs will be reimbursed to the agency by MoHUA.

11 Synergies for effective outcomes

11.1 **Rural-Urban Synergy**:

Water markets for reuse of treated used water shall be ascertained in rural urban continuum. Co-treatment of sewage/ septage from nearby villages in spare capacities of STPs will be explored by ULBs.

To facilitate this, National, State and ULB level committees on water/ sewerage/ river/ water body coordination shall be represented by members of rural areas also, especially for peri-urban areas.

There will be a capacity building convergence between urban and rural, wherever feasible.

11.2 **Urban-Urban synergy:**

Mission covers all ULBs across the country. Many of the ULBs are very small with population below 10,000. For such ULBs, water supply projects may be techno-economically sustainable, if planned for a cluster of ULBs which are adjacent to each other. For example, a common intake line may be laid from a far-away water source for a group of ULBs. State/ULBs will endeavor to plan such projects for cluster of cities where ever feasible. Viability of such projects will be analyzed specifically by the SHPSC before including in the SWAP.

11.3 **Synergy among Missions:**

Swachh Bharat Mission (SBM), Smart City Mission (SCM) and National Urban Livelihood Mission (NULM) have components common with AMRUT 2.0. Sanitation and FSSM are components of SBM and water supply with smart elements is a component of SCM. Employment generation through various components of AMRUT 2.0 like project implementation and capacity building contribute to the cause of urban livelihood, which is also the motto of NULM.

Convergence/ synergy among these Missions is essential to achieve the outcomes targeted towards enhancing ease of living. The ULBs which cannot plan projects to achieve intended outcomes due to resource crunch can plan the projects in convergence.

12 Capacity building

12.1 Capacity building will be taken up for elected representatives, ULB functionaries, contractors & their staff and citizens. Purpose of capacity building is to enhance the functional knowledge and improve the job-related skills of targeted groups.

12.2 Suggested targeted groups and fields of capacity building are as under:

	Targeted group for capacity building	**Suggested fields of capacity building**
1	Elected representatives and Municipal functionaries	a. AMRUT 2.0 and its Reform agenda b. Recycle/ Reuse of treated used water, Rejuvenation of Water bodies, Rain water harvesting. c. Project and financial management d. E-governance and soft skills

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2	Contractors, managers and consultants	a. Project and financial management b. Aspects of water & sewerage infrastructure and recycle of treated used water
3	Plant operators, Plumbers and Workmen	a. O&M of water supply & sewerage networks and treatment plants b. Aspects of plumbing and plugging the leakages. c. RWH structures, NRW reduction,
4	Citizens including Women and members of SHGs	a. Water quality testing b. Management of water demand c. Feedbacks on functional outcomes
5	Town planners	a. Land monetization b. Form based planning, local area plans and town planning scheme c. GIS based master plans

12.3 States/ UTs may impart capacity building in fields other than those described in the Table above as per specific requirements of the State/ ULB. Training can be of any duration as decided by State and can be imparted through class room courses as well as online classes.

12.4 International and Intra-national visits to best water managing cities will also be taken up.

12.5 Capacity building plans will be submitted along with action plan for State A&OE funds as per **Annex-5**. States/ UTs will bear the expenses on capacity building through A&OE funds allocated to them. The capacity building plan will include the list of agencies that are proposed to impart training. States/ UTs may explore the institutions in their proximity to impart capacity building. North-Eastern States may also explore North-Eastern Hill University (NEHU) to impart training. Small States/ UTs can adopt cluster approach whereby persons from different States can participate in common capacity building program.

12.6 1,00,000 persons are targeted to be trained under capacity building program.

13 Urban Aquifer Management Plan

13.1 AMRUT 2.0 acknowledges the importance of wells and aquifers, and the dependence of urban population on these systems. Mission intends to prioritize management of urban aquifer systems towards its pursuit of water secure cities.

13.1.1 ULBs under Mission are expected to develop sound strategies for management of groundwater resources with specific focus on the following parameters:

i. ULB's dependence on groundwater
ii. Key characteristics of city's aquifer systems
iii. Available recharge potential within city limits

13.1.2 Mission will promote and encourage citizen's engagement for groundwater management in cities. Dug wells are identified as a common entry point towards citizen engagement and awareness generation on well recharge and rejuvenation for shallow aquifer systems in the city.

13.1.3 ULBs will facilitate a scientific approach towards management of groundwater aquifer systems by enhancing their technical capacities. ULBs shall monitor groundwater usage, identify aquifer potential and recharge opportunities.

13.1.4 Mission shall support the development of protocols for operating a scientific routine around data collection on groundwater resources that will assist in the development of aquifer management plan and its refinement.

13.1.5 A technical guidance manual specific to different aquifer systems in urban India shall be developed under Mission to assist the cities in developing an aquifer management plan.

13.1.6 The City Aquifer Management Plan will be a dynamic document that shall be revised every year until 2026 to assess the change in the dynamic groundwater balance over the mission period.

13.1.7 For the purpose of development of aquifer management plan, cities/ ULBs may provide baseline information in the first year of Mission to understand the relationship between the urban area and its underlying aquifer systems and work towards generating further information pertaining to the aquifer systems that shall be incorporated in the subsequent plans.

14 IEC Campaign

14.1 In order to ensure extensive outreach of Mission and its objectives; Information, Education and Communication (IEC) will be undertaken. IEC campaign shall target to build the capacities of local communities through information, education, and persuasion of people effecting Behavioral Change Communication (BCC). IEC will envisage to convert the campaign into a movement- *Jan Aandolan* by engaging ward committees, resident welfare associations, senior citizens, home makers, NGOs and civil society groups, students and youth, celebrities, brand ambassadors, and SHG groups.

Ensuring community participation: NULM Mission management will be involved in training and mobilizing SHGs in water quality testing and infrastructure management. At least one project's operation and maintenance of AMRUT/ AMRUT 2.0 in each city may be considered for deployment of well-trained SHG.

14.2 Objectives of IEC campaign areas under:

- To create awareness about practices for water conservation like rainwater harvesting, clean water bodies, ground water recharge and intensive plantation, etc.
- To make people aware about municipal services, especially new water connection.
- To effect behavioral changes about optimum usage and minimizing wastage of water.
- To inculcate sense of ownership of water supply infrastructure among citizens.
- To enhance awareness about creation of markets for treated used water in rural/ peri-urban areas.
- To encourage potential investors to invest in PPP projects in water sector through project profiles.

14.3 **Strategy for IEC:**

MoHUA will devise strategy for IEC activities at National, State, and ULB level. It will include the tools of awareness campaigns on the objectives brought out above. MoHUA may appoint external consultants/ agencies/ organizations etc. to devise the strategy.

This strategy will be designed into two folds – 1) primary creative strategy & master templates and its adaption into multiple tools of IEC campaign. 2) Optimum utilization of such tools for information dissemination.

Similarly, States shall leverage the MoHUA's creative strategy and localize the content at the State, district and ULB level and facilitate its information dissemination.

14.4 IEC tools and action plan

Below is a snapshot of the tools of IEC plan to be used in AMRUT 2.0:

Mass Media - TV, Radio, Newspapers, Movies, AMRUT 2.0 anthem,etc.	**Social media campaign** through influencers, celebrities and Recognition of Water Warriors	**Targeted marketing** through- **Collaterals** – Pamphlets, brochures, leaflets, snippets, **Outdoor publicity** – hoardings, banners, standees, wall paintings etc.
Activations – competition among children, local community	**Community engagement** through train the trainer	**Exhibition/ Melas** of success stories

14.4.1 Mass Media - TV, Radio, Newspapers, Movies

Broadcast of "Audio-Visual spots" through internet, television, local cable TV and social media networks. Advertisements and success stories in newspapers/ magazines and short films on objectives of Mission. An audio-visual anthem on AMRUT 2.0 may be created to effect behavioral change in people regarding water and sanitation.

Radio may also be used to achieve above objectives. Audio spots, anthem and jingles through local FM channels roping in influential radio jockeys may be broadcasted.

14.4.2 Social media campaign and recognition of Water Warriors

Social media campaign can involve celebrities to spread awareness among masses about Mission; optimum usage of water; importance and avenues for recycle/ reuse of treated used water; significance of rejuvenation of water bodies, plantation and rain water harvesting etc. For this purpose, platforms such as WhatsApp, Facebook, Instagram, YouTube, LinkedIn, Twitter, etc. may be used. Mission will recognize citizens who have done outstanding work in the related fields, as '**Water Warriors'. Documentary films/ movies** on Mission objectives and success stories of water warriors may be made and shown during campaign.

14.4.3 **Targeted marketing through collaterals and outdoor campaign**

Pamphlets, brochures, leaflets, snippets may be distributed to schools, RWAs, Slum Welfare Associations, Mohalla Samitis, academic institutions, health workers, key opinion leaders and beneficiaries, etc. **Outdoor campaign may be done via hoardings, banners**, **standees, wall paintings etc**. at ULB offices, schools, institutions, railway stations, bus stops, malls, markets, subways, inside and outside public transport buses, etc.

14.4.4 **Local level activations**

Organizing competitions on painting and essay writing, etc. on water related topics in schools, colleges, slums, and RWAs, etc.

14.4.5 **Community engagement using 'Train the Trainer' workshops**

Community young leaders at local level may be identified and trained in 'Train the Trainer' workshops. These leaders may further train the community and create sensitisation among community in water related aspects.

14.4.6 **Exhibition and Melas of success stories**

Start-ups, entrepreneurs, research centers, institutions etc. may be engaged in local level exhibitions/ Melas to showcase their technologies and processes. This will help in increasing awareness of ULB functionaries, contractors, plant operators, and citizens.

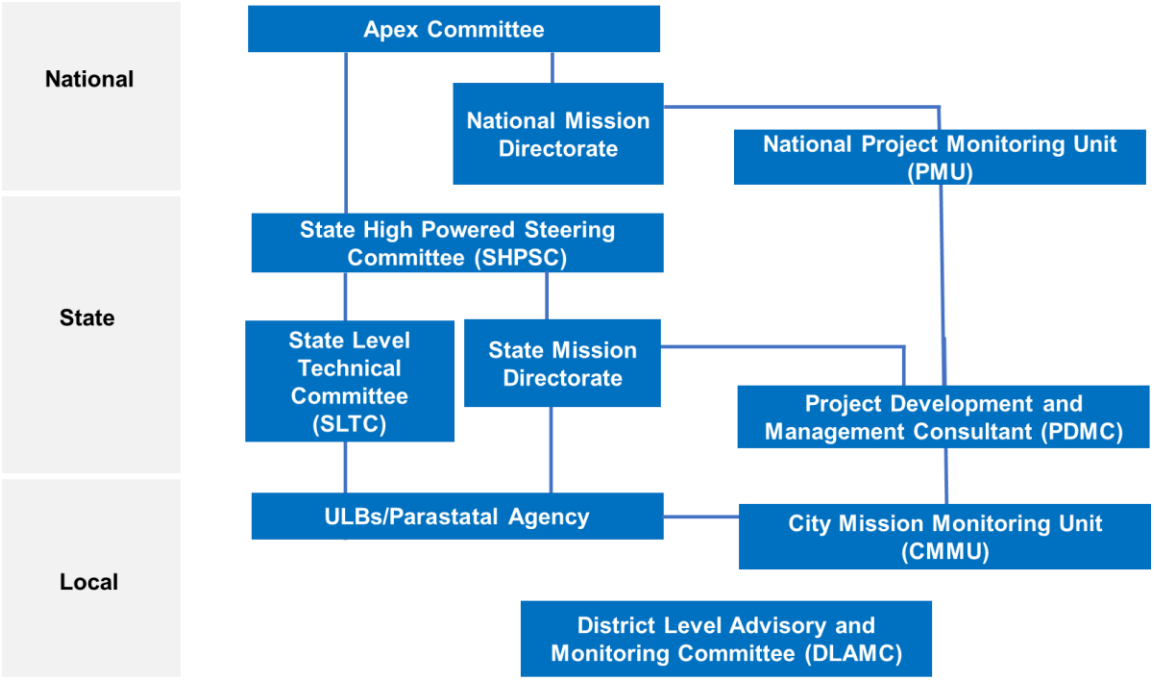
14.5 **Funding**:

MoHUA will receive 1/3rd of annual IEC funds, and remaining funds will be disbursed to States/ UTs. State share will be worked out giving weightage to urban population and area of States in ratio of 90:10.

Annual IEC action plan will be submitted by States/ UTs along with SWAPs as per **Annex-6**. Annual IEC allocation to a State/ ULB will be released in two instalments. First instalment for the first year will be released on receipt of IEC action plan. Second instalment will be released on receipt of online claims and UC worth at least 75% of central assistance already released. In subsequent years first instalment will be released on receipt of action plan and UC worth 75% of all the IEC fund released in previous years.

15 Institutional Mechanism

15.1 A three-tier institutional mechanism has been devised for implementing Mission as under:



15.2 **National Level**

15.2.1 **Apex Committee (AC)**

An Apex Committee (AC) chaired by the Secretary, MoHUA and comprising representatives of related ministries and organizations will monitor Mission. For the successful implementation of Mission, the Apex Committee (AC) will have following responsibilities:

i. Policy guidance formulation, central assistance, and technical support to States/ UTs.
ii. Approval of State Water Action Plans (SWAPs).
iii. Allocate and release funds to the States/ UTs/ Mission Directorate.
iv. Monitoring of Mission progress & fund utilization at State/UT level.
v. Advise States/ UTs on roadmap for reform implementation and monitoring progress.
vi. Advise the State/UT/ implementing agencies on innovative ways for resource mobilization, private financing, and land leveraging.

vii. The Apex Committee may delegate, as it considers appropriate, some of the functions within prescribed limits to the Mission Director for ensuring speedy implementation of Mission.

Apex committee will be empowered to take any decision required for uninterrupted progress of Mission within broad framework of approved Cabinet note. Apex committee shall meet at intervals not exceeding once every quarter.

The composition of the Apex Committee will be:

1	Secretary (MoHUA)	Chairman
2	Secretary (Department of Expenditure)	Member
3	Secretary(Department of Economic Affairs)	Member
4	Secretary (Drinking Water & Sanitation)	Member
5	Secretary (Environment & Forest)	Member
6	Joint Secretary/ Advisor, NITI Ayog	Member
7	Joint Secretary & FA, MoHUA	Member
8	Adviser (CPHEEO)	Member
9	TCPO	Member
10	Director, NIUA	Member
11	Mission Director, AMRUT 2.0	Member Secretary

15.2.2 **National Project Management Unit (PMU)**

National Project Management Unit may be employed to support National Mission Directorate. It will monitor the physical and financial progress of the overall Mission, visit States/ cities as required, liaise with PDMC/ CMMU to keep the portal updated and undertake any other duties as directed by Mission director.

15.2.3 **Independent Review and Monitoring Agency (IRMA)**

IRMAs shall be selected for a State/ UT or cluster of States/ UTs by MoHUA through bidding process. Payments to IRMAs will be made by MoHUA. States/ UTs will facilitate IRMAs in undertaking reviews and feedbacks etc. Periodic reports and other documents will be submitted by IRMA to MoHUA with copy to States/ UTs. Brief description of activities to be performed by IRMAs is as under:

I. Review of projects and reforms undertaken by the States/ UTs. Ascertaining if the projects are taken up in accordance with the approved SWAPs.
II. Verification of Action Taken Report furnished by States/ UTs against IRMA observations and confirmation to MoHUA.
III. Verification of outcomes submitted/ uploaded on portal by the States/ UTs.
IV. Collecting user feedback in form of recorded video interviews and testimonials etc.
V. Assisting States/ UTs in updating the portal on regular basis.

15.3 State level

15.3.1 State High Powered Steering Committee (SHPSC)

State High Powered Steering Committee (SHPSC) chaired by Chief Secretary of State will steer the Mission program at State level. The responsibilities of SHPSC will be as under:

I. Approve State Water Action Plan (SWAP) and accord administrative approval of Detailed Project Reports (DPRs).
II. Monitor Mission including progress of projects, capacity building, IEC campaign and reform implementation, etc.
III. Recommend proposals for release of instalment of funds for projects to the Centre.
IV. Finalize State and ULB share of funds for project implementation.
V. Allocate and release of Central and State share of funds to ULBs in time.
VI. Encourage and facilitate start-ups and private entrepreneurs to participate in Mission through technology sub-Mission.
VII. Approve plans for capacity building, issue notifications, etc. for speedy implementation of reforms.
VIII. Advise State Mission Director on Operations & Maintenance of plants erected under Mission.

The indicative composition of the SHPSC will be:

1	Chief Secretary	Chairman
2	Pr. Secretary (Finance)	Member
3	Pr. Secretary (Housing)	Member
4	Pr. Secretary (Environment & Forest)	Member

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5	Representative of MoHUA	Member
6	State Mission Director	Member
7	Representative of PHE Department	Member
8	Pr. Secretary (UD)	Member Secretary
9	Pr. Secretary/ Secretary Rural Development	Member

SHPSC may co-opt members from other State government departments / organizations and may invite experts in the field to participate in its deliberations.

Mission at State level will be led by State Mission Director, who will be an officer not below the rank of Secretary, nominated by the State Government. The State Mission Directorate will be responsible for developing DPRs and bid documents with the help of ULBs & PDMCs and forwarding them to the SLTC for technical approval. State Mission director may seek guidance from SHPSC to ensure speedy implementation of AMRUT 2.0.

15.3.2 **State Level Technical Committee (SLTC)**

States/ UTs shall appoint SLTC which will be primarily responsible for technical appraisal of DPRs and tender documents. Before giving approval, SLTC will ensure availability of undisputed land for projects, inclusion of O&M for at least five years and last stretch of tap/ sewerage connectivity to households.

The indicative composition of the SLTC is given below.

1	Pr. Secretary (UD)/ Secretary (UD)	Chairman
2	Water Resources/Ground Water Department	Member
3	Public health department	Member
4	Electricity Department	Member
5	Finance Department	Member
6	State Mission Director	Member
7	Technical Head (e.g. Engineer-in-Chief) Urban Water Supply & Sewerage Board	Member Secretary
8	M.D. of Parastatal	Member

15.3.3 **Project Development and Management Consultant (PDMC)**

The PDMCs may be procured by the States/ UTs through a contract, model Request for Proposal (RfP) which is available in Mission toolkit. Each PDMC will have one State office at State capital comprising management and design professionals and multiple field offices comprising project implementation professionals. PDMC in place for AMRUT Mission can continue to work for AMRUT 2.0 at the discretion of State Mission Director.

The scope of PDMCs will broadly cover planning, design, supervision and management of projects. They will prepare CWBPs, CWAPs and SWAPs and carry out investigation, design, procurement, and implementation using PMIS / latest IT tools and techniques. They will help in monitoring physical & financial progress of projects and updating Mission portal. They will also help States/ UTs in conducting capacity building activities.

The PDMCs will examine convergence with other similar schemes in terms of coverage, fund flow, impact and outcomes. The scheduling of projects for next five years will be done in consultation with citizens. During the process of developing the SWAP, the PDMCs shall explore the possibility of Public Private Partnerships (PPP) in project implementation. PDMCs will prepare Detailed Project Reports (DPRs), which shall include financial plan and O&M strategy for complete life cycle of projects. Based on approved DPRs, PDMCs will provide bid documents and support States/ULBs in procurement of contracting firms. They will subsequently provide extensive support to ULBs/State parastatal for project implementation.

15.4 **ULB level**

At the city level, the ULB represented by Municipal Commissioner/ administrative head of ULB, etc. will be responsible for implementation for Mission. The responsibilities of ULB will be as under:

i. Submit City Water Balance Plans in time.
ii. Help State Mission Director/ PDMC in preparation of DPRs.
iii. Act for tendering and award of contracts as per financial rules & regulations and ensure timely completion of work under contract.
iv. Participate actively and provide necessary support for Pey Jal Survekshan.
v. Ensure that the reforms are achieved within timeline.

15.5 City Mission Management Units (CMMUs)

The States/ UTs may decide to appoint CMMUs comprising sector experts to support a city or a cluster of cities within the State.

15.6 District level

The Ministry of Housing & Urban Affairs has issued Guideline regarding District Level Advisory and Monitoring Committee (DLAMC) to be formed under District Magistrate (DM) to review and monitor several programs in urban sector including AMRUT 2.0. Elected representatives and representatives from ULBs and Gram Panchayats in the district will be the part of this committee. The Committee will monitor and review the implementation of AMRUT 2.0 projects in accordance with the applicable guidelines.

15.7 Audit and litigation matters

State Mission Directorate shall be responsible for all matters connected with C&AG Audit and litigation including cases before Courts/Tribunals and Arbitrators. State Mission Directorate shall be responsible for defending the Central Government interests on behalf of the National Mission Directorate, MoHUA.

15.8 Ongoing projects of AMRUT

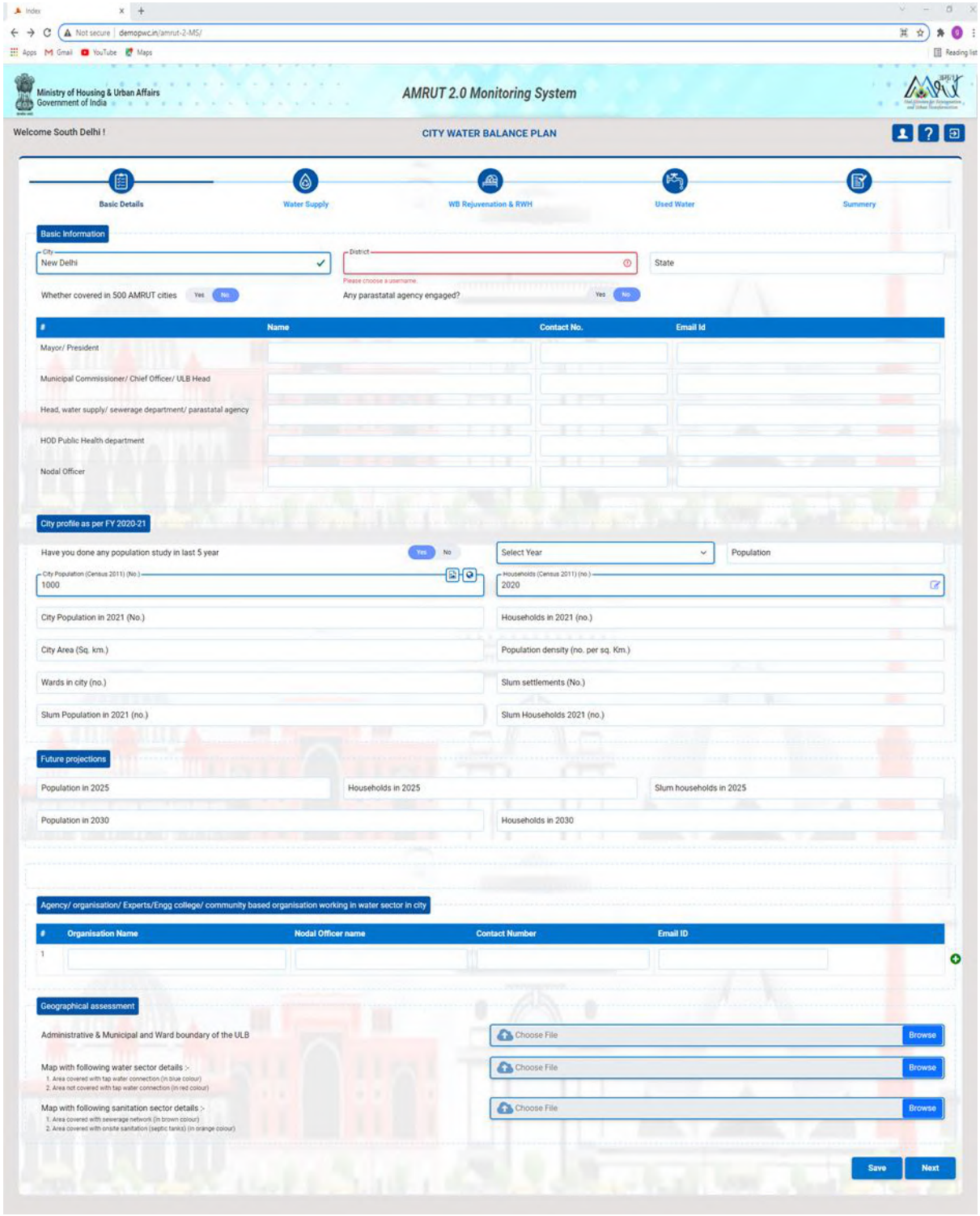
Ongoing AMRUT projects will continue to be funded as per AMRUT guidelines.

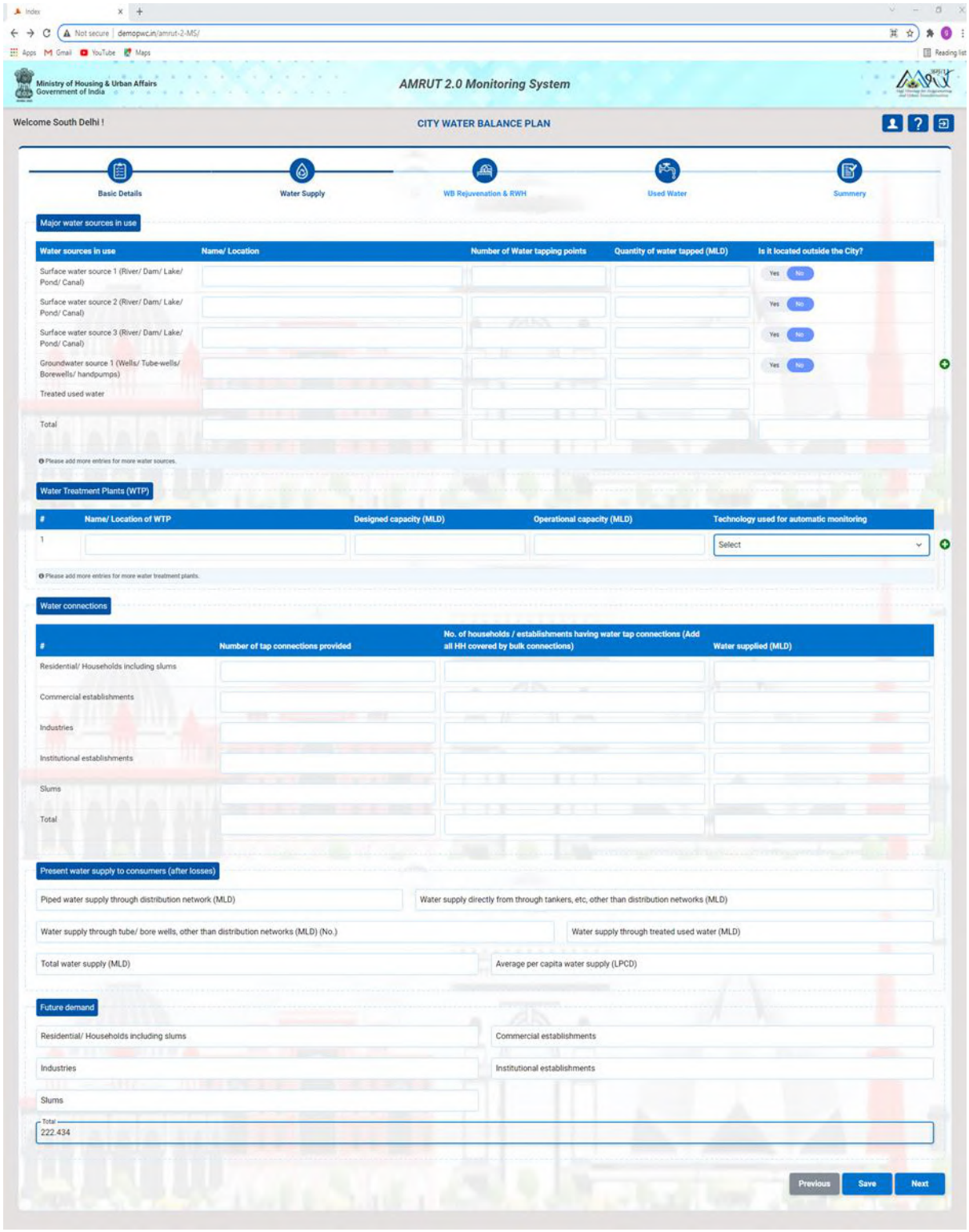
16 Indicative Annexures

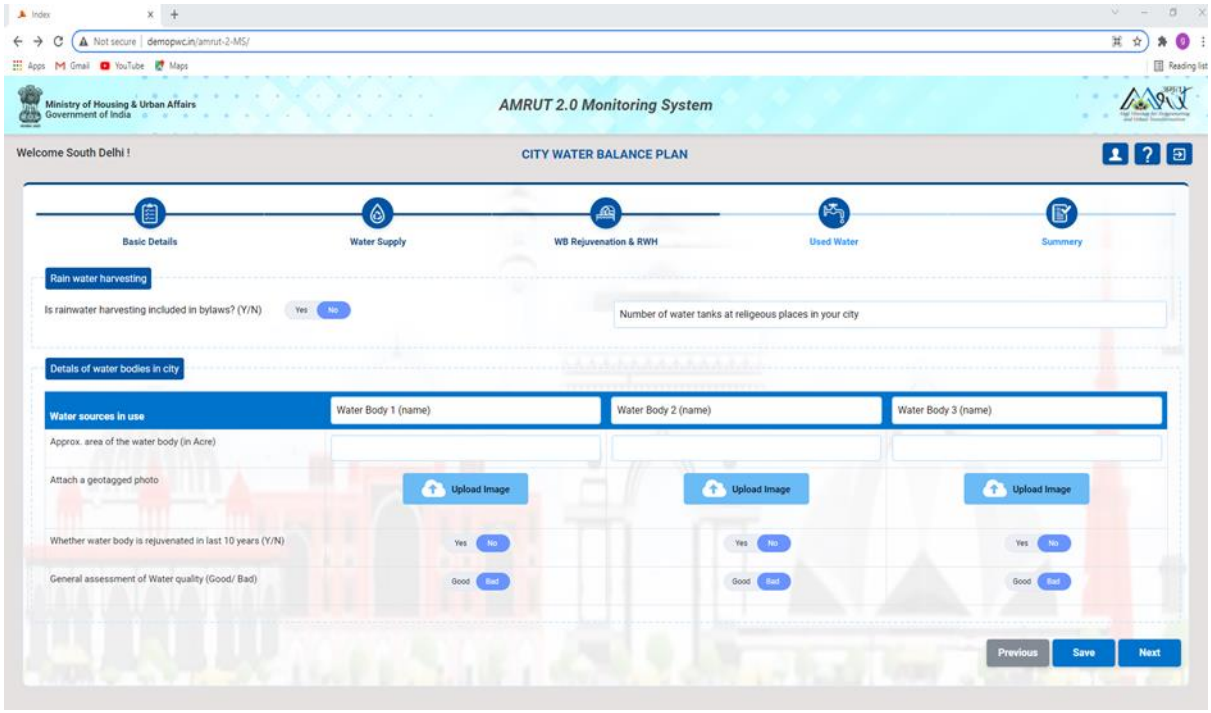
The annexures give indicative formats. The final formats will be made available through online portal developed by MoHUA.

Annexure 1

City Water Balance Plan




Ministry of Housing & Urban Affairs
Government of India
AMRUT 2.0 Monitoring System
Welcome South Delhi !
CITY WATER BALANCE PLAN
Basic Details
Water Supply
WB Rejuvenation & RWH
Used Water
Summery
Major water sources in use
Water sources in use
Name/ Location
Number of Water tapping points
Quantity of water tapped (MLD)
Is it located outside the City?
Surface water source 1 (River/ Dam/ Lake/ Pond/ Canal)
Surface water source 2 (River/ Dam/ Lake/ Pond/ Canal)
Surface water source 3 (River/ Dam/ Lake/ Pond/ Canal)
Groundwater source 1 (Wells/ Tube-wells/ Borewells/ handpumps)
Treated used water
Total
Water Treatment Plants (WTP)
Name/ Location of WTP
Designed capacity (MLD)
Operational capacity (MLD)
Technology used for automatic monitoring
Select
Water connections
Number of tap connections provided
No. of households / establishments having water tap connections (Add all HH covered by bulk connections)
Water supplied (MLD)
Residential/ Households including slums
Commercial establishments
Industries
Institutional establishments
Slums
Total
Present water supply to consumers (after losses)
Piped water supply through distribution network (MLD)
Water supply directly from through tankers, etc, other than distribution networks (MLD)
Water supply through tube/ bore wells, other than distribution networks (MLD) (No.)
Water supply through treated used water (MLD)
Total water supply (MLD)
Average per capita water supply (LPCD)
Future demand
Residential/ Households including slums
Commercial establishments
Industries
Institutional establishments
Slums
Total
222.434
Previous
Save
Next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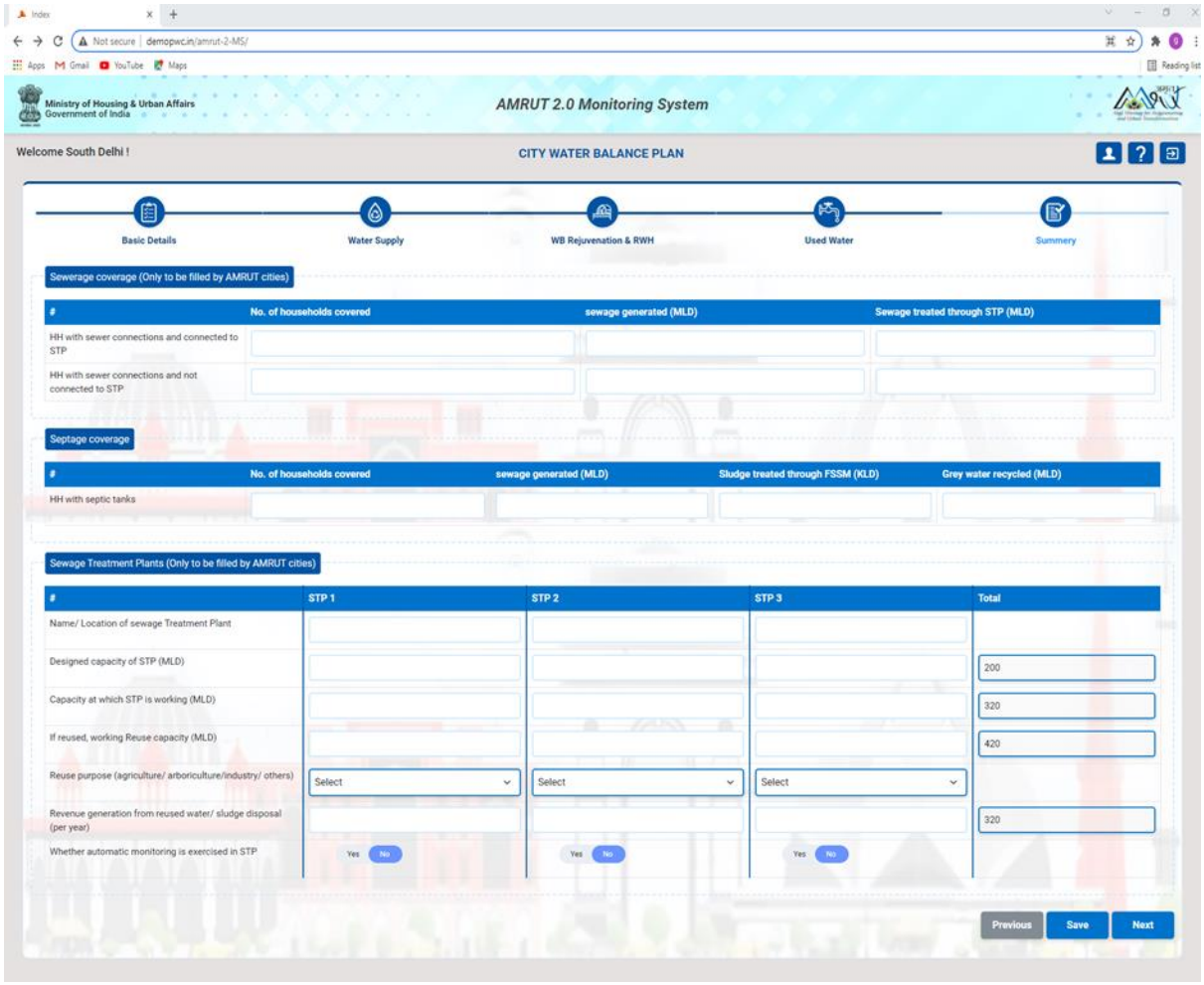
Ministry of Housing & Urban Affairs
Government of India
AMRUT 2.0 Monitoring System
Welcome South Delhi !
CITY WATER BALANCE PLAN
Basic Details
Water Supply
WB Rejuvenation & RWH
Used Water
Summery
Rain water harvesting
Is rainwater harvesting included in bylaws? (Y/N)
Yes
No
Number of water tanks at religeous places in your city
Detals of water bodies in city
Water sources in use
Water Body 1 (name)
Water Body 2 (name)
Water Body 3 (name)
Approx. area of the water body (in Acre)
Attach a geotagged photo
Upload Image
Upload Image
Upload Image
Whether water body is rejuvenated in last 10 years (Y/N)
General assessment of Water quality (Good/ Bad)
Good
Bad
Previous
Save
Next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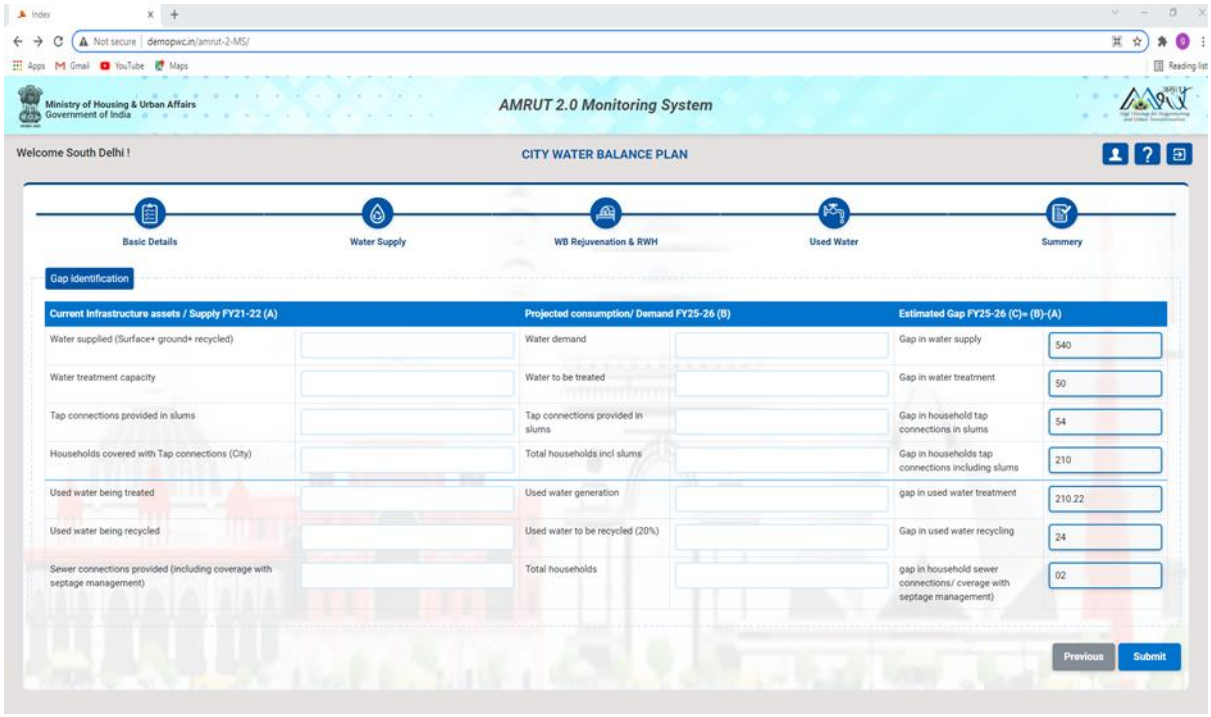
AMRUT 2.0 Monitoring System
Welcome South Delhi !
CITY WATER BALANCE PLAN
Basic Details
Water Supply
WB Rejuvenation & RWH
Used Water
Summery
Sewerage coverage (Only to be filled by AMRUT cities)
#
No. of households covered
sewage generated (MLD)
Sewage treated through STP (MLD)
HH with sewer connections and connected to STP
HH with sewer connections and not connected to STP
Septage coverage
#
No. of households covered
sewage generated (MLD)
Sludge treated through FSSM (KLD)
Grey water recycled (MLD)
HH with septic tanks
Sewage Treatment Plants (Only to be filled by AMRUT cities)
#
STP 1
STP 2
STP 3
Total
Name/ Location of sewage Treatment Plant
Designed capacity of STP (MLD)
200
Capacity at which STP is working (MLD)
320
If reused, working Reuse capacity (MLD)
420
Reuse purpose (agriculture/ arboriculture/industry/ others)
Select
Select
Select
Revenue generation from reused water/ sludge disposal (per year)
320
Whether automatic monitoring is exercised in STP
Yes
No
Previous
Save
Next


Ministry of Housing & Urban Affairs
Government of India
AMRUT 2.0 Monitoring System
Welcome South Delhi !
CITY WATER BALANCE PLAN
Basic Details
Water Supply
WB Rejuvenation & RWH
Used Water
Summery
Gap Identification
Current Infrastructure assets / Supply FY21-22 (A)
Projected consumption/ Demand FY25-26 (B)
Estimated Gap FY25-26 (C)= (B)-(A)
Water supplied (Surface+ ground+ recycled)
Water demand
Gap in water supply
540
Water treatment capacity
Water to be treated
Gap in water treatment
50
Tap connections provided in slums
Tap connections provided in slums
Gap in household tap connections in slums
54
Households covered with Tap connections (City)
Total households incl slums
Gap in households tap connections including slums
210
Used water being treated
Used water generation
gap in used water treatment
210.22
Used water being recycled
Used water to be recycled (20%)
Gap in used water recycling
24
Sewer connections provided (including coverage with septage management)
Total households
gap in household sewer connections/ cverage with septage management)
02
Previous
Submit

Annexure 2

City Water Action Plan (CWAP)

2(a) CWAP for Water supply projects

Name of city: _____					
Sl. No.	**Name of water supply project**	**Number of household water tap connections proposed under project (New, augmented, 24x7 water supply connections)**	**Ward number and name of locality covered under project**	**Estimated cost of the project (₹ Crore)**	**Other source of funding for projects under AMRUT 2.0 in addition (if any)**
Proposed under AMRUT 2.0					
					NA
					NA
Ongoing/ planned projects, other than AMRUT, funded through sources like State/ ULB owned funds, XV FC grants, external funding, PPP, etc.					

2(b) CWAP for Sewerage/ septage management projects (for AMRUT cities only)

Name of city: _____							
Sl. No.	**Name of sewerage/ septage management project**	**Number of household sewer/ septage connections proposed under project**	**Ward number and name of locality covered under project**	**Proposed recycle/ reuse of treated used water and buyer/ receiver**		**Estimated cost of the project (₹ Crore)**	**Other source of funding for projects under AMRUT 2.0in addition (if any)**
				Proposed recycle/ reuse (MLD)	Name of buyer/ receiver		
Proposed under AMRUT 2.0							
							NA
							NA
Ongoing/ planned projects, other than AMRUT, funded through sources like State/ ULB owned funds, XV FC grants, external funding, PPP, etc.							

2(c) CWAP for projects on Rejuvenation of water bodies and development of parks & green spaces

Name of city: _____						
Sl. No.	**Name of project on rejuvenation of water bodies/ parks**	**Identification of water body / park (Name and latitude -longitude)**	**Area of**		**Estimated cost of the project (₹ Crore)**	**Other source of funding for projects under AMRUT 2.0 in addition (if any)**
			water body (acre)	**Park (acre)**		
Proposed under AMRUT 2.0						
						NA
						NA
Ongoing/ planned projects, other than AMRUT, funded through sources like State/ ULB owned funds, XV FC grants, external funding, PPP, etc.						

2(d) Roadmap for water tap connections

Name of the City: ____														
Number of households in the city	**Number of households having functional water tap connections as on 1 Nov 2021 (Base line)**	**Number of households to be covered through AMRUT (Post 1 Nov 2021)**	**Gap in household water tap connections (a) - (b) - (c)**	**Year wise Connections proposed (FY)**										
				2021-22		**2022-23**		**2023-24**		**2024-25**		**2025-26**		
				AMRUT 2.0	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**Total of (e) to (n)**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	

2(e) Roadmap for sewer/ septage connections (AMRUT cities only)

Name of the City: ____														
Number of households in the city	**Number of households having functional sewer / septage connections till 1 Nov 2021**	**Number of households to be covered through AMRUT (Post 1 Nov 2021)**	**Gap in household sewer / septage connections (a) - (b) - (c)**	**Year wise Connections proposed (FY)**										
				2021-22		**2022-23**		**2023-24**		**2024-25**		**2025-26**		
				AMRUT 2.0	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**AMRUT 2.0**	**Other than AMRUT 2.0**	**Total of (e) to (n)**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	

Annexure 3

3(a) State Water Action Plan (SWAP)

Name of State:_____

Sl. No.	Name of the City	Name of the project including Ward number and locality	Name of the sector	Number of new household connections, rehabilitated connections, connections provided with 24x7 water supply, as applicable proposed as applicable (To be left blank for water body rejuvenation and park projects)		Estimated cost of the project (₹ Crore)
				Tap connections	Sewer/ septage connections	

3(b) State Roadmap for achieving universal coverage of household water tap connections

Name of the State: ____														
Total Number of households in the State	**Total Number of households having functional water tap connections as on 1 Nov 2021**	**Number of households to be covered through AMRUT (Post 1 Nov 2021)**	**Total Gap in household water tap connections (a) - (b) - (c)**	**Year wise Connections proposed by State (FY)**										**Total of (e) to (n)**
				2021-22		**2022-23**		**2023-24**		**2024-25**		**2025-26**		
				AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)

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3(c) State Roadmap for achieving universal coverage of household sewer/septage connections

Name of the State: ____														
Total Number of households in the State	**Total Number of households having functional sewer connections as on 1 Nov 2021**	**Number of households to be covered through AMRUT (Post 1 Nov 2021)**	**Total Gap in household water tap connections (a) - (b) - (c)**	**Year wise Connections proposed by State (FY)**										**Total of (e) to (n)**
				2021-22		**2022-23**		**2023-24**		**2024-25**		**2025-26**		
				AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	AMRUT 2.0	Other than AMRUT 2.0/ AMRUT	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)

3(d) State Roadmap for rejuvenation of water bodies and development of parks & green spaces

Name of city	Water bodies proposed for rejuvenation		Number of water bodies proposed to be rejuvenated under AMRUT 2.0							
			FY 2023-24		FY 2024-25		FY 2025-26		Total	
	Number of water bodies	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)

Name of city	Parks & green spaces proposed to be developed		Number of parks & green spaces to be developed							
			FY 2023-24		FY 2024-25		FY 2025-26		Total	
	Number of parks	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)	Number	Total area (Acre)

Annexure 4

A&OE action plan of State

Name of State :_ _____								
Sr. No.	**Items proposed**	**Proposed spending**						
		FY 2021-22	**FY 2022-23**	**FY 2023-24**	**FY 2024-25**	**FY 2025-26**	**Total**	
1.	Procurement of PDMC / SMMU/ CMMU for preparation of CWBPs, CWAPs, Aquifer management plans, DPRs, Bid documents							
2.	Capacity Building							
3.	Reform implementation							
4.	Publications (e-Newsletter, guidelines, brochures, etc.)							
5.	Others							

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Annexure 5

Capacity Building plan of State (To be submitted with State A&OE plan of Action)

Name of State:													
	Targeted group for capacity building	**Suggested fields of capacity building**	**Year 1**		**Year 2**		**Year 3**		**Year 4**		**Year 5**		**Total (₹ crore)**
			No. of trainees	**Cost (₹ crore)**	**No. of trainees**	**Cost (₹ crore)**	**No. of trainees**	**Cost (₹ crore)**	**No. of trainees**	**Cost (₹ crore)**	**No. of trainees**	**Cost (₹ crore)**	
1	Elected representatives and Municipal functionaries	a. AMRUT 2.0 and its Reform agenda b. Recycle/ Reuse of treated used water, Rejuvenation of Water bodies, Rainwater harvesting. c. Project and financial management d. egovernance and soft skills											

2	Contractors and managers	a. Project and financial management b. Aspects of water & sewerage infrastructure and recycle of treated used water											
3	Plant operators, Plumbers and Workmen	a. O&M of water supply & sewerage networks and treatment plants b. Aspects of plumbing and plugging the leakages. c. RWH structures, NRW reduction,											
4	Citizens including Women	a. Management of Water Demand											

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		b. Feedbacks on functional outcomes											
5	Town planners	a. Land monetization b. Form based planning, Local area plans and town planning scheme c. GIS based master plans											

Annexure 6

IEC action plan

Name of State :_ _____								
Sr. No.	**Elements proposed**	**Proposed spending**						**Remarks (If Any)**
		FY 2021-22	**FY 2022-23**	**FY 2023-24**	**FY 2024-25**	**FY 2025-26**	**Total**	
1.	**Mass Media** - TV, Radio, Newspapers, Movies, AMRUT 2.0 anthem, etc.							
2.	**Social media campaign** through- influencers, celebrities and recognition of Water Warriors							
3.	**Targeted marketing** through- **Collaterals** – Pamphlets, brochures, leaflets, snippets, **Outdoor publicity** – hoardings, banners, standees, wall paintings etc.							
4.	**Activations** – competition in institutions, local community							
5.	**Community engagement** through train the trainer							
6.	**Exhibition/ Melas** of success stories							

“Indicative Guidelines for Restoration of Water Bodies”

(in compliance to Hon’ble NGT Order dated 10.05.2019 in M.A.No. 26/2019 in OA.No. 325 of 2015)

Central Pollution Control Board
(Ministry of Environment, Forest and Climate Change, Govt. of India)
Parivesh Bhawan, East Arjun Nagar
DELHI-10 032
(www.cpcb.nic.in)
June 2019

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Indicative Guidelines for Restoration of Water Bodies
(Polluted Lakes, Ponds and Rivers)

1 Introduction

Adequate availability of water of required quality is pre-requisite for survival and quality of human life. Surface water bodies like lakes, ponds, reservoirs, tanks and rivers were treated as community resource or asset over the centuries. In urban areas also such water bodies played an important role as a source of drinking water, absorption of flood water and a conduit for ground water recharge. They were being nurtured, protected, conserved and managed by the active participation of the local community without any code of conduct or rule. In turn, these water bodies have been catering the local human and livestock populations. The introduction of public water supply and ground water development through tube wells and hand pumps in the modern times, coupled with urbanization and industrialization induced pollution, a tectonic shift in the attitude of the people towards these water bodies has been witnessed. Both locals as well as the government have started neglecting this asset and have stopped caring, nurturing and conserving these community resources. Mushrooming urban, industrial and infrastructure development has further changed the status of these water bodies from community resources to a mere dumping ground or sink for solid wastes, construction debris, domestic sewage, industrial effluents, religious offering etc. resulting in severe degradation in the quality of such resources.

India has had abundant supply of water resources. However, from being a water abundant country India is gradually progressing towards water scarcity due to increasing population pressure, urbanization and uncontrolled growth. At present it is sustaining 18 per cent of world population with 4 per cent of global water

resources. Therefore, management of water resources has assumed great importance. Today availability of water resources is a major issue and is a big challenge facing our country.

In order to revive, restore and rehabilitate the traditional water bodies, the Government of India launched a Scheme for Repair, Renovation and Restoration (RRR) of water bodies which has multiple objectives like comprehensive improvement and restoration of water bodies thereby increasing tank storage capacity, ground water recharge, increased availability of drinking water, improvement in agriculture/horticulture productivity, improvement of catchment areas of tank commands, environmental benefits through improved water use efficiency by promotion of conjunctive use of surface and ground water, community participation and self-supporting system for sustainable management for each water body, capacity Building of communities in better water management and development of tourism, cultural activities, etc. by providing Central Grant to State Governments under a Pilot Scheme directly linked to agriculture during the remaining period of X^{th} Five Year Plan in January 2005. Keeping in view the benefits arising out of the implementation of the scheme, it was extended to XII Plan as well. Further, the Ministry of Environment, Forest and Climate Change is implementing a Centrally Sponsored Scheme of National Plan for Conservation of Aquatic Eco-systems (NPCA) since February, 2013 for conservation and management of identified lakes and wetlands in the 11 country in a holistic and integrated manner. Under the scheme financial assistance is provided to the concerned State Governments for undertaking various activities for conservation of wetlands and lakes, which also include a small component of lake front development and beautification, especially in urban lakes.

The National Water Policy (2012) formulated by MoWR,RD&GR advocates conservation, promotion and protection of water and highlights the need for augmenting the availability of water through rain water harvesting, direct use of

rainfall and other management measures. Further, the Standing Committee on Water Resources (2012-13) in their 16th Report on "Repair, Renovation and Restoration (RRR) of Water Bodies" also substantiated that *encroachment on water bodies is threatening the existence of a large number of water bodies and throwing consequent challenges of depleting ground water resources, occurrence of devastating floods in urban areas as well as water scarcity. Afore-said Committee suggested steps required to remove encroachment and to restore the water bodies.*

In recent years several metro cities such as Mumbai and Chennai have witnessed unprecedented flood. Encroachment of river bed is one of the reasons of flooding since it reduces the desired waterway of the river. Inadequacies of flood protection works, reduction in the water holding capacity of natural reservoirs in the basin due to progressive siltation, breaching of river banks, raising of river bed caused by deposition of silt are also the reasons. Encroachments happen due to number of local factors, thus issue is to be looked into by concerned State Government as per the prevailing rules and regulations of the respective State/UT.

As per MoWR, RD & GR, total number of water bodies have declined in the States which may be attributed to (i) increase in population and density of population per square kilometer; (ii) change in land use pattern; (iii) shift from paddy based agriculture to cash crop cultivation; (iv) depletion of ground water; (v) rapid Urbanization; (vi) unplanned urbanization and development activities; (vii) boom in construction activity; (viii) new water bodies have been developed to meet the additional requirement of water for drinking water and irrigation arising due to increase in population; (ix) some of the water bodies mainly, wells in southern group of islands were lost due to submergence of coastal area during tsunami in 2004.

NITI Aayog based on a study warning that India is facing its 'worst' water crisis in history and that demand for potable water will outstrip supply by 2030 if remedial steps are not taken. Nearly 600 million people faced high to extreme water stress. Also, made predictions that twenty-one cities, including Delhi, Bengaluru, Chennai and Hyderabad will run out of groundwater by 2020, affecting 100 million people. If matters are to continue, there will be a 6% loss in the country's Gross Domestic Product (GDP) by 2050. Moreover, critical groundwater resources, which accounted for 40% of India's water supply, are being depleted at "unsustainable" rates and up to 70% of India's water supply is "contaminated" 'Therefore*, water resource available to the country should be brought within the category of utilizable resources to the maximum possible extent.*

Therefore, existing scenario necessitates formulation of guidelines for restoration of water bodies keeping in view (i) to make pollution free water bodies and to meet the desired water quality criteria; (ii) to preserve excess water during monsoon, (iii) to restore and augment storage capacities of water bodies (iv) to serve and enhance ground water recharge; (v) increased availability of water for different intended purposes etc., These guidelines are only indicative guidelines and limited to restoration of ponds, lakes, polluted rivers or streams and divided into two parts i.e., stagnated surface water bodies such as ponds, lakes and rolling surface water bodies such as rivers or streams. However, concerned stakeholders are advised to conduct detailed gap analysis to enable to include related action plans for restoration of water bodies for ensuring compliance to Hon'ble NGT order dated 10.05.2019. For understanding aspects relating to restoration of water bodies, the documents already published or issued by Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR), Ministry of Housing and Urban Development also be referred as given at Sl. No. 7 References of these indicative guidelines.

This requires an understanding on the status of the water bodies, their suitable use, need for management and conservation so that they serve as a good

resource for future, potential strategies for long-term management especially in the urban areas, which are facing severe water shortage. It should include (i) Recognition Phase, (ii) Restoration Phase; (iii) Protection Phase; (iv) Improvement Phase and (v) Sustenance phase

2. Recognition Phase

Identification and recognition of the problem (inventory of existing and lost water bodies (due to encroachment, pollution, diversion etc.), analysis of cause of the problem and its effect and development of alternative solutions of problem as detailed below: -

2.1 Collection and maintenance of historical information relating to the water bodies

Based on the records available or remote sensing data or GIS maps, interaction with the public living in the vicinity of the water body, following information relating to the water bodies should be collected and records maintained by the concerned department in the State/UT: -

2.1.1 Stagnated water bodies such as ponds/lakes

A. ***Geographical details of the water body: -*** GPS Location and address of the water body, size or dimensions, area, elevation above mean sea level, ownership of the water body, boundaries with earmarking, map of water body (Digital map or remote sensing or satellite map over the years/National Wetland Atlas) with salient features

B. ***Hydrological description of the water body: -*** area, category of lake or pond (natural or man-made), average and maximum depth of stored water (during monsoon and non-monsoon period), total storage capacity, main source of water (rainfall/groundwater seepage/catchment

runoff/direct or indirect flow from any river or stream or creek), water permanence (permanent or intermittent), destination of excess water from pond or lake, purpose used to serve (like drinking water source, fisheries and agriculture or cultivation of aquatic food plants, recreational and aquatic sports, ground water recharge, act as a sink for sediments, habitat for noteworthy animal species, migratory birds or any other purpose), status of lakes or ponds in terms of % open water and aquatic vegetation.

C. Catchment Description

- Details on natural drains or flood channels and their flows contributing to water accumulation.
- Major Towns, total population living around the water body, any sewage contribution from the towns, total sewage generation, total no. of existing STPs and their treatment capacities, if any.
- Major industrial clusters or estates contributing to pollution in water body, total no. of industries (sector-wise), sector-wise total industrial effluent generation, existing industrial effluent treatment capacity [(both captive and Common Effluent Treatment Plants (CETPs)], if any.
- Total waste generation (waste like municipal solid waste, plastic waste, industrial hazardous waste, construction and demolition waste), existing provision for collection, transportation, treatment and disposal practices in the vicinity;
- Any other relevant information such as: - (i) Declared Wetland Ramsar sites, (ii) Bio-diversity details such as flora and fauna biodiversity (list of plant species, list of animal species, species of conservation significance (rare, endangered, threatened, endemic species), major plant invasive alien species and extent of invasion, major animal invasive alien species and extent of invasion.

2.1.2 River or streams

A. ***Digital map*** *of river under consideration with its tributaries showing salient features.*

B. ***Geographical and Hydrological description of polluted river***

Origin of the river and confluence with any other water body, length of travel of the river before confluence with any other water body, velocity of flow (in m/sec), average cross-sectional area (in m^2), average depth of flow (in m) during monsoon and non-mon-soon period, volume of flow or discharge (in m^3 /sec), tributaries of the river under consideration for restoration, GPS location details of all the tributaries and drains confluence with the river or stream; drains or channels contributing to river pollution;

C. ***Catchment description***

- Purpose used to serve by the river or streams
- Major towns along the banks of the river, town-wise total population (with projection for the next 20 years), total water consumption (both supply by local or urban bodies and the ground water consumption), total sewage generation pattern, no. of STPs and the treatment capacity.
- Major industrial estates or clusters along the banks of the river, Industry-sector –wise no. of industries, total water consumption, total industrial effluent generation and existing mechanism for treatment of industrial effluent.
- GPS location details of STPs, CETPs and their capacities, if any
- Ground water status, its utilization and the quality.

- Agricultural practices and the control measures with respect to agricultural runoff.
- Flora and fauna including biodiversity etc.

Also, water being state subject, the State Government or Union Territory Administration should assign the task of maintaining historical records pertaining to each water body to concerned Department in the State/UT and also to designate one responsible Department to enable to take necessary remedial actions as and when situation demands.

2.2 Digital Mapping of all the collected information

All the collected information to be located on the map and such details to be periodically updated and maintained by the concerned department in the State/UT.

3. Restoration Phase includes declaring the 'designated best use' in order to formulate strategies and to decide degree of treatment required for restoration of such water body, if required, selection of best solution to problems identified and application of the solution to the problems of the land which vary from case-to-case, to achieve the designated best use water goals as detailed below: -.

3.1 Designation of water body for its use by the State/UT

The landscape of India is dotted with large number of lakes, reservoirs and wetlands. Historically, the water bodies such as ponds or lakes have met water demands of the population for centuries and a community management system had sustained them for a long period of time.

In a water body or its part, water is subjected to several types of uses. Depending on the types of uses and activities, water quality criteria have been specified to determine its suitability for a particular purpose. Among the various

types of users there is one use that demands highest level of water quality or purity and that is termed as “Designated Best Use” in that stretch of water body. Based on this, water quality requirements have been specified for different uses in terms of primary water quality criteria. The Primary Water Quality Criteria for bathing water already prescribed under Environment (Protection) Rules, 1986**.**

Every pond, lake, river or stream falling under the jurisdiction of the concerned Department of the State Government or UT Administration is required to declare for its ‘designated best use’ in order to formulate strategies and to decide degree of treatment required for restoration of such water body, if required. In the absence of such information, it would be difficult for the regulatory authorities to formulate the strategies to be prepared in case restoration of such water bodies is required.

Water being the State subject, such list of water bodies with designated best use with all the relevant information collected by the concerned Department of the State/UT Administration is required to be submitted to the concerned State Pollution Control Board (SPCB)/Pollution Control Committee (PCC), Central Pollution Control Board (CPCB) as well as MoEF & CC, MoWR, RD & GR.

3.2 National Restoration Goals (Ponds, Lakes and Rivers)

‘Water quality criteria-designated best use’ water quality parameters as given at **Annexure-I** is required to be followed as ‘National Restoration Goals (for Ponds, Lakes or Rivers)’. However, this national restoration goals or criteria given at Annexure-I is only indicative and national restoration goals issued from time to time need to be followed for restoration of water bodies.

Monitored water quality of the water body (lakes and ponds) for relevant parameters (monitored at least 8 times in a year) (average mean value) is compared with the ‘National Restoration Goals’. In case of ponds or lakes, if the monitored water quality of the selected water body is complying at least i.e.,

6 out of 8 times to the designated best use water quality parameters, then such pond or lake is fit for the 'designated best use' and if not then requires remedial measures for its restoration**.** *This criterion is applicable only in case of ponds and lakes.*

In case of rivers or streams, the criteria issued from time to time by CPCB for categorization of monitoring location need to be followed and accordingly, the strategies to be formulated for its restoration to achieve at least bathing water quality criteria. Criteria for categorization of river monitoring location is ~~are~~ given in ***Annexure-II. This criterion is to screen the potential locations having pollution (w.r.t bathing water quality parameters i.e., BOD and Faecal Coliform only) and requires more comprehensive examination to identify all the possible sources of pollution.***

3.3 Steps to be followed for restoration of stagnated polluted ponds or lakes

Conservation and restoration requires a systematic and comprehensive plan to study selective and representative freshwater ecosystems. Details of the study should include the status of ponds or lakes or rivers, their suitable use, management and conservation so that they serve as a good resource for future use and formulation of strategies for long-term management especially in the urban areas.

3.3.1 World Lake Vision

The World Lake Vision has been developed by International Lake Environment Committee (ILEC), Japan (https://www.ilec.or.jp/en/pubs/), in collaboration with UNEP , aiming at illuminating the growing crisis in management of lake ecosystem, articulating principles to guide the transition towards managing lakes for their sustainable use and to provide a practical blueprint for ensuring long-term health of lakes and integrity of their survival and economic development. The Seven Principles of Sustainable Lake Management are:

- A harmonious relationship between humans and nature is essential for the sustainable use of lakes.
- A lake drainage basin is the logical starting point for planning and management actions for sustainable lake use.
- A long-term, preventive approach directed to preventing the causes of lake degradation is essential.
- Policy development and decision making for lake management should be based on sound science and best available information.
- The management of lakes for their sustainable use requires the resolution of conflicts among competing users of lake resources taking into account the needs of present and future generations and of nature.
- Citizens and other stakeholders should be encouraged to participate meaningfully in identifying and resolving critical lake problems.
- Good governance, based on fairness, transparency and empowerment of all stakeholders, is essential for sustainable lake use.

The restoration of any water body should be considered only based on the needs and its utilities. *General steps to be followed for restoration of water bodies includes following: -*

3.3.2 Assessment of water quality of the selected water body

Water quality of all the designated best use water bodies are required to be monitored for relevant parameters and as per frequency prescribed under 'guidelines for water quality monitoring 2017' by Ministry of Environment, Forest and Climate Change (MoEF & CC)**.** *Wherever, frequency is not suggested, water bodies are required to be monitored following the standard protocols for collection of samples by the concerned department at least once in a month ~~or~~ but not less than 08 months in a year (covering pre and post-monsoon period)*

3.3.3 Need for restoration of water body

The monitored values of the water body is analyzed based on the criteria suggested under these guidelines or criteria issued from time to time by CPCB for identification of polluted lakes or ponds or rivers or streams and decision be taken for restoration of water body. The criteria suggested for river monitoring location is to use for initial screening and identification of potential hotspots on the river. A comprehensive examination of water quality is required for identifying sources.

3.3.4 Identification of sources of pollution, quantification and assessing detailed gap analysis

Following steps to be followed for idenfication of sources of pollution, its quantification and for carrying out detailed gap analysis

A. Desk Review and Reconnaissance Survey

Identification of various sources contributing to pollution in ponds or lakes–need to be carried out based on desk survey (available information or data/ google map/ historical records) and physical reconnaissance survey (based on physical visual observations, interactions with the local public etc.,) for identification and ascertaining the sources of pollution of ponds or lakes. All the possible sources of pollution should be identified which may be

- open channels or drainage channels contributing untreated sewage or untreated or partially treated effluent discharge from existing sewage treatment plant in the vicinity (or)
- any untreated industrial effluent discharges either from the individual industry or any common effluent treatment plant (CETP) located in the vicinity (or)

- improper disposal of solid waste (plastic waste/ municipal solid waste/industrial hazardous waste/sludges from septic tanks or sewage treatment plants (STPs) or hazardous waste disposal from common effluent treatment plants (CETPs) (or)
- Run off from nearby agricultural fields, if any.
- Social and cultural misuse of ponds or lakes by local communities especially for immersion of idols during festival seasons.
- Any open-defecation around the ponds or lakes by the people living in the vicinity due to lack of sanitary facilities in their dwellings or colonies and fencing all around such water body.
- Physical condition of weed growth and necessity for dredging- Aquatic plants growing in ponds and lakes are beneficial for fish and wildlife as they provide food, dissolved oxygen, and spawning and nesting habitat for fish and waterfowl. Aquatic plants can trap excessive nutrients and detoxify chemicals. However, dense growths (over 25% of the surface area) of algae and other water plants can cause (i) Fish kills; (ii) Fish flavor problems; (iii) Pond water odor problems; (iv) Drinking water taste problem and (v) Stunted fish growth.
- Silting or sediments in the ponds or lakes due to improper disposal of waste including construction and demolition waste or silt contribution from drainage channels which reduces storage capacity and accumulation of contaminated sludges.
- Status of aesthetic conditions around the water body
- Condition of the banks or bunds, spill over (provision to ensure smooth flow of excess floods on downstream especially during monsoon period) or flood channels including obstructions if any.

- Encroachment of waterbodies due to urbanization
- Condition of Eutrophication of lakes or ponds due to inadequate measures (due to indiscriminate discharge of Industrial effluents, run-off from agricultural fields, refuse and discharge of sewage, domestic wastes like food remnants, soaps, detergents cause depleted levels of dissolved oxygen in water lead to a situation where other aquatic life-forms cannot survive).
- Available In-situ available technological options for restoration of ponds or lakes (such as aeration, bio-remediation) in lakes or plants)

B. Detailed gap analysis

Detailed gap analysis to be made w.r.t municipal sewage, industrial effluent and waste management with a projection of at least 15 to 20 years, existing infrastructure for management of municipal sewage, industrial effluents and waste management in the catchment area of the water body under consideration for its restoration including volumetric flow details of all the channels or drains contributing to pollution in water body, as detailed below: -

- ***Sewage management:*** **-** Total population (with projected population at least for the next 20 years) living around the water body, total water consumption (taking into account both water supply by local/urban bodies as well as ground water consumption), total sewage generation (with projected generation quantities), total no. of existing STPs and their treatment capacities and the observed gap with regard to the sewage management (gap may be estimated in the catchment of waterbody).

- ***Industrial effluent management: -*** Industrial clusters or estates contributing to pollution in water bodies, total no. of industries, estimation of total water consumption by the industries, total industrial effluent generation, existing treatment capacity (both captive and common effluent treatment plants (CETPs), gap in industrial effluent management and the requirement for captive or common effluent treatment plants

- ***Waste Management: -*** waste-wise total waste generation, existing provisions for collection, transportation, treatment and disposal (in compliance to the concerned rules) with their capacities and waste-wise gap analysis and the requirements for their management

C. Identification of other associated issues which requires attention as a part of restoration of pond or lake

Apart from identification of all possible pollution sources, detailed gap analysis, additional measures required on case-to-case basis to be identified especially in case of ponds or lakes w.r.t the following aspects: -

- Buffer Zone development maintenance and the existing activities within the buffer zone.
- Feasibility for Bio-diversity park in case adequate land is available in the vicinity of ponds or lakes.
- Greenery development in the vicinity of the ponds or lakes.
- Introduction of recreation facilities such as paddle boats, building jetty.
- Machinery and the man power requirement for maintenance of

the restored water body.

- Existing provision for disposal of waste arising from the de-siltation and de-weeding activity of a pond or lake.
- Awareness and training requirements.
- Any other related measures required also be analyzed for inclusion of such actions while making action plans for restoration of water body (E.g., aesthetic point of view, bins for rubbish management which may be generated due to visitors).

4. **Protection Phase** that takes care of the general health of the water body and ensures normal functioning. A long-term, preventive approach directed to preventing the causes of waterbody degradation is essential.

4.1 Preparation of action plans

Action plans to be prepared based on the historical information collected, desk review, reconnaissance survey conducted, detailed gap analysis for ensuring additional measures required for restoration of water body (vary from case-to-case) covering both direct and indirect measures with specific time targets and the organization responsible for implementation of action plans with budget estimates. Action plans should include covering following aspects: -

A. **Sewage Management: -** for management of sewage inflow if any (which is causing eutrophication of lake or pond) by having adequate infrastructure for treatment of sewage through adequate capacity of sewage treatment plants (STPs) or combination of other low cost treatment technologies for ensuring discharge norms notified under Environment (Protection) Act, 1986 and same should be ensured by an individual generator of sewage as well as by the concerned local or urban body.

B. Industrial effluent management: - for management of industrial effluent inflow by having adequate infrastructure for treatment of industrial effluent in the form of captive industrial effluent treatment plants or through common effluent treatment plants by the respective industry contributing to the pollution of water bodies and same also should be ensured by the respective State Industrial Development Corporations or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC). Adoption of state-of-the technologies for production processes and for ensuring treatment of generated industrial effluent (feasibility adoption of zero liquid discharge).

C. Management of waste

- Adequate infrastructure should be ensured for management of wastes (such as municipal solid waste, industrial hazardous waste, construction and demolition waste, plastic waste, e-waste) in accordance with the respective provisions notified under the Environment (Protection) Act,1986, by all the concerned.

- Periodic physical removal of improperly disposed wastes (such as municipal solid waste, construction and demolition waste, plastic waste, industrial hazardous waste, human and animal night soils) by the concerned local or urban body.

D. De-siltation

- Periodic removal of nutrient enriched accumulated sludges in ponds and lakes helps in ground water recharge potential, removal of contaminated sediments as well as increases storage capacity of lakes or ponds.

- Sediments removed from the ponds or lakes should be stored in a designated area (till moisture is completed drained out) at a suitable distance away from ponds or lakes and such dried sediments should be removed immediately so that sediments will not become a part of ponds or lakes once again especially in the event of any rain fall. Depending on the characteristics, such sediments after draining may be used as manure (complying to the manure quality prescribed under Solid Waste Management Rules, 2016 as amended from time to time or disposed of in accordance with the relevant provisions notified under Environment (Protection) Act, 1986.

E. De-weeding

- **Periodic dredging** (once in three months) of 80 % of dense and thickly covered aquatic plants viz., floating plants such as algae, duckweed, watermeal, water hyacinth; submerged plants such as milfoil, hydrilla, water lettuce, curly-leaf pondweed, clasping-leaf pondweed, coontail, sago pondweed, water lilly, water shield etc., bottom sediment, and associated nutrients should be carried out. De-weeding methods include: -

- **Preventive measures**

  - such as proper design and construction of ponds or lakes including levelling and smoothing of banks

- **Manual or physical control measures**

  - Manual or physical control measures such as non-chemical and non-motorized measures be taken for removal of weeds (manual harvesting) using hand pulling, rakes, cutters, benthic barriers, drawdown, aeration, shading and weed rollers as these measures are typically very low, however, such measures

are labor intensive and are therefore better suited to small, less established weed populations. Hand pulling and raking may result in turbid or murky water and may create plant fragments that can subsequently spread to new sites.

- **Mechanical control measures**

  - Using motor-driven under water weed cutters or floating weeds, rotovators essentially large-scale underwater rototillers for tilling up lake or pond sediments as well as to chop and loosen plant roots, or draglines (in case of underwater pond or lake dredging) (or) dry-land excavation machinery such as bulldozers (in case of drained ponds or lakes) shall be used (or)
  - Limiting the amount of sunlight available to aquatic plants by floating black plastic sheeting on the water surface (or) use of dark-colored and nontoxic water dyes (such as nigrosine, aniline and aqua-shade)

- **Biological controls** i.e., introducing aquatic animals and plants that eat or compete with waterweeds. Herbivorous animals (those that eat plants) include a wide variety of insects, snails, crayfish, tadpoles, turtles, fish (sterile, triploid grass carp), ducks, geese, and swans which can be stocked in ponds or lakes to consume aquatic plant.

- **Application of common aquatic herbicides** for **control of lake or pond weeds**

Use of herbicides is not recommended as it may kill fish in ponds or lakes. Herbicides should be used in a controlled and systematic way under the supervision of the expert and general herbicides that may be used for weed control are as given below-

- *For Algae (microscopic, filamentous, Chara) control- Herbicides such as copper sulfate, copper chelates, endothall,, simazine)*

- *Submerged Plants (coontail, watermilfoil, pondweeds such as sago, curlyleaf, leafy) control- Herbicides such as Endothall, Diquat, simazine, fluridone may be used*

- *Free-floating plants (duckweed, watermeal) control:- Herbicides such as Diquat, simazine may be used*

- *Rooted-floating plants such as (waterlilies, spanerdock) control- Herbicides such as Glyphosate and 2,4,-D may be used*

- *Emergent plants (cattails, perennial grasses, and broadleaves) control: - Herbicides such as Glyphosate may be used*

F. Prohibition of discharges or disposal of waste or washing activity and action against violators

- Ban on discharge of industrial effluent or sewage or waste (such as municipal solid waste or industrial hazardous waste or plastic waste or construction and demolition waste or sludges from septic tanks/ STPs/CETPs) into lakes or ponds or drainage channels connected with ponds or lakes or open defecation in the vicinity as well as washing of clothes or wading of cattle

- Stringent actions be taken against violating industry by the SPCB/PCC as per provisions under Water (Prevention and Control of Pollution) Act, 1974 as well as Environment (Protection) Act, 1986

- Levying of fine or Environmental Compensation on the violators for improper disposal of sewage or industrial effluent or wastes into lakes or ponds.

G. Stabilization of earthen bunds and the drainage channels as well as silt and soil erosion control measures

- Stabilization of earthen embankments, shore line protection with vegetative or rock riprap to avoid soil erosion and the inflow drainage channels with the stone revetment or pitching so as to avoid rapid seepage or leakages

- All the inflow drainage channels should be provided with suitable silt barriers or sediment traps or sediment detention basins at suitable intervals for control of silt especially during monsoon.

- Also, at all the outfalls of drainage channels, suitable strains or traps should be provided to control inflow of all the floating materials and periodic removal of floating materials should be ensured.

H. Protection drainage basin including preservation of drainage channels

A lake or pond drainage basin is the logical starting point for planning and management actions for sustainable lake or pond use. A long-term, preventive approach for preventing the causes of degradation is essential.

- Historically the drainage channels which used to carry natural runoff from the drainage basin and presently carrying either untreated municipal sewage or industrial effluent or both and contributing to pollution of water bodies eventually due to encroachment in view of urbanization. All such drainage channels need to be restored by interventions such as (i) stoppage of inflow of untreated municipal

sewage or industrial effluent. If required, interaction and diversion of untreated sewage or industrial effluent from such drainage channels by routing through properly designed dedicated sewerage network to ensure conveyance and for ensuring treatment and disposal through STPs/CETPs. Feasibility of in-situ treatment of treated sewage and industrial effluent within drainage channels and prior to the inflow into the water bodies also be explored by the concerned authorities.

- Major channels running from the larger watersheds should be identified based on the historical data and such drainage channels should be preserved and protected with suitable buffer land without any impervious cover. This aspect should be ensured by the State Local/ Urban Development/Town Planning authorities while planning or expansion of a locality.

I. Removal of encroachments and blockades

- The Stat Government or UT Administration should maintain records pertaining to the boundaries of each pond or lake in the respective State/UT and necessary steps should be taken and ensured removal of all encroachments in the water body spread area/water body boundary as and when required.

- Removal of encroachments in the drainage channels should be carried out periodically to facilitates enhancement in aeration naturally in the water body

- Refrain from granting any consent for establishment for large scale projects in the catchment areas.

- Pond or lake boundary should be provided with fence (permanent / temporary fencing) to avoid unauthorized entry.

J. Flood Control Measures

- Excess floods from drainage basin be controlled with a provision of properly designed ‘spill way’ with a provision of controlled gates for smooth flow of excess water or run off during monsoon.

- Remove all encroachments (lake bed, storm water drains) to prevent calamities related to floods and to facilitate inter connectivity of water bodies.

- Removal all blockades at inlet or outlets should be ensured to avoid stagnation or blockage of storm water.

5. Improvement phase that deals with overall improvement in the water body and its uses including resolution of conflicts among competing users of lake resources taking into account the needs of present and future generations and of nature.

5.1 Adoption of In-situ techniques for in-situ remediation of ponds or lakes

A. Physical treatment approaches

Aeration (using surface aerators or , submerged aerators or a combination of both may be used to increase the dissolved oxygen in the water body, which is used by microorganisms to degrade the pollutants. Aeration also aids in mixing the different thermal layers of the water body, resulting in de-stratification, exposing the lower-most layers to atmospheric air. The need and extent of aeration is calculated based on the water quality parameters, depth of water body, ambient temperatures, wind conditions

etc.). Apart from aeration, methods such as wastewater diversion, periodic de-weeding and sediment dredging, proper maintenance of drainage channels or feeder channels also helps in increase in dissolved oxygen)

B. **Chemical treatment approaches**

Flocculation using chemicals like alum and neutralizing chemicals especially during acidification (increase in pH level of the stagnated water body)

C. **In-situ techniques**

- *Using aquatic plants* (Macrophytes such as water hyacinth (Eichhornia crassipes) and water lettuce (Pistia stratiotes), Whorl-leaf watermilfoil (Myriophyllum verticillatum), pondweed (Potamogeton spp.), common reed (Phragmites communis), cattail (Typha latifolia), duckweed (Lemna gibba) and canna (Canna indica)

- *Using aquatic animals* such as clams, snails and other filter-feeding shellfish

- *Using biological techniques* may be used to decompose, transform and absorb water pollutants. However, concentration and frequency of dosing of the microbial cultures is decided based on the volume of the water body, water quality parameters, ambient temperatures and extent of algal growth [as per literature (i) an enzyme namely Phycoplus and the nutrients are mixed thoroughly and sprayed into the pond within 2-3 weeks' time significance difference may be seen; (ii) treatment method based on hydroponics technique that cleans the lake by absorbing nutrients dissolved in the water and thereby supporting living species inside the lake; (iii) floating

treatment wetlands (FTW) which are artificial islands made of chemically inert materials, gravel having floating characteristics with plants that stay afloat on the lake or ponds such as wetland plants, water hyacinth, mosquito repellents and ornamental plants like cattails, bulrush, citronella, canna, hibiscus, fountain grass, flowering herbs, tulsi and ashwagandha) which helps in cleaning the lake or pond through hydroponics system, (iv) Introduction of mixture of nutrients to grow algae formed by diatoms (the most basic, single-cell life form found in water bodies) which helps in release of oxygen into water and in turn aerobic bacteria present in water body helps to break down the organic matter and convert the pollutants to base constituents and also reduces odors from the lakes or ponds. The diatoms are eaten by zooplanktons that are, in turn, consumed by fish].

5.2 Drainage basin management

- Drainage basin management includes control of non-point sources, structural and land treatment measures (regular monitoring of structures and systems and carrying out necessary rehabilitation and modernization programmes), interception and diversion of nutrients, sediments control (terracing, contour farming, grassed water ways, prior to reaching stagnated water body.

- Crop management, crop residue management and creation of shelter belts, good Irrigation practices, run off control provisions from agriculture runoff laden with excess fertilizers and pesticides

5.3 Green or Buffer Zone

- Buffer Zone around a lake or pond (at least 50 to 100 m periphery) should be maintained as green belt zone or no activity zone and no activity is allowed within the buffer zone by the concerned Departments in the State/UT. In case, any activity presently existing within the buffer zone (50 to 100 m), such as residential or commercial or industrial activity should take necessary measures to prevent discharge of any wastes into the water body.

- Within the buffer zone, no impervious cover is allowed and mainly plantation with a dense population of deeply rooted plants, trees, shrubs and grasses should be created so as to absorb nutrients (which promotes aquatic plant growth and a shift in the water quality) that comes directly from the anthropogenic activities.

5.4 Creation of biodiversity environment

In case the water body happens to be a site for the visit by migratory birds the number and type of trees by the side of the water body and water channels have also to be monitored to ensure adequate shelter as well as suitable environment for egg laying and propagation of bird species.

5.5 Monitoring of Implementation of action plans for restoration of ponds or lakes

The action plans are to be prepared and submitted to CPCB for seeking approval. The action-plan should include activity-wise action points, specific time lines, organization responsible for implementation, budget estimates as well as Program Evaluation and Review Technique (**PERT**) chart for implementation of action plans within the specified timelines, Upon approval of action plans for restoration

of ponds or lakes, thereafter, execution of action plans to begin and to be mentioned on monthly basis by the Monitoring Committee to be constituted under the Chairmanship of Principal Secretary (Environment) of the respective State Government or Union Territory Administration. The monitoring committee should review the progress on implementation of the action plans at least once in three months and apprise the Chief Secretary of the State/UT periodically.

A model lake restoration technique is given at **Figure 1** and a model flow chart for restoration of Ponds or Lakes is given in **Figure 2**.

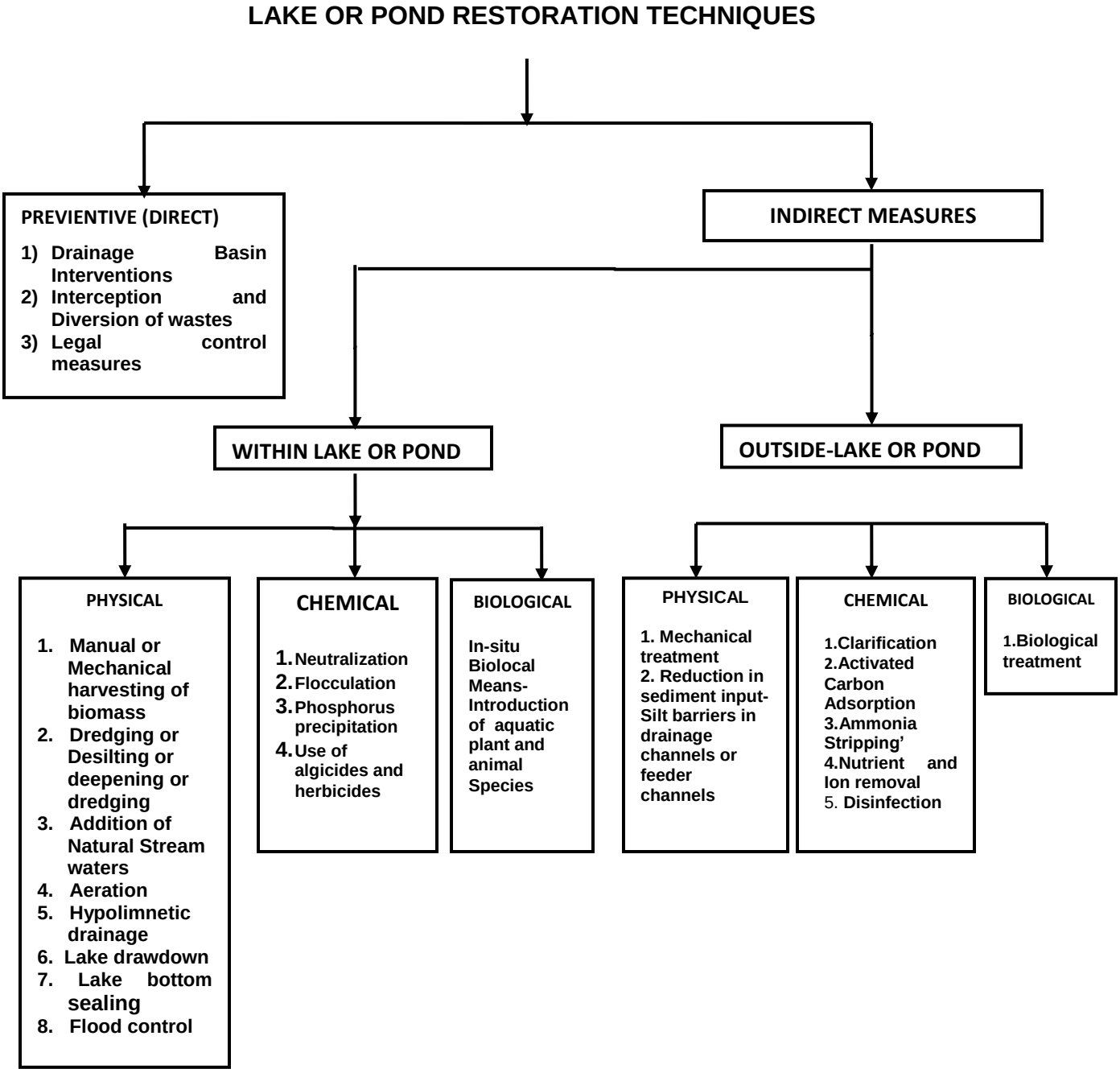

Figure 1. A Model Lake or Pond Restoration Technique

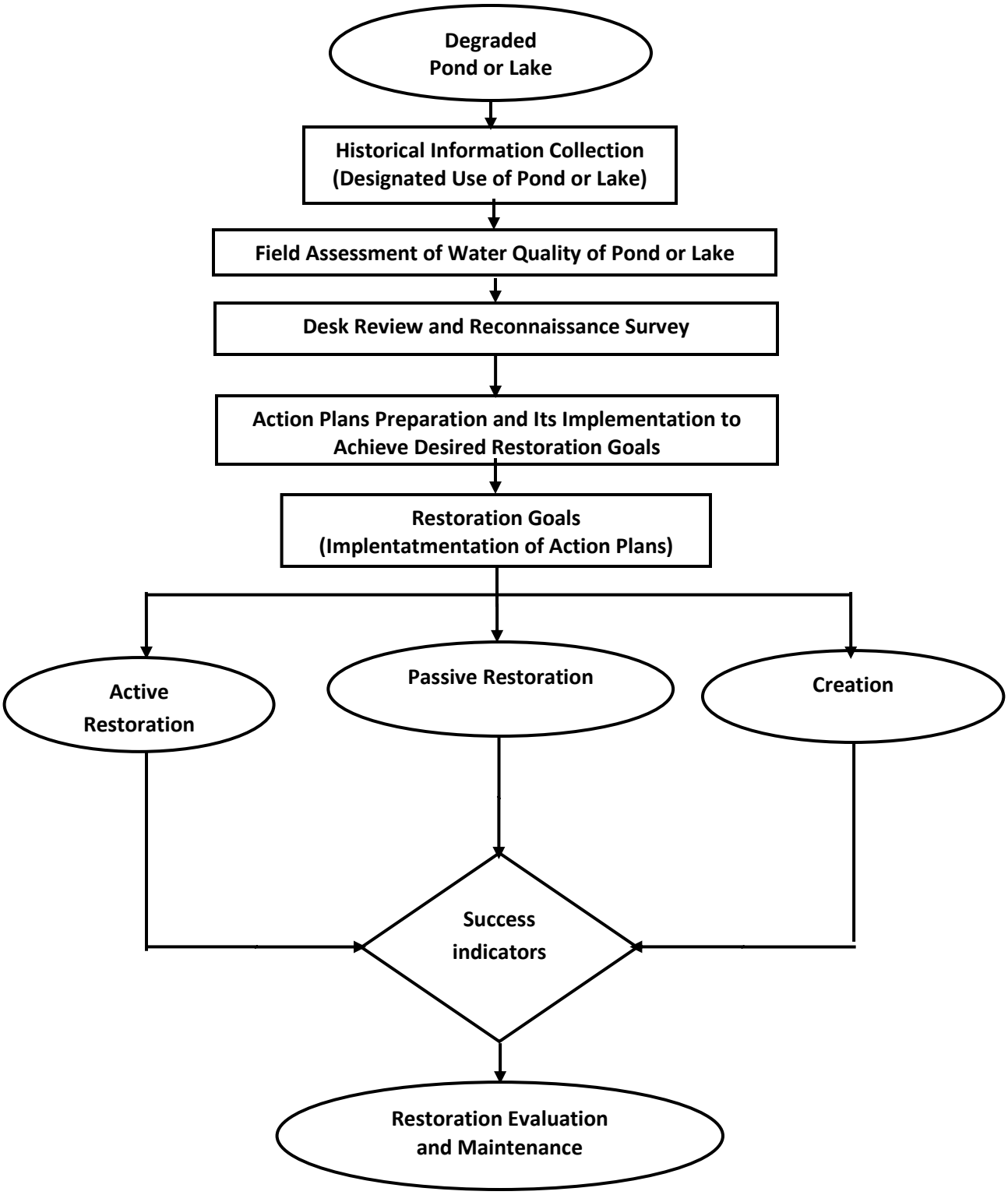

Figure 2. Model Flow Chart for Restoration of Pond or Lake

5.6 Steps involved in preparation of Action Plan for rejuvenation of polluted river stretches

A. Background Information (Refer to Sl. No. 2.1.2)

(i) Digital map of identified polluted river with its tributaries
(ii) Geographical and hydrological description of polluted river
(iii) Catchment description- uses of river, towns, cities and villages, industries (sector-wise no. of industries), ground water status and its utilisation, agricultural practices, flora and fauna etc.

B. Water Quality of River and Its Tributaries

(i) Water quality of river and its tributaries (at least for five years)
(ii) Quality assigned as per modified Water Quality Criteria **(Annexure-I)**

C. Identification of Causes of Pollution in Catchment Area of the River

- **Industrial Pollution**

(i) List of water polluting industries, industry sector-wise: water consumption, effluent generation and quantity of industrial effluent discharged into river
(ii) Status on granting of Consent under Water (Prevention and Control of Pollution) Act, 1974
(iii) Status on granting of authorization under the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016 as amended (as applicable)
(iv) Compliance status and action taken (Placing in public domain)
(v) Final disposal mode of treated industrial effluents (i.e., disposal on land or drain or ZLD or drain connected to CETP etc.,)
(vi) Performance status of captive Effluent Treatment Plants (if applicable)
(vii) Existing Common Effluent Treatment Plants (CETPs) and their performance status.
(viii) Regulation of small scale industries/tiny units'/service units discharging effluents/sludge disposal into drains/landfill or any other mode of disposal

- **Ground water management**

(i) Status of ground water level-reserves in the catchment area of river under consideration
(ii) Blocks identified as over exploited, critical, semi-critical and safe (as per Central Ground Water Board (CGWB) if any)

(iii) Status of permissions granted by Central Ground Water Board (CGWB) to the industries and other Development projects in the catchment area of river.
(i) Compliance of conditions stipulated by CGWB and subsequently by SPCB.
(ii) Ground water sources (Hand –pumps, Wells, Tube Wells) identified in the catchment area of the river and the characteristics (at least for the period of two years);
(iii) Ground water sources (Hand –pumps, Wells, Tube Wells) identified as non-potable for human consumption in river stretch with Geo-genic/or polluted due to industries.
(iv) Compliance on ground water charging imposed by Rain Water Harvesting Mechanism.
(v) Existing mechanism for supply of potable water to the human population in the affected areas.
(vi) Health deformities /clinical reports in polluted river stretch areas in view of ground water contamination.

- **Sewage treatment and disposal: -**

(i) Cities, towns and villages located on the bank of river stretches discharging sewage effluents through drains into the river.
(ii) Quantification and pollution load of sewage generated by a city/town/village.
(iv) Status of septage management.
(v) Listing of drains carrying sewage and trade effluents joining river and determining flow and characteristics with details of catchment contributing sources (drainage maps from major /minor irrigation development of State/or local body).
(vi) Existing sewage treatment capacities and performance of Sewage Treatment Plants and their compliance Status
(vii) Final mode of disposal of treated sewage as well as sludge management

- **Waste management in the catchment area of river: -**

(i) Area-wise Hazardous waste generation, treatment and final mode of disposal and the existing infrastructure.
(ii) Area-wise Status on municipal solid waste generation, treatment and final mode of disposal and the existing infrastructure
(iii) Area-wise Status on bio-medical waste generation, treatment and final mode of disposal and the existing infrastructure
(iv) Any other waste generation, treatment and final mode of disposal and the existing infrastructure

- **River catchment information**

(i) Regulation of Flood Plain Zone
(ii) Encroachment in Flood Plain Zone
(iii) Plantation status
(iv) Flow data of river/tributary

- **Gap Analysis and Identification of the problems in the identified polluted river catchment: -**

(i) Sewage generation, existing infrastructure with treatment capacities and the observed gaps w.r.to infrastructure for sewage management
(ii) Industrial effluent generation, existing infrastructure with treatment capacities and the observed gaps w.r.to infrastructure for industrial effluent management
(iii) Waste generation, existing infrastructure with treatment capacities, designed life of the treatment and disposal facilities as applicable and the observed gaps w.r.to infrastructure for waste management
(iv) Any other relevant issues

(Note: - All the details such as river and its tributaries, area-wise population, sources and water consumption quantities, sewage generation, existing infrastructure for sewage management and the gaps observed, area-wise industries (industry sector-wise no. of industries), sources of water and water consumption quantities (industry-sector-wise), industrial effluent generation, existing infrastructure for treatment (like Captive ETPs, CETPs), final mode of disposal of industrial effluents, waste generation and its management with existing infrastructure, characteristics of river and its tributaries, identified contaminated ground water resource areas has to be detailed in the map preferably a digital map)

D. The River Rejuvenation Action Plan:-

After having complete based information as detailed under earlier paras A to D above, Action Plans on each Activity with time-lines can be framed. The key components of action plan may follow the suggested points as given the Table below:

S. No	Key Activity and Components		Agency to perform the task	Proposed Specific Time Frame for implement ation of action plan
1	**Industrial Pollution Control**			
	(a)	Inventorisation of water polluting industries	SPCB	
	(b)	Grant of consents	SPCB	
	(c)	Compliance verification	SPCB/ District Magistrate (DM)	
	(d)	Planning for CETP (as applicable)	SPCB+ State Industries Department or of Industries	
	(e)	Insisting on ZLD measures, recycling/reuse of treated industrial effluents	SPCB	
	(f)	Prohibition of disposal of effluents into drains except during rainy season subject to complying to effluent discharge norms for disposal in surface water.	SPCB + DM	
	(g)	Covering small and tiny units and not allowing discharge of effluents either individually or combined	SPCB+ Local Body/ Urban Body	
	(h)	Publishing list of defaulting industries in local newspapers and involving public in reporting deliberate discharges (without entering in the premises-backyard water and reporting running of industry against the closure orders.	SPCB + DM	
	(i)	Hazardous or Non Hazardous Waste Management Plan and no dumps anywhere except at identified locations	SPCB + DM	
	(j)	Reporting Non-Compliance of CGWB	SPCB +	

		conditions and closure of Non complying units.	CGWB	
	(k)	Levying compensation or fines for non-compliances as empowered to UPPCB under the Hon'ble NGT Order Dtd. 13/07/2017 in Ganga Matter in case of Tanneries.	SPCB	
	(l)	Other Action as relevant	SPCB + Concerned Agency of State	
2	**Ground Water Protection**			
	(a)	Declaration of Polluted Blocks	CGWB	
	(b)	Embargo on Water pollution /over-abstraction of industries as per block status	CGWB	
	(c)	Rain water harvesting	Local Body + DM	
	(d)	Identification of Geo-genic contamination (as applicable)	CGWB	
	(e)	Identification of industries discharging industrial effluent illegally and levying fine on such industries including closure of such industries	SPCB + CGWB	
	(f)	Remediation of contaminated ground water (due to discharge of industrial /sewage) with the recovered funds from the default industry	SPCB + CGWB	
	(g)	Capping of contaminated tube wells and Potable water supply through alternate measures in the affected areas of groundwater	Water Supply Department	
3	**Sewage Management**			
	(a)	Identification of cities, towns and villages discharging sewage into river/tributary	State Local and Urban Development and Executing Agencies	
	(b)	Identifying drains joining river and their quantification and characterizations of pollution load		
	(c)	Preparation of Detailed Project Report (DPR) for interception and diversion (I & D) of drains to sewage treatment plant (STP) for which suitable site to be identified and plan for utilization of treated sewage.		

	(d)	Execution of STP works and necessary infrastructure and ensuring household sewer connection for full utilization of STP		
	(e)	Regular cleaning of drains and prohibiting disposal of garbage/plastic and filthy material into drains including dairy waste		
	(f)	Restoration of natural drains for carrying only storm water (but not sewage)	Local and Urban Bodies + State Water Resources + State Irrigation Department + SPCB	
	(g)	Ensuring utilization of treated sewage for beneficial use such as agriculture, construction activity, washing/flushing/cleaning, industrial cooling etc.,	Local and Urban Bodies + State Irrigation Department + SPCB	
	(h)	Interception and Diversion of sewage from Drains and connectivity to STPs	Local and Urban Bodies	
4	**Flood Plain Zone (FPZ) Protection**			
	(a)	Demarcation of FPZ and not permitting encroachments	State Irrigation Department	
	(b)	Adopting good irrigation practices to conserve water	State Irrigation Department /DFO	
	(c)	Plantation and bio-diversity parks in FPZ	State Forest Department	
5	**E-Flow**			
	(a)	E-Flow determination/gauging	State Irrigation Department	
	(b)	Regulation of flow from barrages	State Irrigation Department	
6	**Health Impact Assessment Reports-Treatment Services**			

	(a)	Epidemiological survey in the catchment to find out water-born diseases/ health issues	State Health Department	
	(b)	Providing treatment services to the diseased persons in the catchment area		
7	**Education and Awareness**			
	(a)	Regular involvement of educational institutions for creating awareness and conservation programmes	State Education Department with concerned Departments	
8	**Funding for execution of Action Plans**			
	(a)	Pooling of financial resources of state and central assistance	State Finance Commission/ MoUD and MoWR, RD & GR	

E. Monitoring of Implementation of Action Plans for Rejuvenation of Polluted River Stretches:-

(i) In compliance with Hon'ble NGT Order dated 20/09/2018 (OA No. 673 of 2018), State/UT Level 'River Rejuvenation Committee (RRC)' constituted firstly has to ensure timely preparation of action plans (before 20/11/2018).

(ii) Prepared actions plans need to be submitted to CPCB for random scrutiny as well as for approvals.

(iii) Thereafter, execution of action plans to begin and to be mentioned on monthly basis by the 'RRC' under overall supervision of the Principal Secretary (Environment) of the respective State Government or Union Territory Administration.

A model flow chart for rejuvenation of polluted river is given in **Figure 3**

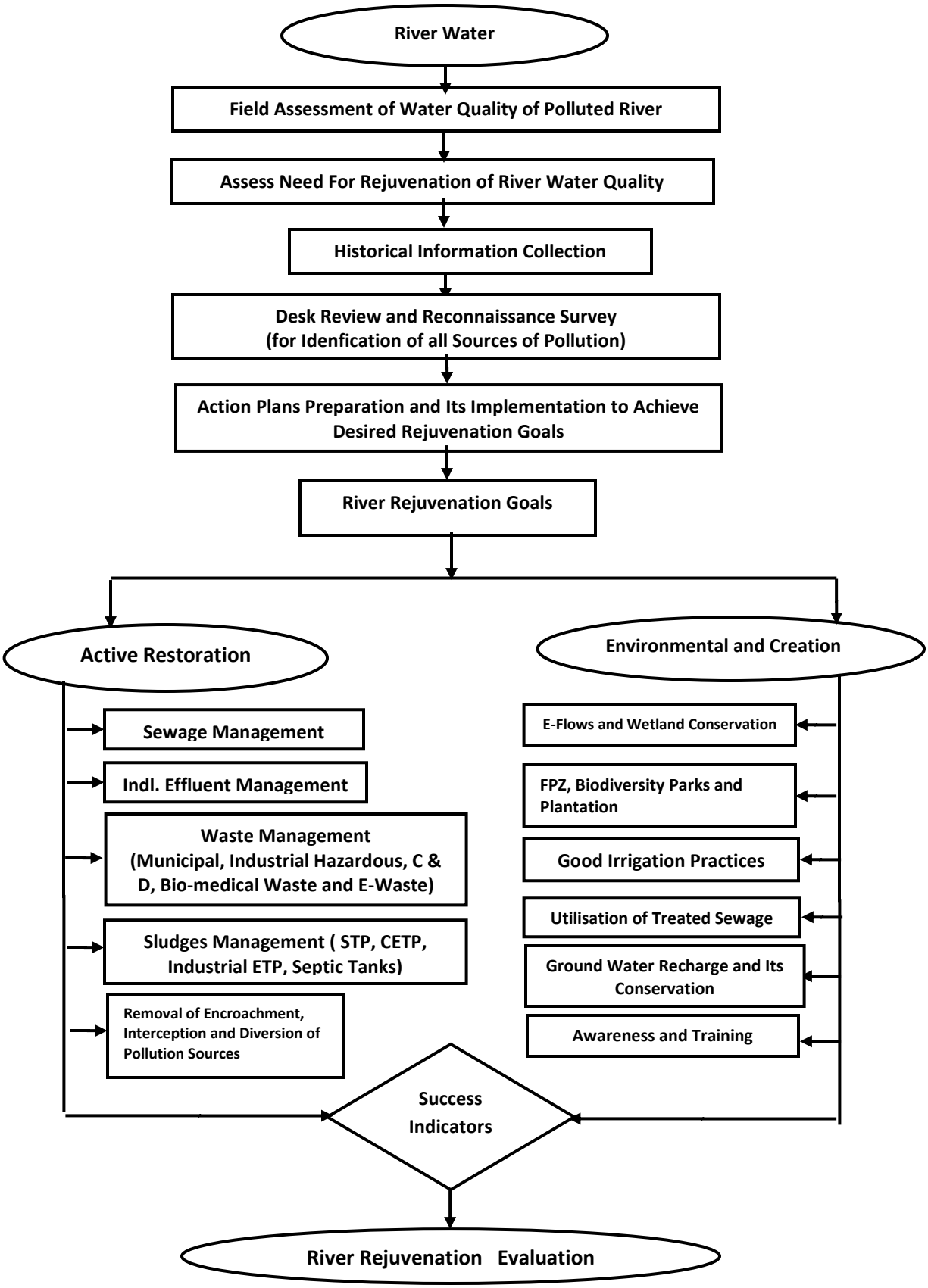

Figure 3. Model Flow Chart for Rejuvenation of Polluted Rivers

6. Sustenance Phase

Good governance, based on fairness, transparency and empowerment of all stakeholders, is essential to sustain the restoration efforts. Also, ownership of each waterbody should be decided, as most of them face indefinite sustenance due to multiplicity of administrative control and/or lack of specific action by singular authority. The in charge authority should treat the water body as ‘natural resources’, to act as the potential catalysts to better civic health, provide recreation, improve tourism, possibly meet water-needs of local people, etc. Such gains shall be attained only after the water bodies are treated on eco system based approach.

6.1 Awareness

Awareness for citizen’s groups, resident welfare associations, local organizations, activist groups, green organizations, political organizations, educational institutions and government agencies in protection of the water bodies should be organized periodically by the concerned authorities through campaigns, electronic media in vernacular languages also be ensured by the concerned authorities

6.2 Training

Organizing periodic trainings through identified and reputed institutions for all the concerned on aspects relating to maintenance during post- restoration phase of the water body.

6.3 Promoting Public Participation

Promoting active public participation (with the help of schools, colleges and universities, NGOs) for identifying and resolving critical lake or pond problems as

well as periodic maintenance and restoration of water body from aesthetic and restoration point of view should be organized.

6.4 Dissemination of Information

Water quality of the pond or lake should be displayed at the main entrance of the pond or lake boundary and such water quality data also connected to the servers of concerned custodian State Department (s) as well as State Environment Department, respective State Pollution Control Board (SPCB)/Pollution Control Committee (PCC). Display boards also should be provided at all the salient points on **'Do's and Don'ts'** for the public.

6.5 Recreational Centre

Creation of pond or lakes can be converted into recreational centers with boating activities, walkways and benches for visitors on charge basis so as to generate revenue for operation and maintenance of the lake or pond areas

7. References

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- OA No. 231 of 214 Titled Doaba Paryavaran Samiti Vs State of UP & Ors. (on river Hindon) Order of HON'BLE NGT Dated 08/08/2018
- OA No. 673 of 2018 Titled News item published in "The Hindu" authored by Shri Jacob Koshy titled "More river stretches are now critically polluted: CPCB" Order of HON'BLE NGT Dated 20.09.2018, 19.12.2018 and 08.04.2019

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Annexure-I

Water Quality Criteria-Designated Best Use

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism in MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20C 2mg/l or less
Outdoor bathing (Organised)	B*	Faecal Coliform in MPN/100ml: 500 (desirable) and 2500 (Maximum Permissible) Faecal streptococci in MPN/100 ml: 100 (desirable) and 500 (maximum Permissible) pH between 6.5 to 8.5 Dissolved Oxygen: 5mg/l or more Biochemical Oxygen Demand 3 Day BOD, 27 ^{O} C: 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling	E	pH between 6.0 to 8.5 Electrical Conductivity at 25 ^{O}C micro mhos/cm Max.2250 Sodium Absorption Ratio Max. 26 Boron Max. 2mg/l

* ***Class B as per Primary Water Quality Criteria for Bathing Water (Water Used for Organised Outdoor Bathing) as per Environment (Protection) Rules, 1986***

Annexure-II

CRITERIA FOR CATEGORISATION OF RIVER MONITORING LOCATION

1. Introduction

Water Quality monitoring is an essential component to maintain and restore the wholesomeness of resources by way of prevention and control of pollution as prescribed under the Water (Prevention and Control of Pollution) Act, 1974. However, the Water (Prevention and Control of Pollution), Act, 976 does not define the level of wholesomeness to be maintained or restored in different water bodies of the country. In view of the said reason, the Central Pollution Control Board (CPCB) has tried to define the wholesomeness of water in terms of safe human uses, and thus, taken human uses of water as base for identification of water quality objectives for different water bodies in the Country. It is considered ambitious to maintain or restore all natural water body at pristine level which is possible only by taking proper control measures. The level and degree of treatment required can be decided depending on the categorization of the polluted river locations/stretch, as per the criteria detailed below:-

2. Categorization of River Monitoring Location

The water quality data is required to be analyzed and primarily mean or average values of Biochemical Oxygen Demand (BOD) and Faecal Coliform (FC) need to be estimated. Then, based on the total score estimated for the parameters BOD (weightage- 70 %) and FC (Weightage- 30 %), based on the criteria, the monitoring location is categorized as 'polluted' location. The polluted monitoring locations in a continuous sequence are defined as 'polluted river stretch'. However, actual self-purification distance need to be estimated based on the requisite input parameters which depend on the case-to-case and the local conditions.

The monitoring locations may be categorized in five classes from Category I to Category –VI. i.e., critically polluted to Good or Fit for Bathing i.e., Category –I indicates 'critically polluted'; Category-II indicates 'severely polluted'; Category-III indicates 'moderately polluted', Category –IV indicates 'less polluted', Category –V indicates 'Good' or Fit for Bathing'

Above suggested criteria is intended only for categorization of the river monitoring locations. However, if any State/UT desires to identify any other water body such as lakes, tanks may also apply these criteria depending on the need and the requisite achievable goals for rejuvenation of such water bodies.

Table 1 to Table 3 gives the mean or average BOD/Faecal Coliform values or range and the corresponding scores as well as categorization of the monitoring location

Table 1. Observed Mean or Average BOD Value in mg/l and corresponding BOD Score

S. No	*Mean or Average* **BOD (Weightage-70 %)**	
	Mean or Average BOD (in mg/l)	**BOD Score (X)**
1	> 48	100
2	24-48	80
3	12-24	60
4	6-12	40
5	≤ 6	20

Table 2. Observed Mean or Average Faecal Coliform (in MPN/100 ml) and corresponding FC Score

S. No	**Mean or Average Faecal Coliform (Weightage -30 %)**	
	Mean or Average Faecal Coliform (in MPN/100 ml)	**FC Score (Y)**
(1)	> 5,00,000	100
(2)	5000 to 5,00,000	80
(3)	5000 to 50,000	60
(4)	500 to 5000	40
(5)	≤500	20

Table 3. Total Score and corresponding Category of River Monitoring Location

S. No	**Total Score* (Z')**	**Category ~~Priority~~ Class of the Monitoring location**	**Category of Monitoring location**
(1)	81-100	Category -I	Critically Polluted
(2)	61-80	Category--II	Severely Polluted
(3)	41-60	Category -III	Moderately Polluted
(4)	21-40	Category -IV	Less Polluted
(5)	≤ 20	Category -V	Good or Fit For Bathing

Note:

(i) Above criteria must be considered only for the river locations having monitored at least for 2 years and 8 observations in each year covering at least pre-monsoon and post-monsoon period;

(ii) *Above criteria is a preliminary screening criteria for categorizing monitoring locations. However, comprehensive assessment needs to be done by States/UTs to arrive at the extent of contamination;*

(iii) *Please refer to the procedure for estimation of Total Score given in S.No 3.;*

2.1 **Criteria for Category- I – Critically Polluted: -** If the Total score is 81-100, then the monitoring location is categorized as **'Critically Polluted'.**

2.2 **Criteria for Category- II – Severely Polluted: -** If the Total score is 61-80, then the monitoring location is categorized as **'Severely Polluted'**

2.3 **Criteria for Category- III-Moderately Polluted: -** If the Total score is 41-60, then the monitoring location is categorized as **'Moderately Polluted'**

2.4 **Criteria for Category-IV –Less Polluted: -** If the Total score is 21-40, then the monitoring location is categorized as **'Less Polluted'**.

2.5 **Criteria for Category -V-Good or Fit for Bathing:-**If the Total score is ≤ 20, then the monitoring location is categorized as **'Good or Fit for Bathing'.**

*For easy understanding, flow chart given in **Figure 4** and steps for calculating the total score may also be referred in the subsequent paras:-*

3. Steps for calculating total score and categorizing of monitoring location : -

(i) *Depending on the average BOD measured value, assign the BOD score (X) as given in **Table 1.***

(ii) *Similarly depending on the average FC measured value, assign the FC Score (Y) as given in **Table 2.***

(iii) *Total score **(Z)** is estimated as: BOD Score **(X) X** (Weightage of BOD i.e., 70 %) + FC Score **(Y) X** (Weightage for FC i.e., 30 %). and*

(iv) *Now compare calculated Total Score (Z) with the **Z'** Value given in the Table 3 and the monitoring location is categorized suitably.*

For easy understanding following examples may be referred in the subsequent paras.

E.g. (1): *At a particular monitoring location, the average values of BOD and the FC values are observed as 6 mg/l and 9000 MPN/100 ml respectively. Then, the total score is calculated as*

- *X is the BOD Score corresponding to the mean BOD value of 6 mg/l as per* ***Table 1*** *= 20*
- *Y is the FC Score corresponding to the average FC value of 9000 MPN/100 ml as per* ***Table 2*** *= 60*
- *Calculated Total Score* ***(Z)*** *=* ***X*** *X* ***Weightage of BOD*** *+* ***Y*** *X* ***Weightage of FC*** *i.e.,20 X 0.7 + 60 X 0.3 = 14 + 18= 32.*
- *Compare 39 value with the* ***Z'*** *values given in* ***Table 3*** *to decide on the ~~Priority~~ Category of the Monitoring Location. In this case, monitoring location is Category-IV i.e., 'Less Polluted',*

E.g.(2): *At a particular monitoring location, the average value of BOD and the FC values are observed as 2 mg/l and 45 MPN/100 ml respectively. Then, the total score is calculated as*

- *X is the BOD Score corresponding to the average BOD value of 2 mg/l as per* ***Table 1*** *= 20*
- *Y is the FC Score corresponding to the average FC value of 45 MPN/100 ml as per* ***Table 2*** *=20*
- *Calculated Total Score* ***(Z)*** *is calculated as =* ***X*** *X* ***Weightage of BOD*** *+* ***Y*** *X* ***Weightage of FC*** *i.e., 20 X 0.7 + 20 X 0.3 =20*
- *Compare 20 value with the* ***Z'*** *values given in* ***Table 3*** *to decide on the Category of the Monitoring Location. In this case, monitoring location is Category-V i.e., 'Good' or Fit for Bathing*

E.g. (3): *At a particular monitoring location, the average value of BOD and the FC values are observed as 2 mg/l and 550000 MPN/100 ml respectively. Then, the total score is calculated as*

- *X is the BOD Score corresponding to the average BOD value of 2 mg/l as per* ***Table 1*** *= 20*

- *Y is the FC Score corresponding to the average FC value of 550000 MPN/100 ml as per **Table 2** = 100*

- *Calculated Total Score **(Z)** = **X** X **Weightage of BOD** + **Y** X **Weightage of FC** i.e., 20 X 0.7 + 100 X 0.3 = 44.*

- *Compare 100 value with the **Z'** values given in **Table 3** to decide on the Category of the Monitoring Location. In this case, monitoring location is Category-III i.e., Moderately Polluted'*

E.g.(4): *At a particular monitoring location, the average value of BOD and the FC values are observed as 45 mg/l and 400 MPN/100 ml respectively. Then, the total score is calculated as*

- *X is the BOD Score corresponding to the average BOD value of 45 mg/l as per **Table 1** = 80*

- *Y is the FC Score corresponding to the average FC value of 400 MPN/100 ml as per **Table 2** = 20*

- *Calculated Total Score **(Z)** = **X** **X** **Weightage of BOD + Y X Weightage of FC** i.e., 80 X0.7 + 20 X 0.3 = 62.*

- *Compare 100 value with the **Z'** values given in **Table 3** to decide on the Category of the Monitoring Location. In this case, monitoring location is 'Category-II i.e., Severely Polluted'*

E.g (5): *At a particular monitoring location, the average values of BOD and the FC values are observed as 24 mg/l and 200000 MPN/100 ml respectively. Then, the total score is calculated as*

- *X is the BOD Score corresponding to the mean BOD value of 24 mg/l as per **Table 1** = 60*

- *Y is the FC Score corresponding to the average FC value of 200000 MPN/100 ml as per **Table 2** = 80*

- *Calculated Total Score **(Z)** = **X** X Weightage **of BOD** (70 %) + Y X **Weightage of FC** (30 %) i.e.,60 X 0.7 + 80 X 0.3 = 42 + 24= 66.*

- *Compare 90 value with the **Z'** values given in **Table 3** to decide on the Category of the Monitoring Location. In this case, monitoring location is Category-II i.e., 'Severely Polluted',*

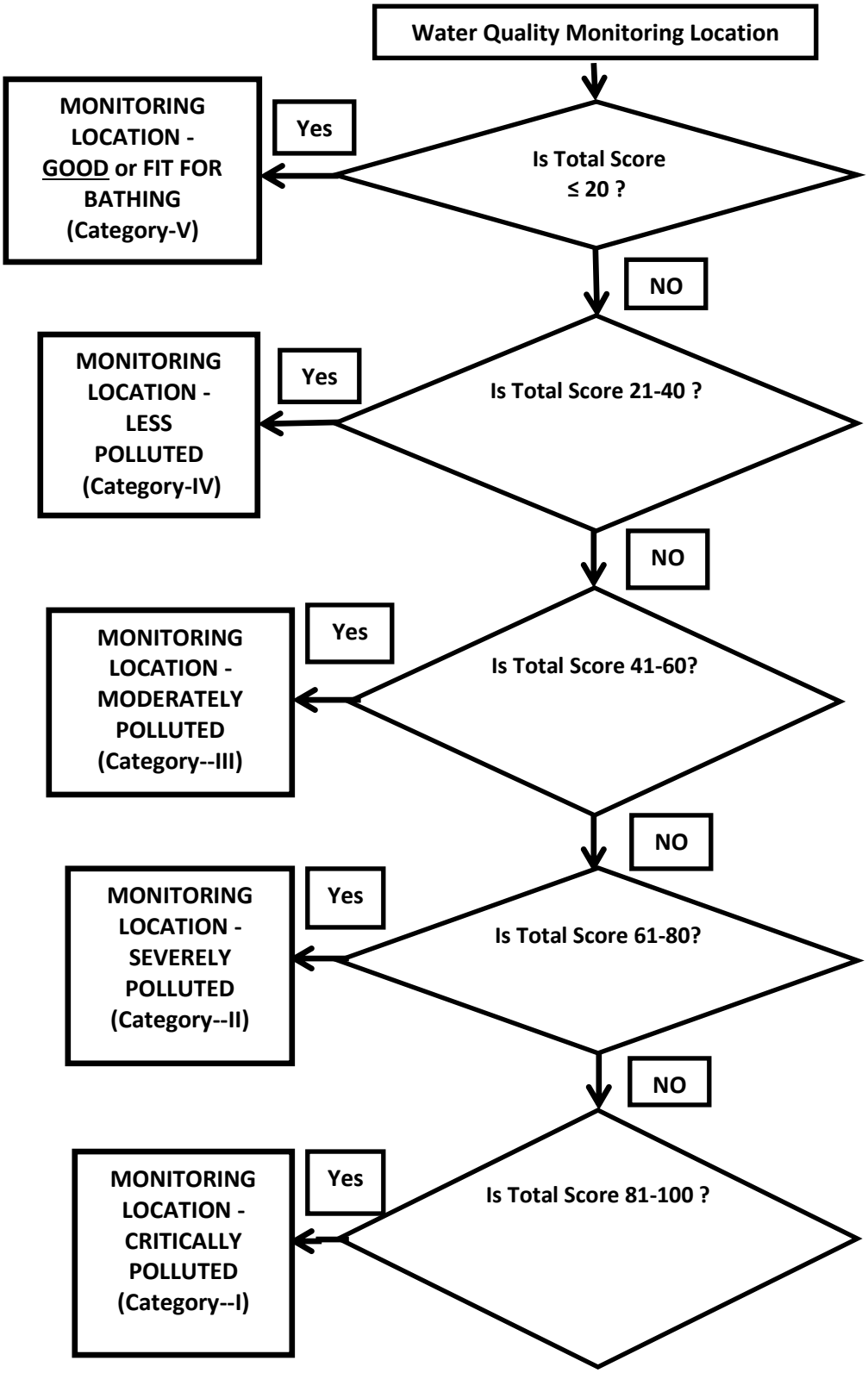

Figure 4. Flow Chart Showing Criteria for Categorization of River Monitoring Location

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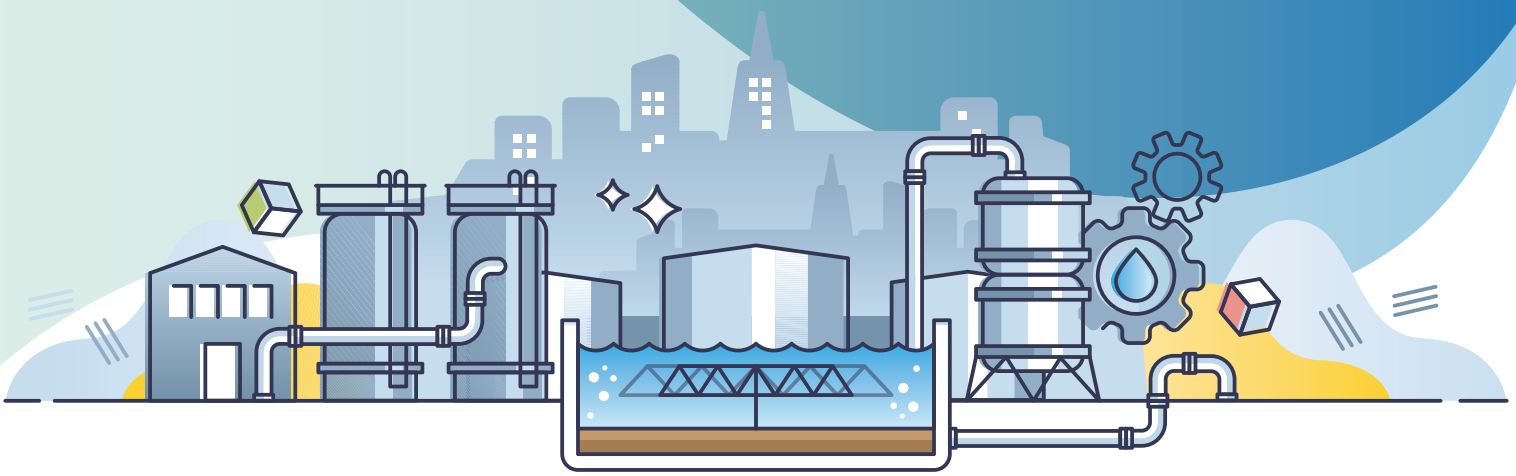

ICDK | RuDRA | NAMAMI GANGE

URBAN WASTEWATER SCENARIO IN INDIA

AUGUST 2022

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FOREWORD

Water is the most important natural resource needed to sustain life on this planet. In terms of Sustainable Development Goals (SDGs), water as a resource and access to clean water is a central theme to most SDGs, e.g. out of 17 SDGs at least 7 SDGs is directly linked to clean water and 5 are indirectly linked to water. India, still an agrarian nation with high water demand for agriculture, is also marching towards its goal to become a world leader in sustainable development, for which sustainable water use is key.

With climate change impacts water demands are growing. The hydrological water balance indicates more floods and droughts, with less water recharging groundwater thereby reducing water supply. In addition, growing domestic and industrial demands for water has to be met for India to become a major hub for industries and development. It is therefore necessary to reuse and recycle water as much as possible, in particular urban wastewater. Urban wastewater management needs a holistic approach with all relevant stakeholders and incorporating site-specific conditions and challenges. Involving public participation needs to be increased for better adoption and use of recycled and treated wastewater (e.g. toilet to tap initiatives). It should be noted that, wastewater treatment is not only to augment water resources but should also be viewed from the solid waste perspective.

Waste to wealth initiatives have been increasing across the world, wherein the solid waste is used as fertilizer pellets and other uses, which need to be documented. Such reuse of waste has faced challenges in acceptance, however with improved post-processing methods and Government initiatives, the segregated solid waste from wastewater has found many uses, thereby increasing the support for effective wastewater treatment. Therefore, wastewater treatment needs to be viewed using different lenses to capture all possibilities to increase the efficiency of treatment plans and reuse both the water and solid waste effectively.

On this note, an interdisciplinary team was formed with partners from Government knowledge agencies (Atal Innovation Mission-AIM, NITI Aayog), Government water management agencies (Ministry of Jal Shakti and National Mission for Clean Ganga-NMCG), international agency (Innovation Centre Denmark-ICDK) and academia (Indian Institute of Technology Bombay-IITB) to develop a whitepaper on urban wastewater management. The team had expertise ranging from science, technology, field implementation, to policy, adaptation and application. With such an interdisciplinary team, it was possible to consider all stakeholder's concerns for wastewater management and produce a whitepaper that holistically captures the current status of wastewater treatment in India and potential pathways for future treatment structures, co-creation and collaborations.

This whitepaper curated by experts from IITB, AIM-NITI Aayog, ICDK and NMCG presents the current status of wastewater generation in India, future capacity need for wastewater treatment, scope for improvement and augmentation in existing infrastructure and technologies, methods for public participatory approach, financing and co-financing options, smart technologies for rapid data collection and dissemination and building capacity via training and stakeholder apex bodies for increasing the efficiency of urban wastewater treatment for India.

MESSAGE

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2 September 2022

I wish to congratulate the Atal Innovation Mission, NITI Aayog, Innovation Centre Denmark (ICDK), IIT Bombay, Rural Data Research & Analysis (RuDRA) Lab and National Mission for Clean Ganga (NMCG) for bringing out a white paper on Management of Wastewater in India through Innovative Solutions.

I also wish to congratulate all the start-ups and student teams of the five nations - India, Denmark, South Korea, Kenya and Mexico - competing at the IWA World Water Congress 2022 in Copenhagen, Denmark.

Parameswaran Iyer

Parameswaran Iyer

स्वच्छ भारत
एक कदम स्वच्छता की ओर

MESSAGE

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MESSAGE

India and Denmark have a Bilateral Green Strategic Partnership focused on green hydrogen, renewable energy and wastewater management. Addressing the global water woes through innovations is an integral part of the Strategic partnership. The collaboration between Atal Innovation Mission, Niti Aayog and Innovation Centre Denmark, Embassy of Denmark, has effectively exhibited cross-border collaboration between entrepreneurs and innovators aligned with the vision of addressing and mitigating water related issues faced by India and the world today.

Atal Innovation Mission, a flagship initiative of Niti Aayog and Innovation Center Denmark (ICDK) under the aegis of Denmark Embassy in India, and the Denmark Technical University (DTU) launched the AIM-ICDK water innovation challenge to scale up innovations in the water sector. Being the nodal agency to launch this challenge, AIM has played a crucial role in the Indo-Danish Bilateral partnership. In this challenge, the selected startups and student teams received mentorship from IIT Bombay and IIT Madras and funds and incubator access by ICDK and AIM, NITI Aayog. It is a matter of great pride for us that altogether five teams from India will represent us in the IWA World Water Congress 2022 in Copenhagen, Denmark, I congratulate them all on their well-deserved success.

AIM strongly believes in the power of innovation and on the fact that Entrepreneurship driven technology is an important driving force in green transition. It is crucial for India to seize bilateral opportunities to learn and collaborate with developed countries, which have successfully tested these technologies, and to implement sustainable solutions for wastewater treatment and reuse.

Many developing countries including India have been experiencing water crisis, both in terms of availability and quality of water. India's urban centers are witnessing unprecedented growth, driven by new economic reforms and migration. This increase in urban population is putting enormous pressure on planners, particularly for the provision of public services, especially clean and affordable water. Sectoral water demands have also increased as irrigation, domestic utilities, energy and industry absorb ever-increasing amounts to meet growing demands. These ever-increasing demands can in some parts be met by Wastewater recycling and reuse. It is imperative that we focus on wastewater and aim to reduce the amount of untreated wastewater and dramatically increase recycling and safe reuse.

This white paper on 'Urban Wastewater Scenario in India' reviews the current scenario of the country and discusses in detail wastewater management and reuse solutions practiced worldwide that India can learn from. It lays emphasis on the need to understand wastewater generation and the associated reuse measures.

I wish to offer my warmest congratulations to Innovation Centre Denmark (ICDK), IIT Bombay, Rural Data Research and Analysis (RuDRA) Lab, National Mission for Clean Ganga (NMCG) and our team at Atal Innovation Mission, NITI Aayog on doing a commendable job on the white paper.

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एक कदम स्वच्छता की ओर

MESSAGE

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MESSAGE

Management of used water in Indian urban sector has always been a challenge, and thereby one of the prime points of discussion as well. Urban water sector is stressed by tremendously growing demand due to increase in population, rise in domestic use, consumption by industrial and commercial entities, requirements for sanitation, compounded by depletion and contamination of water sources and climate change impacts. Contrary to the general perception, a significant fraction of the urban dwellers is under-privileged, marginalized or poor and live in urban-slums. As resource becomes scarce, competition builds up and the weaker sections get side-lined leading to a widened gap in socio-economic disparity.

Estimates suggest that the present domestic water demand of Indian urban areas is about 90,000 million litres per day (MLD), which works out to be nearly 33 billion cubic meter (BCM) annually. Out of this, 26 BCM is discharged as wastewater, and only less than 10 BCM is treated. While the untreated water pollutes freshwater storage on one side, even the treated water finds no much significant uses owing to social stigmas. During the pluvial urban floods, the sewage gets mixed with the flood water and poses serious health concerns. Further to this, many urban water bodies have been turned to landfills and fresh water rivers became sewerage channels. Curbing this detrimental trend is essential to ensure unhindered and sustainable growth and to achieve the Sustainable Development Goal targets.

Government of India have been collaborating with other countries and multilateral agencies to tackle the urban wastewater problems. We must look for the solutions that can resolve the critical pollution problems efficiently and rejuvenate extinct urban water bodies. Nature based or nature friendly solutions should be promoted. It is heartening to observe that young scientists, start-ups and brilliant students are aware of and concerned about these issues and are striving to innovate in addressing these problems in unorthodox ways. I do always place a high reliance on the power of research & development by scientific community, and am certain that they have solution for every other problem. However, the challenge lies in translating the results into practice and in making the solutions affordable and accessible to everyone.

This whitepaper is an outcome of a novel thought to present in 'black & white', where India is standing, to where it is heading and what it looks for in terms of sustainable urban wastewater management. I am confident that this exercise will help to bring like-minded ones together, cutting across sectors, in resolving many issues which are common across geographies.

AVINASH MISHRA

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MESSAGE

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MESSAGE

India is growing at a tremendous pace and has been recognised to be the fastest growing economy in the Asia this year. This elevates India's image and the citizens pride across the globe. To sustain such growth and pride, it is necessary to keep the growth sustainable and long-term. With socio-economic growth, cities have become larger and cater to a large population, higher than the urban carrying capacity of the city. Such growth also puts tremendous pressure on Government agencies that manage natural resources that are used for development, especially water. Scientific and technological solutions can aid to keep the current trend of growth and development in a sustainable manner.

Advances in science and technology are being researched in many educational institutions in India, of which the Indian Institute of Technology-Bombay (IITB) is leading with many recognitions, e.g. IITB has been recognised by the Government of India as an Institution of Eminence (IoE). In IITB, there are many departments, centres and interdisciplinary programs that address issues and create solutions that are scientifically validated. Many initiatives, with collaborations, are started in IITB focussing on specific issues and providing training and up-skilling of people to address these issues. The Rural Data Research and Analysis (RuDRA) lab, at the Centre for Technology Alternatives for Rural Areas, was created to specifically work on rural issues by collecting holistic and interdisciplinary data from different stakeholders and by creating correlations and causality relationships to improve the understanding of the issues and to provide better solutions.

Considerable amount of research is ongoing, however most of them are not readily up-taken for societal or industrial solutions. Thus, there is a need for more action-based research that focuses on ground solutions and there is a need for extension work to upscale the solutions from lab to real world scenarios. Extension agencies, as found in many countries, are key in extending the research activities to the ground. Such solutions should be co-created through collaborations between multiple institutions and government agencies so that expertise can be shared with improved sustainability of projects. Identifying venues for such collaborations is key, which is reviewed in this Whitepaper.

Through this Whitepaper, co-created by multiple partners from academia, government agencies and public networks, it is clear that wastewater should be treated more sustainably and stakeholders need to be sensitised to newer technologies in India. Low cost technological solutions, data monitoring instruments and simulation models are needed for providing better understanding of wastewater treatment issues, which can be researched in premier institutions of India (e.g. IITs) and then promoted and used by Government agencies (e.g. Niti Aayog, ICDK, NCMG). Feedback from data, stakeholders and modes can be routed to the academics for fine-tuning the management plans and efficiency of treatment methods can be improved. With such participation from a multidisciplinary team, wastewater treatment in India can be improved which will lead the path to sustainable development in India.

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ACKNOWLEDGEMENTS

The authors acknowledge all the Government and non-government agencies for sharing the data on urban wastewater generation and treatment scenarios. We acknowledge all the authors for their valuable case study examples for understanding the importance of site-specific conditions. We acknowledge Central Pollution Control Board (CPCB), all State Pollution Control Boards, State water agencies, Ministry of Education, Ministry of Urban Development Government of India, Presidency University (Bengaluru), India WRIS for providing a database of hydrological variables, Indian Space Research Organisation (ISRO) for spatial data and Central public health and environmental engineering organization (CPHEEHO) for providing the guidelines and manuals for the waste management and sewage treatment systems.

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ABBREVIATIONS

ABR	:	Anaerobic Baffled Reactor
AHP	:	Analytic Hierarchy Process
ASP	:	Activated Sludge Process
BOD	:	Biochemical Oxygen Demand
BORDA	:	Bremen Overseas Research and Development Association
CAG	:	Comptroller and Auditor General
CBO	:	Community-Based Organizations
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board
CPHEEO	:	Central Public Health and Environmental Engineering Organisation
CW	:	Constructed Wetlands
CWWT	:	Centralized Wastewater Treatment
DEWATS	:	Decentralized Wastewater Treatment Systems
DPS	:	Duckweed Pond Systems
DWWT	:	Decentralized Wastewater Treatment
EA	:	Extended Aeration
FAB	:	Fluidized Aerobic Bed Reactor
FC	:	Faecal Coliform
FICCI	:	Federation of Indian Chambers of Commerce and Industry
FSSM	:	Faecal Sludge and Septage Management
FTW	:	Floating Treatment Wetland
FWS	:	Free Water Surface
GAP	:	Ganga Action Plan
GIS	:	Geographic Information System
HRAP	:	High-Rate Algal Ponds
INR	:	Indian Rupee
IoT	:	Internet of Things
JnNURM	:	Jawaharlal Nehru National Urban Renewal Mission
MBBR	:	Moving Bed Biofilm Reactor
MBR	:	Membrane Bioreactor
MLD	:	Million Litres per Day
MoEFCC	:	Ministry of Environment, Forest and Climate Change
MoHUA	:	Ministry of Housing and Urban Affairs
MoJS	:	Ministry of Jal Shakti

MoUD	:	Ministry of Urban Development
MoWR,RD&GR	:	Ministry of Water Resources, River Development and Ganga Rejuvenation
NBS	:	Nature-Based Solutions
NGO	:	Non-Governmental Organizations
NGT	:	National Green Tribunal
NPCA	:	National Plan for Conservation of Aquatic Ecosystems'
NRCD	:	National River Conservation Directorate
NRCP	:	National River Conservation Plan
O&M	:	Operation and Maintenance
OP	:	Oxidation Pond
PCB	:	Pollution Control Boards
PHED	:	Public Health Engineering Department
PPP	:	Public Private Partnership
PPPP	:	Public Private People Partnership
RBC	:	Rotating Biological Contactor
RS	:	Remote Sensing
RWA	:	Residential Welfare Associations
SAFF	:	Submerged Aerobic Fixed Film
SBR	:	Sequencing Batch Reactors
SPCB	:	State Pollution Control Boards
SRTW	:	Safe Reuse of Treated Wastewater
SSF	:	Sub-Surface Flow
STP	:	Sewage Treatment Plants
SWM	:	Solid Waste Management
SWQMS	:	Smart Water Quality Monitoring Systems
SWSDB	:	State Water Supply and Drainage Board
TDS	:	Total Dissolved Solids
TSS	:	Total Suspended Solids
UASB	:	Upflow Anaerobic Sludge Blanket
ULB	:	Urban Local Body
UNDP	:	United Nations Development Programme
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
UWM	:	Urban Waste Management
WQM	:	Water Quality Monitoring

WRG	:	Water Resources Group
WSN	:	Wireless Sensor Network
WSP	:	Waste Stabilization Pond
WSSB	:	Water Supply and Sanitation Boards
WWP	:	Wastewater Treatment Plants

1. Executive Summary

Every nation aims for socio-economic development, however, sustainable development is key. Population growth and urbanisation along with socio-economic development have intensified the water supply and demand imbalance, leading to water shortage conditions, especially in developing countries like India. As cities continue to grow and consume more water, there is added pressure on agricultural productivity factors such as water, land, energy, and changing diets, bringing major challenges to urban and rural food security. Parallelly, climate change impacts are affecting the availability and distribution of water resources due to extreme floods and droughts. There is an urgent need for wisely using the water resources we have. This whitepaper provides a detailed holistic review of the urban wastewater situation with respect to the state of wastewater generation, collection, treatment and reuse; the existing legal, institutional and policy regime for wastewater management; the types of treatment systems and their performance; and pathways for collaborations and engagements between institutions and stakeholders to develop sustainable and affordable solutions for wastewater treatment and reuse purposes.

From the review it is clear that the concept of waste to wealth fits well for water management in India. Wastewater is and should be considered a valuable resource from which water can be recycled and energy/nutrients can be extracted. Globally, innovative wastewater treatment and reuse technologies have played a crucial role in improving urban sanitation and enhancing water security, as stipulated under Goal 6 of the Sustainable Development Goals. Despite the known benefits, wastewater treatment and reuse practices and technologies need to upgraded in India, as currently, India generates 72,368 Million Litres per Day (MLD) of urban wastewater and only 28% (20,236 MLD) is treated. This implies that 72% of the wastewater remains untreated and maybe disposed of in rivers/ lakes/groundwater. This gap, between generated and treated, has to be addressed to utilise the wastewater as a valuable resource. The gap is due to the challenges in wastewater treatment such as: limited land available for setting up new treatment plants, mapping the connectivity of sewage drainage systems, identifying leakages and illegal dumping of sewage water, limited data on load generated and collection points, one size fits all approach, absence of new technologies that can bring down the costs and improve the efficiency of treatment, aversion of public in re-using treated wastewater and absence of collective action between stakeholders from wastewater generation to treated wastewater reuse.

Efforts are needed to develop guiding frameworks for the use of suitable technologies and practices following the fit-for-purpose principle as per the need of each urban centre (city/town/community/building/individual). Strengthening the institutional and monitoring capacity is crucial to increase the assurance and trust of the users in the quality of the treated wastewater, generate demand, and ultimately safeguard human health and the environment. Recent developments show a transition towards advanced technologies and adaptation of nature-based cost-effective solutions for treatment driven by both government and private sectors. New low-cost technologies should be involved in wastewater monitoring and treatment plans. Data should be freely shared to improve confidence in re-using wastewater for purposes that suit the quality. Added public participation and involvement can improve fine-tuning of the infrastructure requirements and also help in the long-term sustainability of the treatment system through effective monitoring and creating ownership among users. This will lead to efficient recycling and reuse of wastewater leading to sustainable development in India.

2. Introduction

India, with 1.38 billion people, is the second largest populous country in the world. Of the total population, 65% (900 million) live in rural areas, and 35% (483 million) are concentrated in urban centres. The estimated wastewater generation is approximately 39,604 Million Litres per Day (MLD) in the rural regions, while in the urban centres, the wastewater generation has been estimated as 72,368 MLD for the year 2020-21. The estimated volume of urban wastewater is almost double (due to the associated water needs for flushing and sewage drainage) that of rural and such availability of more water for sanitation has increased the living standards in urban cities. There is thus more population growth and migration of people to cities for a better source of living immediate attention due to rapid urbanization, and therefore there is an immediate attention to manage wastewater due to rapid urbanization.

Urban areas currently accommodate more than 50% of the global population and by 2050, it is expected that 70% of the population will be residing in urban cities. Rapid urbanization creates opportunities for economic development but may also add pressure on freshwater resources to meet the food and water demands in water-scarce areas and areas in which expansions occur at unprecedented pace. With increase in the population of such cities, it is important to identify water resources to sustain such expansion.

A growing set of viable but unconventional water resources, such as wastewater, offer enormous potential for narrowing the water demand-supply gap towards a water-secure future (Jones et al., 2020). Wastewater is increasingly recognized as a reliable and cost-effective source of freshwater, particularly for agricultural applications; however, wastewater remains an "*untapped*" and "*undervalued*" resource (WWAP, 2017), especially in India. Wastewater treatment aims to improve the quality of "used" water sources to reduce contaminant levels below sectoral quality thresholds for re-use or to minimize the environmental impacts of wastewater return flows. Treated wastewater flows can also provide a substantial source of (clean) freshwater flows for maintaining river flows, especially during drought (Luthy et al., 2015). However, much of the wastewater currently re-used is inadequately treated or even untreated due to multiple issues. Demands for clean water are increasing at a faster pace than wastewater treatment solutions and faster than technological developments in institutions that ensure the safe distribution and management of wastewater (Sato et al., 2013). The primary challenge in promoting re-use is ensuring safety – both for human and ecosystem health – and thus ensuring that wastewater is adequately treated prior to use or environmental discharge. If that is not achieved, wastewater is considered as waste and not treated, recycle or reused. There is an urgent need to achieve the required paradigm shift in water resources management, whereby wastewater is viewed as a resource (for energy, nutrients and water) rather than as "waste" (WWAP, 2017; Qadir et al., 2020). However, challenges exist globally.

2.1. Urban wastewater as a growing global challenge

The information on current volumes of wastewater generated, collected, treated and reused at different scales is scattered, infrequently monitored and reported, or unavailable in many countries (Mateo-Sagasta et al., 2015). Such important information is essential for water and energy-related sustainable development in an era when the World is embarking on achieving the Sustainable Development Goals (SDGs) set by the United Nations. In particular, SDG 6.3 target is focused on wastewater and aims to half the proportion of untreated wastewater and substantially increase recycling and safe reuse globally. The SDG 6.3 target is interlinked with many other SDGs and targets, which can help in achieving their goals and targets and vice versa (Fig. 2.1.1), and these are; to expand international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes (SDG 6.a), to enhance

international cooperation to facilitate access to clean energy research and technology and promote investment in energy infrastructure and clean energy technology (SDG 7.a), enhancing inclusive and sustainable urbanization (SDG 11.3), reduction in the waste generation through prevention, reduction, recycling and reuse (SDG 12.5) and to increase our adaptive capacity to climate change (SDG 13.2). Therefore, it is important to understand wastewater generation and associated measures to reuse.

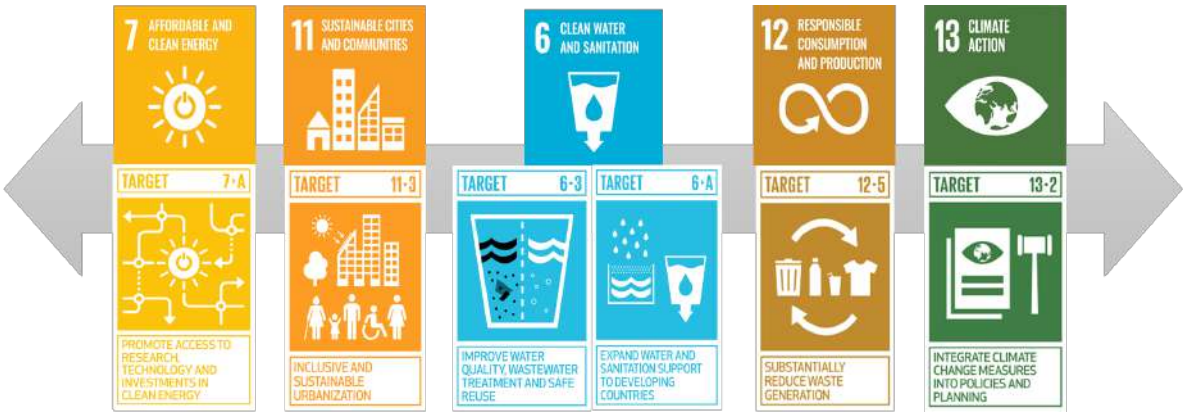


Figure 2.1.1: SDG interlinkages with respect to wastewater treatment and management (Adapted from UN SDGs)

Recently, few global studies have been carried out to estimate the wastewater volumes and make predictions for the future. For example, Qadir et al. (2020) estimated that 380 billion m^3 of wastewater is generated annually across the world. Based on the rate of population growth and urbanization, the daily wastewater generated is expected to increase by 24% (470 billion m^3) by the end of the SDG era in 2030 and 51% (574 billion m^3) by 2050 over the current estimates (Fig.2.1.2). It is to be noted that, among the global regions, Asia generated the largest volumes of wastewater representing 42% (159 billion m^3) of the wastewater globally. It is expected that by 2030 there will be an increase in the wastewater generation to 44%, and hence needs attention.

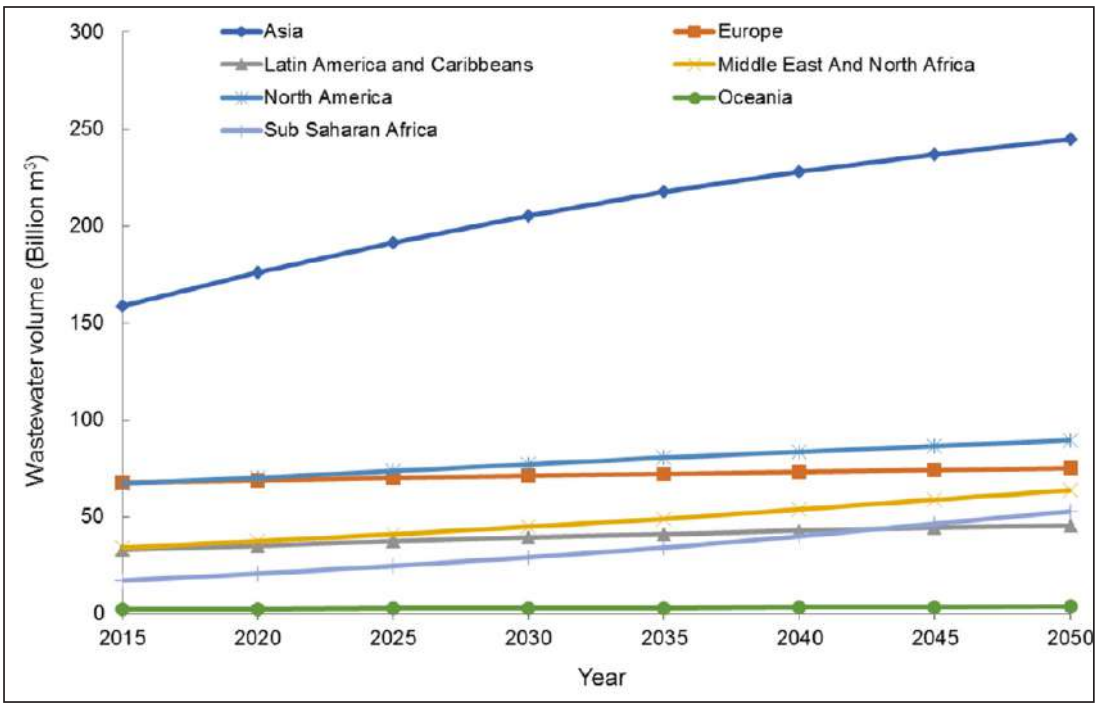


Figure 2.1.2: Wastewater production across the different regions of the world for 2015-2050 (Source: Qadir et al., 2020)

A similar study was done by Jones et al. (2020), wherein the global annual wastewater generation was estimated at 359.4 billion m^3, of which 63% (225.6 billion m^3) is collected and 52% (188.1 billion m^3) is treated. Annual wastewater reuse is estimated at 40.7 billion m^3, representing 11% of the total wastewater generated and 22% of the treated wastewater for direct reuse. This indicates that approximately 40% (171.3 billion m^3) of the wastewater is, unfortunately, discharged directly to the environment without being treated (Fig. 2.1.3).

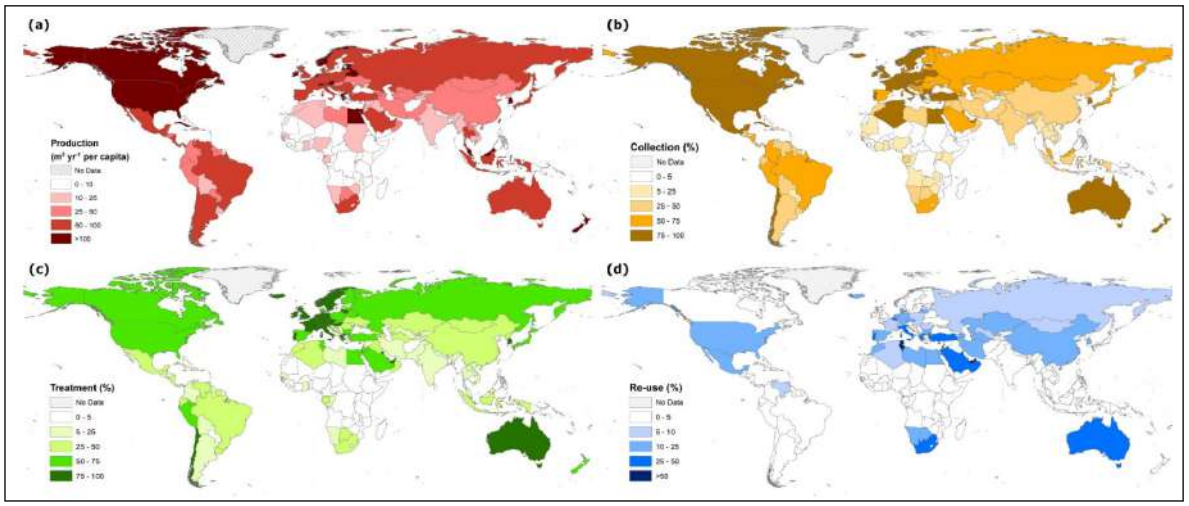


Figure 2.1.3: Global wastewater estimates at country scale: a) Wastewater production (m3/year per capita), b) wastewater collection (%), c) wastewater treatment (%), and d) wastewater reuse (%) (Source: Jones et al., 2020)

The study also found that high-income countries generate 42% of global wastewater, which is almost twice that of low- and lower-middle-income countries (Fig. 2.1.4). Wastewater treatment and collection percentages follow similar patterns, with high-income countries collecting and treating the majority of their wastewater (82% and 74%, respectively), while the low-income groups collect 9% and treat 4% of their total wastewater generated. The wastewater treatment is less than 50% for the upper and lower middle income and low-income groups. In the case of wastewater reuse, the proportion of treated wastewater reuse is higher in the upper middle (25%) and lower middle income (25%) than in the high-income group (19%); while the low-income groups are only able to reuse 8% of the treated wastewater. Regionally, East Asia and the Pacific generate the largest volume of wastewater, coinciding with the largest population share (31%) (Fig 2.15). Wastewater collection and treatment rates were found to be highest in Western Europe and lowest in Southern Asia. With the lowest treatment rates, the reuse of treated wastewater was also low in Southern Asia. These results suggest that even though developed countries generate more wastewater, they also have the infrastructure to reuse wastewater.

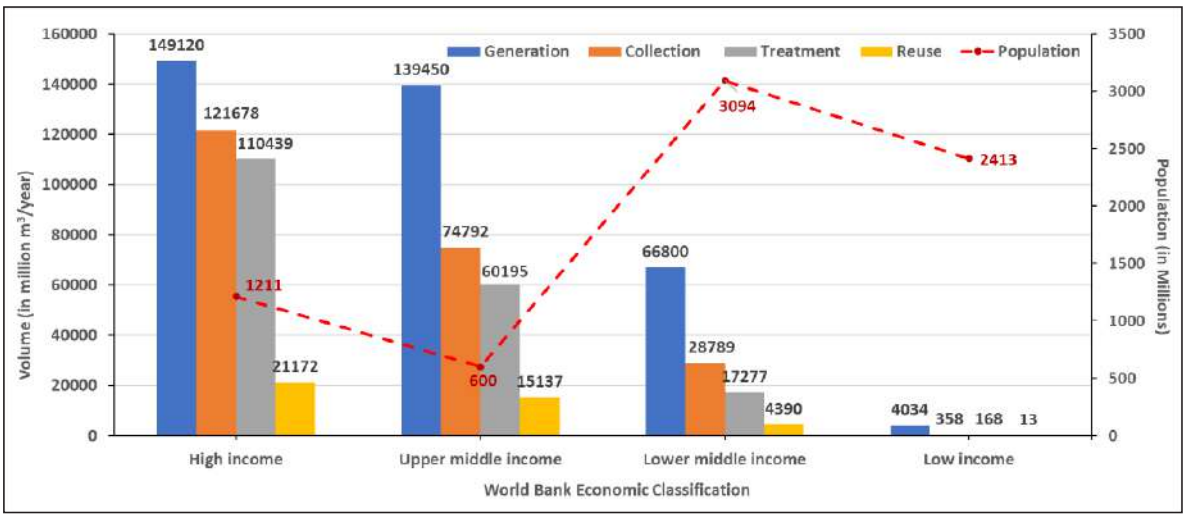


Figure 2.1.4: Wastewater statistics as per World Bank economic classification for the year 2015- 2050 (Data Source: Jones et al., 2020)

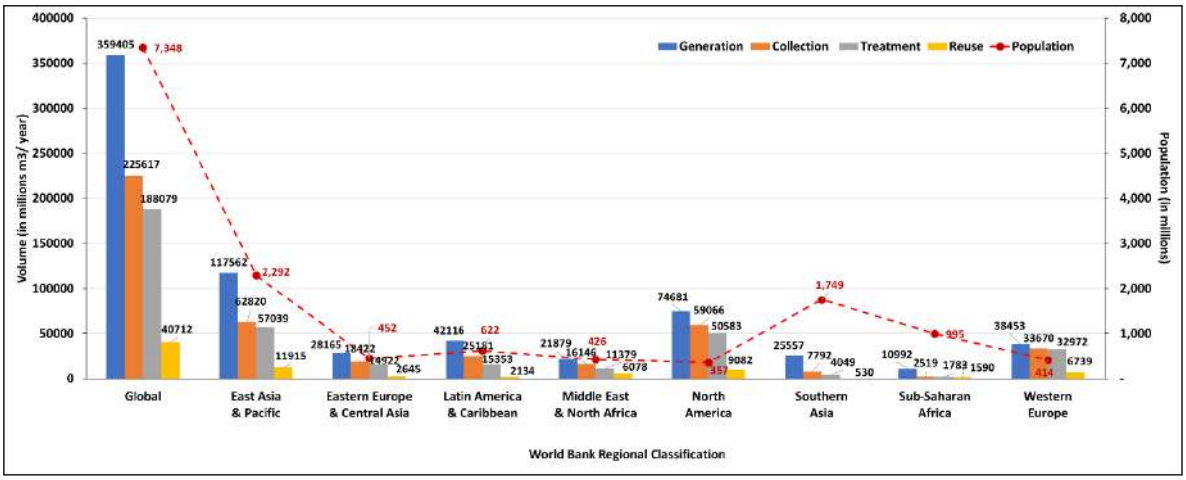


Figure 2.1.5: Wastewater statistics as per World Bank's regional classification for the year 2015 (Data Source: Jones et al., 2020)

Thus, both of these recent studies highlighted the under-performance of the Asian region, particularly the Southern Asia region, in the treatment and reuse of wastewater. It is to be noted that, among the South Asian countries, India, the second largest populous country, has the highest wastewater generation.

2.2. India's wastewater scenario

India's urban centres are witnessing unprecedented growth, propelled by new economic reforms and migration. Its population, 1.38 billion (as on 2020), is now fast converging on cities in search of a better source of income generation and quality of life. According to recent estimates, 35% of the total population (483 million) is concentrated in urban centres (United Nations, 2019). According to Census 2011, as many as 53 cities in India had a population above a million. At this current growth rate, the urban population is estimated to reach 607 million by 2030; and it is estimated that by 2050, 50% of the country's population (877 million) will be urban cities. This unsustainable increase in urban population exerts enormous pressure on city planners, especially for provisioning utility services, particularly for clean and affordable water. Allocation of water for such urban cities will eventually take water from the common pool where multiple sectoral demands exist.

Sectoral water demands are reaching new heights where irrigation, household supply, energy and industry constantly seek increased volumes to meet growing needs. The 2050 projections for India report that it will require 1,447 km^3 of water, of which 74% is identified for irrigation, while the rest is for drinking water (7%), industry (4%), energy (9%) and others (6%) (Amerasinghe et al., 2013). However, with the aforementioned rapid urban growth in Indian cities and towns, the demand for drinking water is also rising and has a higher priority than competing rural water needs, including irrigation. Water transfers from rural and peri-urban regions to urban cities are increasing. A large number of these growing cities are located in major river basin catchments, taking freshwater away and discharging wastewater back into the catchments and thus polluting irrigation water as well as posing major challenges for urban and rural planners, especially concerning urban wastewater management.

2.2.1. Urban waste generation and treatment

In India, the sewage generation in the urban centres, as per the recent assessment by Central Pollution Control Board (CPCB), was 72,368 Million Litres per Day (MLD) for the year 2020-21. Currently, the installed sewage treatment capacity is 31,841 MLD, but the operational capacity is 26,869 MLD, which are much lower than the load generated. Of the total urban sewage generated, only 28% (20,236 MLD) was the actual quantity of wastewater treated. This implies that 72% of the wastewater remains untreated and is disposed of in rivers/lakes/groundwater. There are some increases in infrastructure e.g., another 4,827 MLD sewage treatment capacity, has been proposed. If this is added to the existing installed capacity, even then, there is a gap of 35,700 MLD (i.e., 49%) between the wastewater generated and the capacity available for treatment (CPCB, 2021b).

Looking more closely at the city-scale wastewater generation, the estimated wastewater generation from Class I cities and Class II towns (as per the 2001 census) is 29,129 MLD, which is expected to be 33,212 MLD at present, assuming a 30% decadal growth in urban population (Fig. 2.2.1). Against this, the installed sewage treatment capacity is only 6,190 MLD. There remains a gap of 79% (22,939 MLD) between sewage generation and installed sewage treatment capacity. Another 1742.6 MLD wastewater treatment capacity is under the planning or construction stage. If this is added to the existing capacity, there still is a gap of 21,196 MLD (equal to 73%) in sewage treatment capacity (CPCB, 2021c).

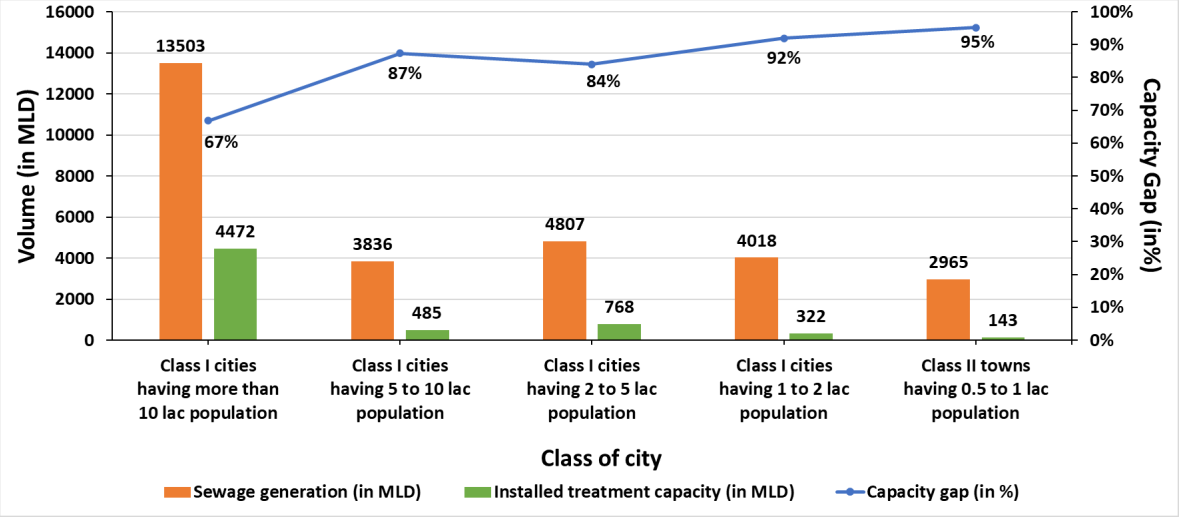


Figure 2.2.1: Wastewater generation and treatment capacity gap at city level in India (CPCB, 2022)

The untreated wastewater largely finds its way out through the nearby rivers, lakes, and groundwater aquifers, thus causing contamination and deterioration of water quality. The CPCB has identified 351 stretches on 323 rivers to monitor the river water quality using Biochemical Oxygen Demand (BOD) as an indicator of pollution. The monitoring results (Table 2.2.1) show that 13% of Indian river stretches are in Priority 1, which indicate that they are severely polluted, and 17 % of the stretches in Priority 2 and 3 are moderately polluted. Apart from high BOD and Chemical Oxygen Demand (COD) levels, high levels of heavy metals, arsenic, fluorides, and hazardous chemicals are also found in many places, especially in groundwater (CPCB, 2018).

Table 2.2.1: Priority wise number of polluted Indian river stretches

Priority Category	Health Status	BOD Value (mg/L)	Number of stretches
1	Severely polluted	BOD >30 mg/L	45
2	Moderately polluted	BOD between 20-30 mg/L	16
3	Moderately polluted	BOD between 10-20 mg/L	43
4	Mildly polluted	BOD between 6-10 mg/L	72
5	Clean	BOD between 3-6 mg/L	175
Total			**351**
Data Source: CPCB. (2018)			

With the rapid increase in population and urbanization of the country, the generated wastewater volume also would increase at the same pace. In addition, the depletion of freshwater resources in terms of quantity and quality would worsen the situation. On the other hand, the time needed to develop understanding of these concerns and testing treatment technologies is limited. Because of these issues, it is crucial for India to use bilateral opportunities to learn and collaborate with the developed countries, who have successfully tested these technologies, and implement sustainable solutions for the treatment and reuse of wastewater. With this objective, this white paper reviews the current scenario of wastewater management in India and documents categories in which collaborations can be made. It offers a detailed discussion on waste treatment, and reuse solutions practiced worldwide that India can learn from and tailor as per the requirements of land, natural resources, energy, cost and in accordance to abiding with the country's specific laws and regulations.

2.3 Structure of the white paper

This white paper is structured in six sections starting from section 2.

Section 2 gives an introduction and a general overview of wastewater generation, treatment and use across the globe. Based on the analysis of global statistics, India's urban wastewater scenario is discussed as per the recent assessments.

Section 3 explains the different policies and legal frameworks along with the role of different institutions in India responsible for Urban Wastewater Management (UWM). Also, the transfer of power in managing wastewater from national to state and local levels has been mentioned. Various initiatives taken by the government of India for urban wastewater management have been enlisted. Further, the section explains India's storage, transport, and treatment of urban wastewater. Different types of sewage management setups followed in India are discussed, and technologies used for

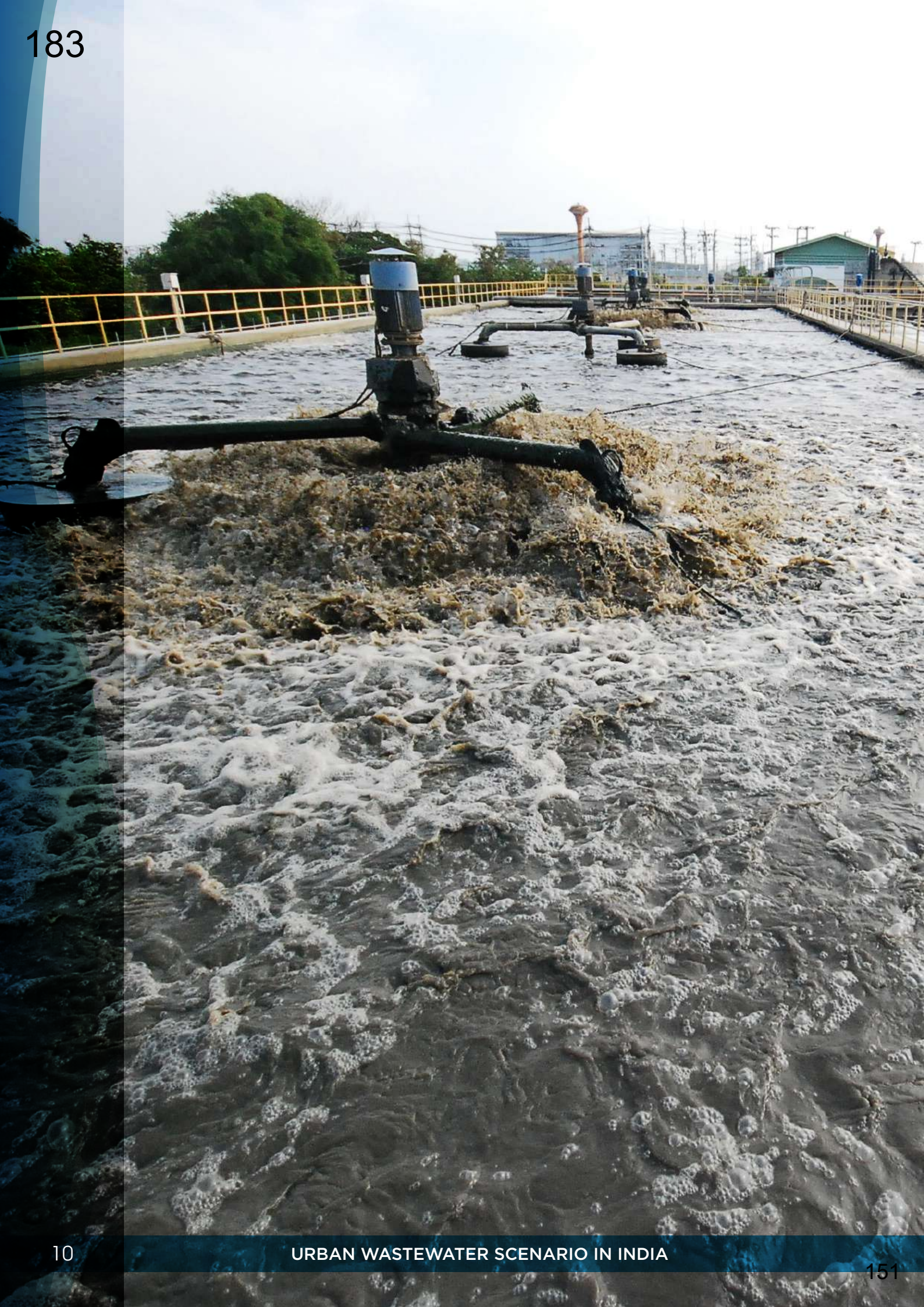
wastewater treatment are explained. This section includes the scenario of reusing treated wastewater and the current practices followed in India. Lastly, various challenges faced by a centralized domestic wastewater treatment system in India are explored.

Section 4 provides a review of innovative, sustainable, cost-effective, and energy-efficient solutions to treat urban wastewater using multiple case studies, globally. The decentralized approach and popular conventional, nature-based and advanced technologies are discussed. Innovative solutions such as the Internet of Things, Remote Sensing and Geographic information systems are explored to achieve near real-time water quality monitoring and management, leading to more efficient and effective problem detection and treatment. Also, the section explores the potential reuses and advantages of treated wastewater in the light of the National Framework on the Safe Reuse of Treated Wastewater-2020. The need and scope of upgradation in traditional septic tanks and possible technological advancements have been explained using case studies. Further, how these solutions can be promoted and adopted at the institutional, community and individual levels are discussed using Public Private Partnership and Public Private People Partnership.

Section 5 focuses on capacity building and raising awareness for Urban Wastewater Management (UWM). The purpose of this section is to present a theoretical framework for capacity building at the national level to address and identify capacity gaps. The focus is on building a human resource base (with training and knowledge transfer), researchers and institutional and international collaboration, and sensitization of the public/community to face the future wastewater management challenges.

Section 6 mentions the key learnings from the case studies under the National Clean Ganga Mission.

Section 7 discusses the ways forward



3. Current scenario of Urban Wastewater Management (UWM) in India – An Overview

3.1 Policy and legal regulation framework for UWM

As per Schedule Seven of the Indian constitution, the *"water"* is a State subject. But in case of inter-state waters, Parliament has a power to legislate, whereas State has power to make policy and legal regulations about the use of water within the State. The 74th Constitutional Amendment, enacted in 1993, decentralizes the water supply and sanitation services from state government to the urban local bodies (ULB).

As far as dedicated regulation regarding wastewater is concerned, there is no specific Act dedicated to management of wastewater in India. But there are provisions in the Water (Prevention and Control of Pollution) Act, 1974 which deals with wastewater as a source of pollution. The Central and State Pollution Control Boards are established under this act and thy are responsible for the prevention and control of water pollution. There are penal provisions regarding pollution in water flowing into the streams, wells, sewer, or land. The Central Pollution Control Board (CPCB) prescribes the criteria for different class of Water as *"Water Quality Standards"* and *"Industrial Effluents Standards"*, however these need to be constantly updated using international standards and considering emergent pollutants. The municipal laws impose certain obligations regarding wastewater disposal into sources of drinking water supply.

The Water (Prevention and Control of Pollution) Cess Act, 1977, which came into force in 1992, provided the financial resources for the Central and State Boards by levying taxes on industrial water use. In order to incentivize the wastewater treatment, a provision of a rebate of 25% on the payable cess is made in the Act.

The Environment (Protection) Act, 1986 empowered the Central Government to prescribe the standards for sewage and effluent and ensure compliance. This is an umbrella act about environmental protection and it enshrines the "polluter pays principle" into the Indian environmental policy. Under the Environment (Protection) Rules, 1989 the industry specific standards for emission/effluent discharge are prescribed. The Wastes (Management and Handling) Rules, 1989 regulate the business of sewerage and sewage treatment, along with other matters.

The National Environment Policy, 2006 emphasises the direct and indirect causes of pollution of surface (e.g. river, wetlands) water sources, groundwater, and coastal area and recycling of wastewater before discharging into water bodies. The policy prescribes the action plans for urban cities to address water pollution through appropriate regulatory systems and technological development for treatment, reuse, and recycle of urban wastewater before final discharge into water bodies.

National Urban Sanitation Policy, 2008, focuses on sanitary and safe disposal of human waste and recommends recycle and reuse.

The integrated water resources management in planning, development, and management is adopted in **India's National Water Policy, 2012**. This policy incentivises decentralised sewage treatment plants, recycling and reuse of treated water through planned tariff systems, and subsidized treatment of industrial effluents. National Water Policy focuses on reducing water pollution and the draft revised National Water Policy, 2020 that embraces the imperative of recycling and reuse.

National Faecal Sludge and Septage Management Policy, 2017 focuses to achieve 100% access to safe sanitation, achieve integrated urban sanitation, safe disposal of faecal waste and mandates strict environmental discharge standards, and promotes an appropriate, affordable and incremental approach to achieving these standards.

The Model Bill for Regulation of Groundwater Development 2016 deals with regulation of ground water in both urban and rural areas and various State Governments enacted the Ground Water Development Act, based on this model bill. These Acts provides the regulation for control on use of chemical fertilizers or pesticides, to regulate the disposal, burial or injection of waste, industrial effluent and to protect the quality of groundwater.

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 prohibits the manual cleaning of sewers and septic tanks and it aims to eliminate insanitary latrines, and rehabilitate identified manual scavengers in alternative occupations.

The Coastal Regulation Zone Notification aims to protect the livelihood of fishermen families, protect the coastal area ecology and generate economic activities in coastal areas. This also aims to reduce the disposal of waste along the coastal regions.

The National Water Mission promotes the recycling of wastewater for meeting water needs of urban areas. The Tariff Policy, 2016 by Ministry of Power mandates the thermal power plants located within 50 km radius of a sewage treatment plant of an urban local body to mandatorily use treated urban waste. The Service Level Benchmarks of the Ministry of Housing and Urban Affairs (MoHUA) mandate the extent of reuse and recycling of sewage in urban areas as 20%.

The National Water Quality Monitoring Programme of India, through its network of SPCBs, advises central and State governments on prevention, control, abatement of water pollution and sets standards on water quality in streams and wells. The Guidelines of National Building Code 2016, emphasizes the reuse of treated sewage and sullage in commercial or residential multi-storeyed complexes for flushing of toilets, horticulture and fire-fighting purposes. It also suggests separate storage tanks and separate distribution pipes.

The National Guidelines on Zero Liquid Discharge developed by CPCB for industrial sectors highlights the zero effluent discharge. The CGWB Master Plan for Artificial Recharge to Ground Water in India, 2013 emphasizes careful monitoring for regarding the treated urban wastewater in order to avoid any possibility of contamination of ground water. The Prime Minister's Krishi Sinchayi Yojana emphasises exploring the feasibility of reusing treated municipal used water for peri-urban agriculture.

The vision expressed in **the National Framework on the Safe Reuse of Treated Water, 2021** is – "*widespread and safe reuse of treated used water in India that reduces the pressure on scarce freshwater resources, reduces pollution of the environment and risks to public health, and achieves socio-economic benefits by adopting a sustainable circular economy approach*" (MoJS, 2020) and accordingly requisite recommendations are made in the framework.

3.2 Institutional arrangements/organizational set-up–Roles and responsibilities

Under Article 246, Indian Constitution vested the state government's legislative jurisdiction of water resources (water supply and treatment, wastewater treatment, irrigation and canal management, water storage and water power). Thus, the States are vested with the constitutional right to plan, implement, operate and maintain and cost recovery of water supply and sanitation projects. At the local level, the responsibility is entrusted by legislation to the local bodies like municipal corporation, municipality, municipal council, and notified area committee/authority for towns or on a state/regional basis to specialized agencies. The organization flow chart is shown in Fig. 3.2.1.

The Public Health Engineering Department (PHED) is the principal agency at the State level for planning and implementing water supply and sanitation programs. In several states,

statutory Water Supply and Sanitation Boards (WSSBs) have taken over the functions of the PHEDs. The primary objectives for creating WSSBs have been to bring in the concept of commercialization of the water supply and sanitation sector management and more accountability.

Ministry of Housing and Urban Affairs (MoHUA) formulates policy guidelines concerning the urban water supply and sanitation Sector. It provides technical assistance to the States and Urban Local Bodies (ULBs). Central Public Health and Environmental Engineering Organization (CPHEEO) supports MoHUA in policy formulation and also handholds States by technical advice, guidelines, scrutiny and appraisal of schemes, and propagation of new water supply and sanitation technologies, including municipal solid waste management. Also, State Water Supply and Drainage Boards (SWSDBs) were formed at the state level to support ULBs in planning, designing, and implementing sewerage and wastewater treatment infrastructure. SWSDBs draw funds from national and state governments. They can build treatment plants and then hand them over to ULBs for operation and maintenance.

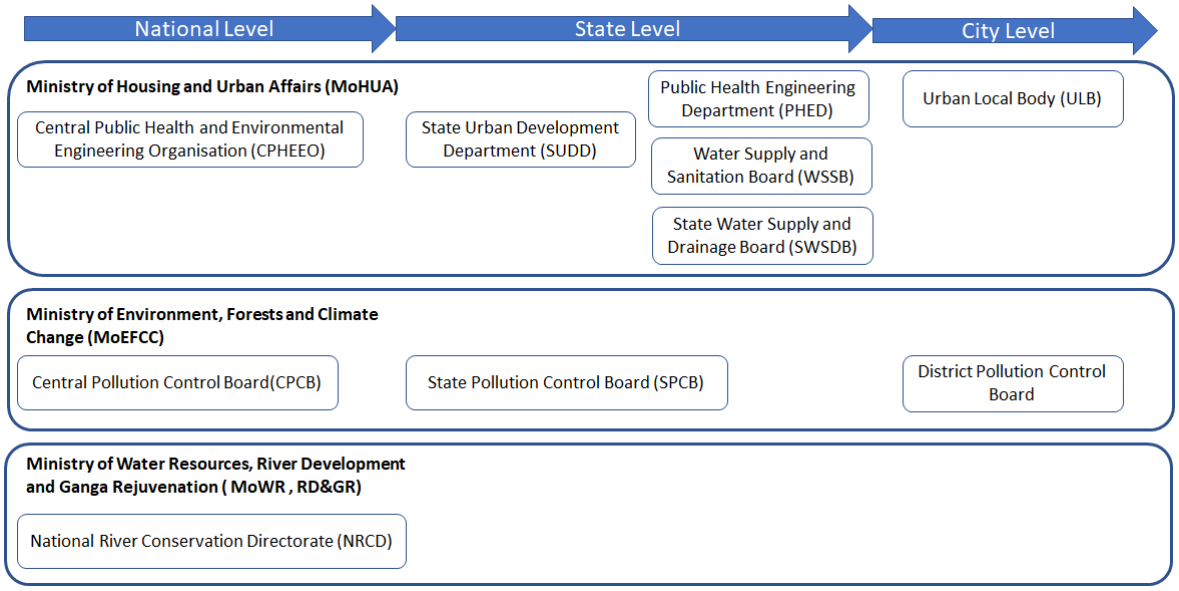


Figure 3.2.1 : Government agencies responsible for urban wastewater management in India

Ministry of Environment, Forest and Climate Change (MoEFCC) and line agencies are in charge of minimizing environmental pollution and planning, promoting, and coordinating environmental policies and programs in the country. They are responsible for setting environmental standards (especially the discharge standards for treated wastewater). The Central Pollution Control Board (CPCB) was constituted under the Water Act in 1974 as a line agency of MoEFCC with the responsibility to prevent, control, and diminish environmental pollution and to set the wastewater discharge standards for the entire country. All the sewage treatment plants (STPs) in India should adhere to the standards issued by CPCB. At the state level, state pollution control boards (SPCBs) are responsible for the implementation of legislation related to environmental pollution. In addition, SPCBs are provided the freedom to toughen the regulations enforced by CPCB. SPCBs are accountable for monitoring the performance of all wastewater discharging entities (buildings, industries, large and small-scale sanitation systems).

The National River Conservation Directorate (NRCD) in the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR , RD&GR) is implementing the Centrally Sponsored Schemes of National River Conservation Plan (NRCP) and National Plan for Conservation of Aquatic Ecosystems' (NPCA) for conservation of rivers, lakes and wetlands in the country. The pollution reduction works taken up under the NRCD include:

interception and diversion works/ laying of sewerage systems to capture raw sewage flowing into the rivers through open drains and diverting them for treatment; setting up of STPs for treating the diverted sewage; construction of low cost sanitation toilets to prevent open defecation on river banks; construction of electric crematoria and improved wood crematoria to conserve the use of wood; river front development works, such as improvement of bathing ghats; and public participation and awareness and capacity building.

The Central Government acts as an intermediary in mobilizing external assistance in the water supply and sanitation sector and routes the aid via the State plans. It also provides direct grant assistance to some extent to water supply and sanitation projects in urban areas under the various programs of the Government of India.

3.2.1 Initiatives of the Government of India

Water (Prevention and Control of Pollution) Act of 1974 (amended 1988): This Act laid the foundation for establishing the Central and State Pollution Control Board (CPCB and SPCBs) to advise, monitor, and enforce sewage and industrial effluent treatment and disposal regulations. All the STPs in India should adhere to the standards issued by CPCB (https://cpcb.nic.in/wqstandards/).

Environment (Protection) Act of 1986: This Act regulated the discharge standards STPs. It prescribes limits of various pollutants be discharged to different environmental zones (land, surface water bodies, marine coastal areas, etc.).

Ganga Action Plan (GAP-I 1985, GAP-II 1993) and National River Conservation Plan: Under GAP-I and GAP-II, cleaning of River Ganga and its major tributaries, Yamuna and Gomti was initiated. It was expanded to cover other rivers under the National River Conservation Plan in 1995. Under GAP, 1098.31 MLD sewage treatment capacity was created (Dutta, 2020). The pollution reduction works taken include: (i) interception and diversion of sewerage systems for treatment, (ii) setting up of STPs, (iii) construction of low-cost toilets, (iv) riverfront development works, (v) public participation and awareness and capacity building.

National Plan for Conservation of Aquatic Ecosystems' (NPCA) (2015): The NPCA aims to provide a framework for conservation and sustainable management of wetlands, with the objectives: (i) Developing policy guidelines, (ii) Supporting, promoting, and strengthening conservation of wetlands, and (iii) Facilitating the development of a national inventory, and (iv) Strengthening the capacity of wetlands managers and stakeholders.

National Urban Sanitation Policy (2008): This policy made local governments responsible for behavioral change, total sanitation, and 100% safe waste disposal. It envisages that cities will implement city sanitation plans, prioritizing areas and implementing long-term plans in parallel, emphasizing mobilizing all city stakeholders. It is the responsibility of the state governments to draft state urban sanitation policies, under which the cities can develop their own sanitation strategies.

Other essential flagship national programs launched by the Government of India: Namami Gange program launched in 2015. Under Namami Gange Programme, Government has sanctioned 161 sewage management projects at 245.81 billion INR for creation and rehabilitation of 5501 MLD sewage treatment capacity and laying 5,134 km of sewerage network. Out of these, 92 projects have been completed resulting in creation and rehabilitation of 1,643 MLD of STP capacity and laying of 4,156 km sewerage network (PIB, 2022). It also includes sectoral programs to improve un-sewered and sewered sanitation, such as the Swachh Bharat (Clean India) Mission 2014-2019, the AMRUT Mission 2015-2023 and the Smart City initiative 2017-2023.

3.3 Current technologies and practices in UWM

In India, UWM is performed in two ways (i) On-site systems and (ii) Off-site systems. An on-site system retains wastewater in the vicinity of the toilet in a pit or tank, and the produced sludge is removed periodically to the faecal sludge/septage treatment system. While an off-site system removes wastewater from the vicinity of the toilet for disposal elsewhere. An off-site system comprises of a sewerage network to transport sewage to a sewage treatment plant (STP); the treated wastewater's solid content is disposed to drying beds, and liquid is disposed to waterbodies. Such treated wastewater is being used for different applications like (a) Irrigation, (b) Toilet flushing, (c) Industrial use, (d) Fish culture, and (e) Indirect and incidental uses (CPHEEO, 2012). The storage, transport, and treatment steps followed in an off-site and on-site system are depicted in Fig. 3.3.1. These two systems are explained in detail in the coming sections.

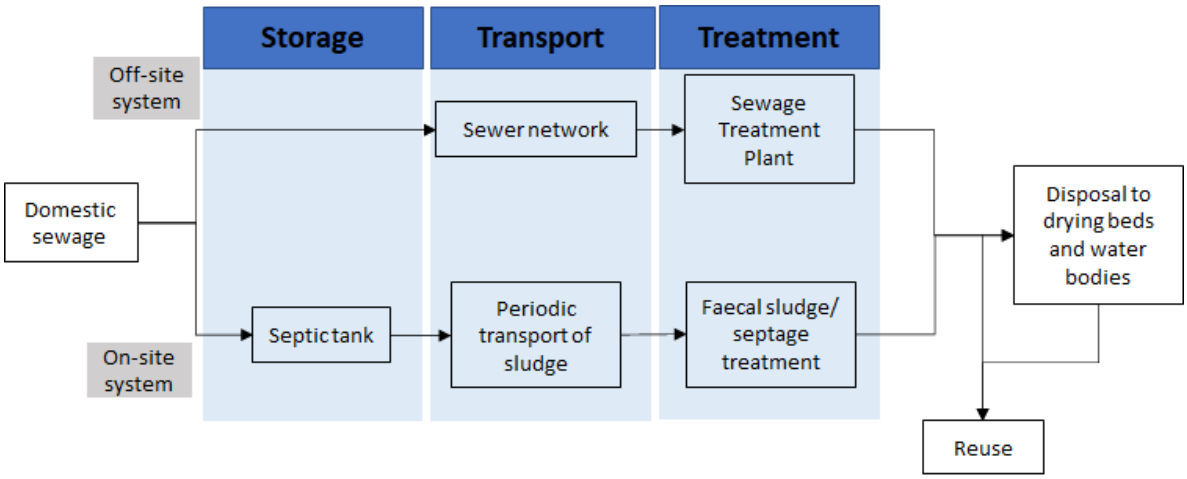


Figure 3.3.1 : Storage, transport, and treatment mechanism of an off-site and on-site wastewater treatment system

3.3.1 Off-site system

Sewage collection system: Wastewater collection can be done using two systems (i) Separate system, which collects sewage and stormwater in separate drains, and (ii) Combined system, which collects sewage and stormwater together in the same drain. In India, almost all the sewer networks are designed for separate systems, which satisfies the technical and economic advantages. However, old sewerage systems which were developed during British rule have a combined system like in Kolkata (Murmu et al. 2021).

Sewage treatment facilities: In India, under an off-site treatment system, domestic sewage is transported to STPs. The STPs are designed based on the influent characteristics like total suspended solids (TSS), Biochemical oxygen demand (BOD), and Faecal coliform (FC). At present, 1,469 STPs (as of 2020 – 21) have been installed in the urban centres of 28 states and union territories in India, with a total installed capacity of 31,841 MLD, Compared to the 2014 assessment by CPCB, the number of STPs has almost doubled, and the capacity increased by 41% in 2020 (Table 3.3.1). Of the 1,469 STPs, 102 STPs are non-operational, and 274 STPS are under construction. Another 162 STPs with a capacity of 4,827 MD are proposed. So, currently, the total treatment capacity is 36,668 MLD; however, only 26,869 MLD is the operational capacity (CPCB, 2021b).

Table 3.3.1: Comparative STP status with respect to number and capacity for years 2014 and 2020

S.No.	STP Status	2014		2020	
		Number of STPs	Capacity (MLD)	Number of STPs	Capacity (MLD)
1	Operational	522	18883	1093	26869
2	Non-Operational	79	1237	102	1406
3	Under construction	145	2528	274	3566
4	Proposed	70	628	162	4827
	Total Installed (1+2+3)	**746**	**22648**	**1469**	**31841**
	Total Treatment (1+2+3+4)	**816**	**23276**	**1631**	**36668**
Data Source: CPCB. (2021)					

In an off-site system, sewage treatment is composed of three stages (i) Primary treatment, (ii) Secondary treatment, and (iii) Tertiary or advanced treatment, as depicted in Fig. 3.3.2.

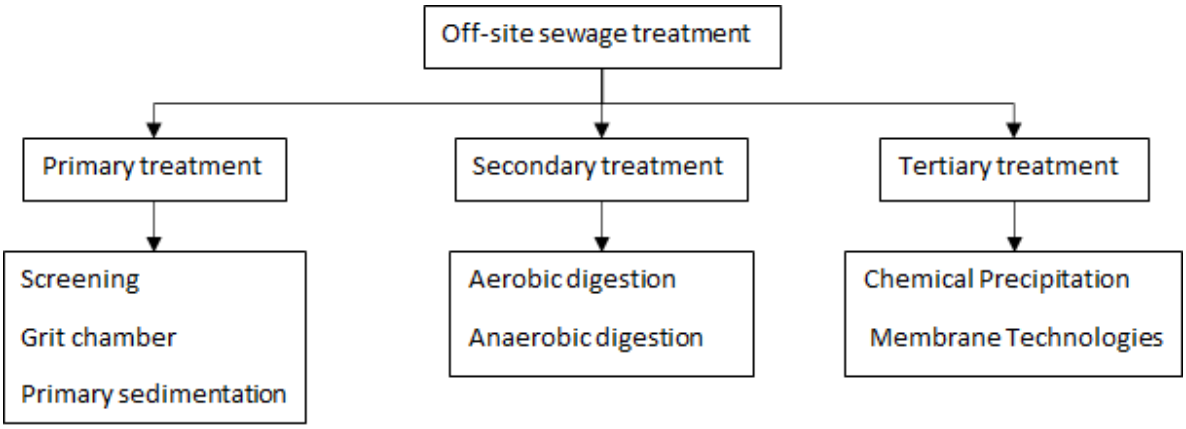


Figure 3.3.2 : Primary, secondary, and tertiary treatment methods of an off-site wastewater treatment system

i. Primary treatment involves a preliminary filtration process that removes physical and chemical pollutants like suspended solids. This process also removes some organic nitrogen, phosphorus, and heavy metals. However, it provides limited removal of microbial pathogens. The first step of primary treatment is screening, which removes the solid waste of wastewater, like pieces of cloth, hair, paper, wood, cork, and kitchen solids. The screening element may consist of parallel bars, rods, or wire mesh, and the openings may be of any shape. It is recommended that three sequential stages of screens shall be provided coarse, followed by medium, and followed by fine screens. Then sewage goes to the grit chamber, which removes grit to protect the moving mechanical equipment and pump elements from abrasion and damage. After the grit chamber, primary sedimentation is done in a sedimentation tank, also called settling tanks and clarifiers. Sedimentation is used to remove (i) inorganic suspended solids, (ii) Organic and residual inorganic solids, free oil and grease, and other floating material, and (iii) chemical flocs produced during chemical coagulation and flocculation. If the sedimentation is insufficient to cause the settlement of suspended solids, certain chemicals (such as alum, starch, iron

materials, activated silica, and aluminium salts) are added to cause the settlement of the solids by coagulation. The wastewater flow through the primary treatment unit is depicted in Fig. 3.3.3.

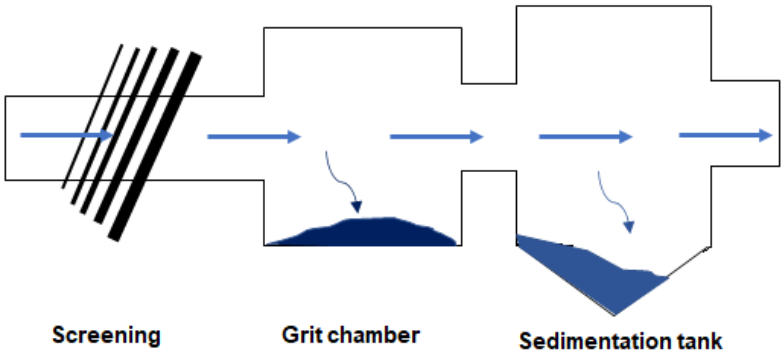


Figure 3.3.3 :Wastewater flow through different units involved in primary treatment

ii. Secondary treatment includes biological digestion to remove organic content, leading to a reduction in BOD of up to 85%. Secondary treatment can be aerobic or anaerobic. Aerobic decomposition is done in the presence of dissolved air or oxygen in wastewater by the aerobic or facultative bacteria, causing a reduction in or removal of BOD, COD, dissolved and suspended organics, volatile organics, nitrates, phosphates, and other substances. However, it results in vast amounts of biosolids as waste, requiring costly treatment and management practices. Anaerobic decomposition occurs without dissolved oxygen or air, and anaerobic and facultative bacteria carry it out. In this process, prolonged retention time can give better results by degenerating organic contaminates (through nitrification and denitrification processes) (Hasan et al., 2019). The arrangement of primary and secondary treatment units for wastewater treatment is depicted in Fig. 3.3.4.

iii. In India, various treatment technologies, from conventional to advance to natural, are used for secondary treatment purposes. The technological distribution with respect to the number and the capacity of the installed STP is given in Table (3.3.2). SBR (30%) and ASP (20%) are the prevailing technology adopted by ULBs.

Table 3.3.2 : Technological distribution with respect to number and the capacity on installed STP capacity

Technology	Technology type	Number	Capacity (in MLD)
Activated Sludge Process (ASP)	Conventional	321	9,486
Extended Aeration (EA)	Advanced	30	474
Fluidized Aerobic Bed Reactor (FAB)	Advanced	21	242
Moving Bed Biofilm Reactor (MBBR)	Advanced	201	2,032
Oxidation Pond (OP)	Natural	61	460
Sequencing Batch Reactors (SBR)	Conventional	490	10,638
Upflow Anaerobic Sludge Blanket (UASB)	Advanced	76	3,562
Waste Stabilization Pond (WSP)	Natural	67	789
Any other		364	8,497
Data Source: CPCB. (2021b)			

iv. Tertiary treatment is the removal of constituents beyond the ability of secondary treatment. It includes chemical precipitation and membrane technologies. Chemical precipitation is required to remove phosphorous to control eutrophication, salt to use the treated sewage for industrial purposes, and heavy metals. Membrane technologies are the alternative to the removal of hardness, but they result in the removed salts as a reject solution, which will need either ocean disposal or thermal evaporation. Besides, they require extensive pre-treatment to eliminate suspended solids.

After tertiary treatment, disinfection of treated sewage is done when the coliforms may affect the receiving water quality. Chlorination is the most widely used disinfection technology for sewage treatment. As the treated sewage is fresh from secondary aerobic biological treatment, the chlorination of such effluents does not result in hazards. In the case of effluents from anaerobic processes like UASB, the provision of an aerobic polishing treatment is mandatory before chlorination.

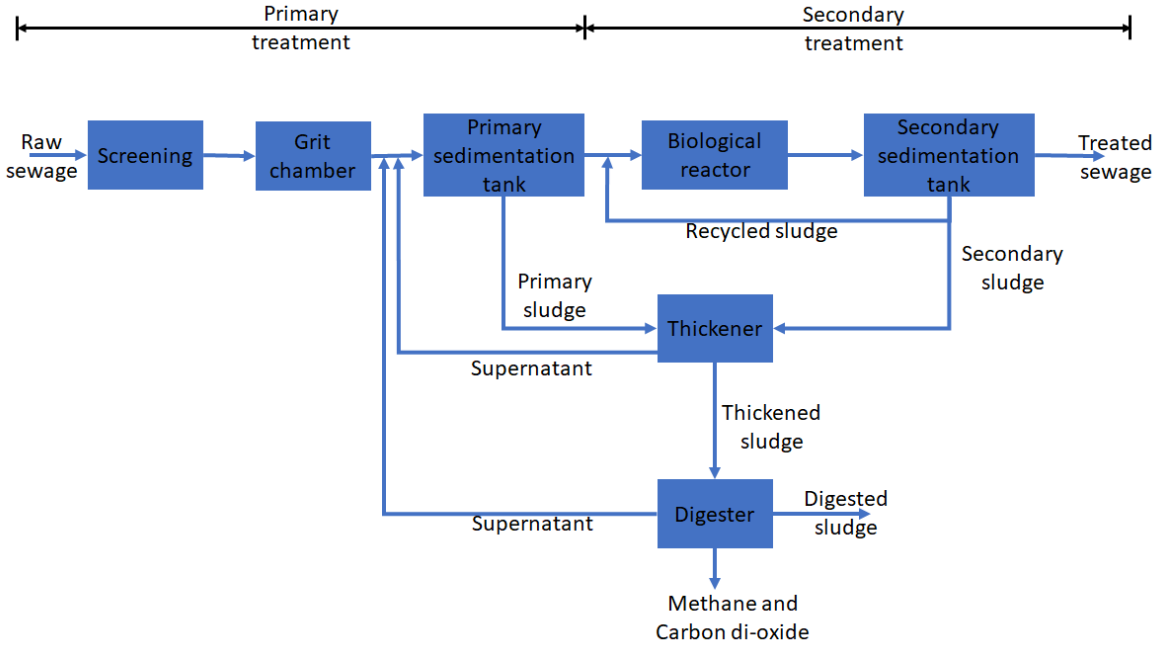


Figure 3.3.4 : Sewage flow through the primary and secondary treatment units of an STP (Source: CPCB, 2013)

Sludge management: In STP, sludge means primary sludge when the suspended solids of raw sewage settle in a primary clarifier, secondary sludge when the mixed liquor (sewage aerated in aeration tanks) is settled in secondary clarifiers to separate the microorganisms by gravity. Return sludge, a major portion of the secondary sludge is returned to the aeration tank for seeding the microorganisms. Excess sludge, a small portion of secondary sludge is wasted. When raw sewage or secondary treated sewage is subjected to chemical precipitation, the resulting sludge is called chemical sludge. The concentration of settled out organics and microorganisms from primary settling or secondary settling or both is carried out in sludge thickeners. After this, if the thickened sludge is put through anaerobic digestion to produce Methane, it is called an anaerobic digester. If it is oxidized, it is called an aerobic digester. In both cases, the digested sludge will have to be dewatered. There are many types of equipment like centrifuge or filter press or natural solar drying beds for this purpose.

3.3.2 On-site system

In India, about 60% of the population is dependent on the on-site sewage management system. The on-site sewage treatment systems treat sewage within the premises of its generation and are also termed non-sewered sanitation. Conventional Septic tank with soaking options like soak pit and dispersion trenches is India's most commonly used on-site sewage treatment system. A septic tank is a buried chamber that collects and stores domestic sewage and partially treats it under anaerobic conditions. Effluent from the septic tank should be discharged to an on-site infiltration system like a soak pit or drain field, as shown below in Fig. 3.3.5. In the septic tank, solids settle and digest anaerobically, which reduces sludge volume and enables overflow effluent to infiltrate into the ground in the soak pit without clogging the leaching system. In practice, many premises do not have a soaking arrangement due to space constraints and lack of awareness. Thus, they discharge pathogenic effluent directly into open drains, posing a public health risk.

The standard septic tank design incorporates two chambers. Some septic tank designs adopted in India have three chambers. Most of the treatment takes place in the first chamber. A well-managed septic tank could remove about 50–60% of the biological load in the sewage. Further, a well-designed soak pit can remove bacterial load up to the discharge standards. Soak pits are cheap to construct and need no media when lined or filled with rubble or brickbats. The pits may be of any regular shape, circular or square being more common.

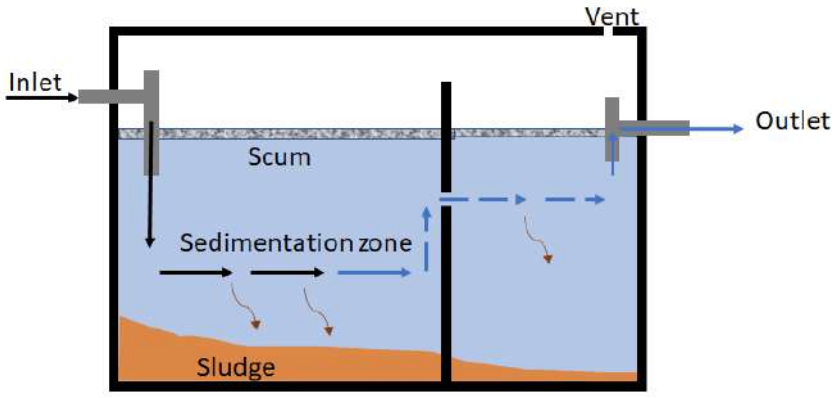


Figure 3.3.5: Septic tank showing three distinct layers (scum (oil, fats, and grease), clarified water, and sludge

On-site sewage treatment methods invariably generate faecal sludge or septage that must be safely collected, transported, treated, and reused/ disposed off. Faecal Sludge and Septage Management (FSSM) assumes significance in the Indian scenario as about 60% of households depend on on-site sanitation systems. On-site sanitation systems in urban India largely consist of double leach pits and septic tanks. A study by the Centre for Science and Environment 2019 in some cities of Uttar Pradesh shows that most (about 80%) containment systems are often not connected to functional soak pits. The situation in other cities in the country is no different. However, drawing inspiration from the National FSSM Policy launched in 2017, states and cities are moving towards scaling up innovative and inclusive urban sanitation service delivery. Managing faecal sludge has gained prime importance in the three states of Maharashtra, Odisha and Tamil Nadu. Almost 500 faecal sludge treatment facilities are already sanctioned in the states mentioned above, and these units shall cater to more than 600 cities and towns. However, there is a scope and support from the government to enhance these treatment facilities keeping in mind the future demands and ways to convert waste to wealth as successfully implemented in developed nations.

3.3.3 Reuse of sewage

Considering increasing load of untreated sewage, there is a need to realize sewage as a resource that can be treated as per requirement and utilized for non-potable purposes and industrial utilities. In the recent past, different ULBs of India have focused on reusing treated sewage and initiated the reuse of treated sewage in horticulture, irrigation, non-contact impoundments, and washing and utilization for industrial activities.

The wastewater reuse examples of India include:

i. The Government of Punjab has notified *"The State Treated Wastewater Policy 2017"* to promote recycling and reuse of treated sewerage for non-potable applications. Till date, 47 projects have been completed by the Department of Soil and Water Conservation for using 243.3 MLD treated wastewater of STPs. These projects have been implemented by laying underground pipeline system for irrigation water conveyance covering an area of 7652 hectares (DECC, 2020).

ii. The Indian Agricultural Research Institute, Karnal, has researched sewage farming and recommended an irrigation method for sewage-fed tree plantations.

iii. The Government of Karnataka has issued an official directive to take all necessary steps to ensure that only tertiary treated sewage is used for non-potable purposes, like all gardening, including parks, resorts, and golf courses.

iv. In major metropolitan cities like Delhi, Mumbai, Bengaluru and Chennai, treated grey water is used for toilet flushing in major condominiums and high-rise apartment complexes on a pilot scale.

v. Secondary treated sewage is purchased and treated for use in cooling water makeup in the industrial sector from as early as 1991 in major industries like Madras Refineries, Madras Fertilizers, GMR Vasavi Power plant in Chennai as also in Rashtriya Chemicals and Fertilizers in Maharashtra and most recently in the Indira Gandhi International Airport in Delhi and Mumbai International Airport.

3.4 Limitations and challenges

The following section explores various challenges phased by domestic wastewater treatment system in India. While they face numerous challenges in setting up and operation, the challenges are grouped under the following issues i) Institutional challenges ii) Regulatory challenges iii) Economic challenges iv) Technological challenges and v) Social challenges.

3.4.1 Institutional challenges

The Urban Local Bodies (ULBs) in India are important institutions as far as domestic wastewater management is concerned. They are primarily responsible for the provision and maintenance of wastewater treatment facilities in their administrative area. However, in many cases, they lack the capacity to plan and implement such projects. For instance, the performance audit report of ULBs by the Comptroller and Audit General (2017) in the state of Tamil Nadu finds that the shortage of manpower in municipalities affected the revenue collection and delivery of citizen services. It also revealed deficiencies in planning, financial management, implementation, and monitoring of various projects. Similarly, the CAG performance audit (2016) in the state of Jharkhand found that none of the sampled ULBs had a sewage network. In the absence of the same, around 175 MLD of untreated wastewater is discharged into open drains polluting nearby water bodies (CAG, 2016). Thus, it can be seen that ULBs have suffered from planning, implementation, and financial management. While the management of wastewater suffers from issues

as listed, the enforcement mechanism for employing corrective measures suffers from various challenges as follows.

The existing institutional, policy and legal mechanisms to enforce the management of wastewater and control water pollution in the country are not sufficient to address the looming crisis. The performance audit of water pollution by the Comptroller and Auditor General (2011) has found that *"there is no specific policy at both the Central or State level that incorporates prevention of pollution, treatment of polluted water and ecological restoration of polluted water bodies and that without this, government efforts in these areas would not get the required emphasis and thrust."* The enforcement (to the existing laws regarding wastewater management) capacities of State Pollution Control Boards (SPCBs) both in terms of power and resources is limited. The penalty amount enforced against the industries or domestic households for non-compliance or defiance of the provisions of the Water (Prevention and Control of Pollution) Act by the State governments is too low (up to a maximum of INR 5 lakhs as per the latest amendments). The cost of non-compliance/violations is found to be significantly lesser compared to the cost it takes for compliance (CAG, 2017). Out of the total STPs (1,114), 21% do not comply with the standards. While looking at corrective measures for non-compliance, in 55% of the cases no action is taken (pending action), and in 40% of the cases action is restricted to show cause notices (CPCB, 2020).

Staff shortages limit the capacity of SPCBs to monitor water quality and disseminate results to the concerned parties. The shortage of staff is 37.6%, 39%, and 52.3% in Group A, B, and C categories respectively (see Fig. 3.4.1). Shortage includes staff in scientific, technical, and administrative domains. Laboratories play an important role in the analysis of pollution levels for regulatory and research requirements. Labs are not well equipped due to a shortage of manpower and procurement delays in instruments, equipment, and consumables (CPCB, 2020). With an insufficient laboratory setup, delay in water quality testing after the sample collection alters the parameters of water quality (Kumar & Tortajada, 2020), thus failing to give a real picture of the water quality on the ground. Along with laboratory-related shortcomings, the lack of an adequate number of monitoring stations (the present monitoring network comprises 4,484 stations (CPCB, 2022) and their geographical spread (as many of them are located not in cities far or immediately downstream of the pollution hotspots) fail to give the real picture of the extent of water pollution in the country (Kumar & Tortajada, 2020). The Class II towns and stagnant water bodies in the states are not included in monitoring networks (CPCB, 2020). Both centre and many states have not yet undertaken the complete incentivization of water bodies, and have not yet quantified the contaminants or human activities that affect the water quality. There is no environmental or health risk assessment performed to understand the impacts of pollution (CAG, 2011). These knowledge gaps further limit the monitoring and enforcement capacities of SPCBs.

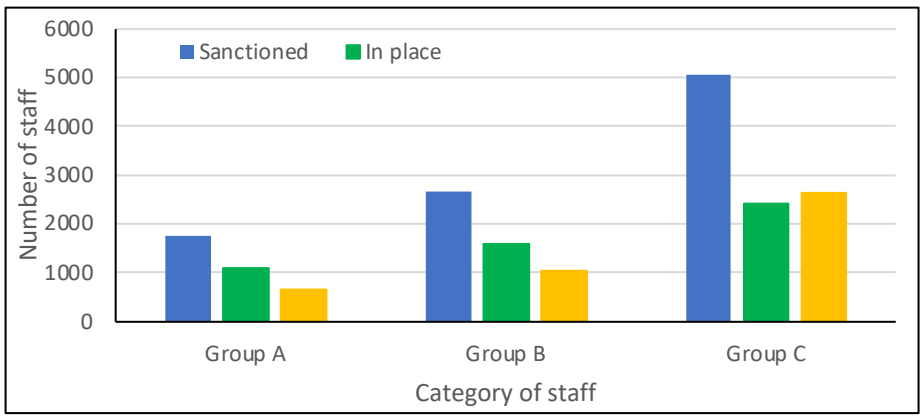


Figure 3.4.1. Human power availability in SPCBs based on category (CPCB, 2020)

Many urban areas with STPs in place suffer from underutilization because of a lack of proper sewerage networks and lack of proper operation and maintenance of the existing plants. As a result, in those areas wastewater will be fed to neighbouring water bodies such as lakes and urban streams capturing the natural drainage or using cesspool vehicles, polluting the water bodies and associated ecosystems (Ravishankar et al., 2018). Further, the efforts to revive such waterbodies suffer from issues related to institutional coordination. There exist multiple institutions in silos to manage stormwater drains, sewage treatment plants, and waterbodies but with considerable overlaps in roles and responsibilities and a lack of coordination (Lele & Sengupta, 2018). For instance, weak institutional mechanisms, absence of proper planning and supervision, and limited databases changed the focus of polluted water body rejuvenation from the preservation of ecosystems and pollution control to enhancement of recreational aspects in urban areas (e.g., in 50% of rejuvenated lakes in Bangalore non-core works exceeded the stipulated 25% of project cost) (CAG, 2020).

3.4.2 Regulatory challenges

Challenges in relation to regulation can occur in three aspects namely, standards, monitoring, and jurisdiction. The regulatory set up in India, related to the regulation of water pollution, consists of Pollution Control Boards (PCB) and an active judiciary including the National Green Tribunal (NGT). The water quality monitoring arena is expanded from just 18 sites in 1978 to 4111 sites by 2020. The major challenges associated with the standard setting of water pollution include i) the diversity of pollutants ii) the variety of targeted uses in which treated/untreated water is being put iii) the amount of dilution that may happen when the pollution load is released to a neighbouring water body (or in other words, polluted water is not used directly in many cases). While the discharge standards presume that enough amount of dilution may take place after mixing with freshwater probably from a rural watershed or forested area, the actual scenario may differ especially in the case of non-perennial rivers or if the upstream areas of the catchment are reasonably urbanized (Lele et al., 2021).

The existing challenges in the set standards include the differences in the standard setting for different uses. For instance, as per the CPCB notified "*General Discharge Standards*", surface waterbody is regulated by 35 parameters while wastewater for land application (or irrigation) is regulated by 10 parameters, not including heavy metals *(https://cpcb.nic.in/displaypdf.php?id=R2VuZXJhbFN0YW5kYXJkcy5wZGY=)*. However, in a mixed catchment, the domestic sewage may get mixed up with other contaminants, hence monitoring more parameters including heavy metals is really important. In addition, the standards are set based on the concentration and not on the load, hence the total amount of pollution entering the receiving water body is not regulated. Also, no standards have been set for the ambient water quality for a surface water body which is probably on the receiving end of treated or untreated domestic sewage and thus misses the goals that need to be set (water quality criteria by CPCB are set based on the uses-). Such lapses basically affect the end users such as downstream farmers. Because, none of the upstream agencies can be made responsible for the quality of discharge, given irrigation is going to be the largest user of treated domestic sewage (Schellenberg et al., 2020). Thus, the lower number of monitoring parameters and lacunas in ambient water quality standards affect the end users, cross-checking mechanisms in discharge regulation, or refrain them from using it since the domestic sewage may contain higher amounts of chemicals such as phosphates in detergents (Comber et al., 2013; Lele et al., 2021). In addition, the standards need to be set based on load, studying the nature of inflows from the catchment in order to avoid complexity and help the potential end users of treated water.

Better defined water quality standards need to be met with rigorous monitoring in order to detect pollution levels, trace them back to the source and estimate the impacts of

the same. As shown in Fig. 3.4.2 monitoring has to happen at multiple points including sources, environmental systems, exposure pathways, and finally, the recipients of the pollution loads including human populations. However, as shown in Fig. 3.4.2, monitoring levels and standards are limited. If we consider the domestic effluents, the monitoring is limited since only organic contaminants are monitored properly, while the monitoring of chemical contaminants is conducted on a limited scale. When it comes to water quality standards, in case of release to water bodies standards are set for organic contaminants but not for chemical contaminants. Importantly, in case of release to the soil, water quality standards are not present. In a similar manner, if one considers the exposure pathways and risk involved, monitoring systems are not fully functional and water quality standards are either partial or non-existent.

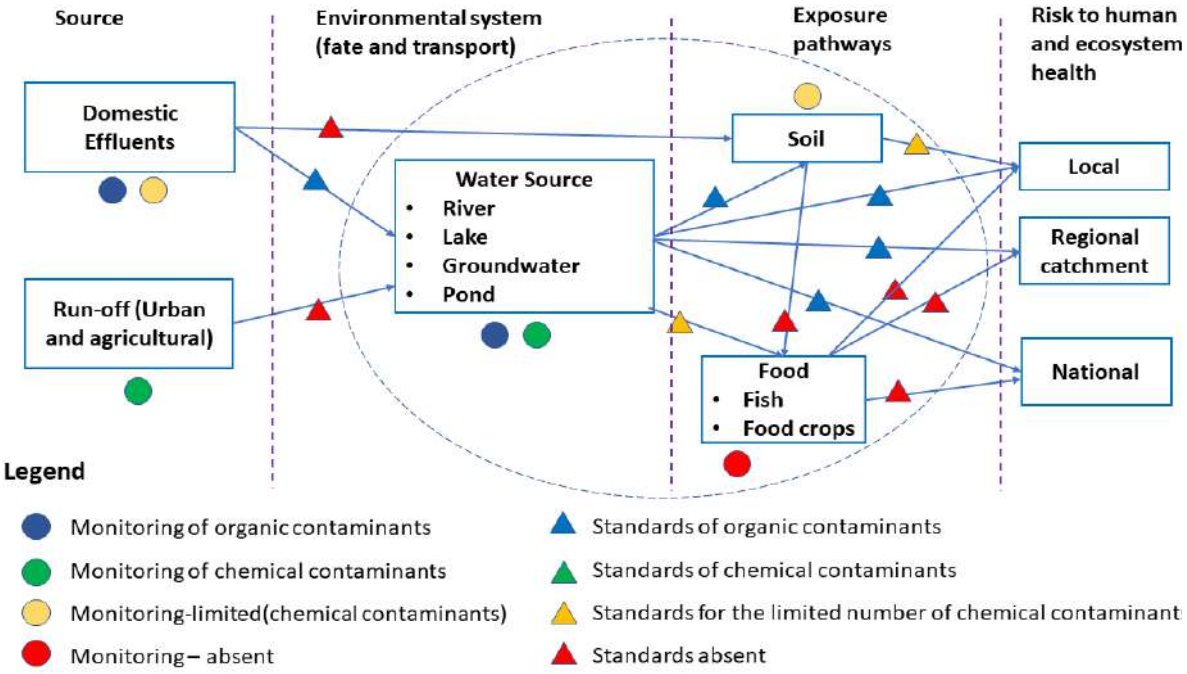


Figure 3.4.2. Framework showing gaps in the water quality monitoring framework in India (Adapted from Lele et al., 2021)

The lacunas present in the monitoring system and the points at which the standards are set are of concern, considering the current treatment capacity is very low. For instance, in the case of domestic sewage, the monitoring is mainly focused on STPs which is also not conducted properly (Jamwal et al., 2015). Importantly, the total capacity gap in domestic sewage treatment is 78.7%, (CPCB, 2022) implying a major part of the sewage is not treated in the STPs. The lacunas in standardization further expand into another tragedy considering the disconnect or gap between monitoring and its use. This is because as per the CPCB's water quality criteria, the water bodies may fall into a class between A and E or below E based on the designated use they are fit for, while ambient water quality standards and not enforced. In addition, the sample collection strategy is limited to the form of one-time samples at a fixed time of the day. However, in many cases round the clock estimates showed higher peaks at night and early morning in urban streams (Jamwal et al., 2021), due to illegal dumping. In the case of jurisdiction, it does not convert into any action, as there is no legal requirement to reduce pollution. In a centralized system, where the catchment of the STPs span across a large geographical area, such gaps increase the adverse impacts.

3.4.3 Economic challenges

As depicted in Fig. 2.2.1, the capacity gap (i.e., the gap between the generated sewage and present treatment capacity) is very large in all classes of towns and cities in India. Also, it can be observed that the gap increases in the order of decreasing the population. Thus, it can be attributed that the smaller cities and towns face difficulty in finding necessary resources for setting up STPs considering the higher capital expenditure and operation and maintenance costs. High capital discourages the entry of private players with an average break-even time span of three to eight years. The cost of the utilities is rarely covered by the revenue from the STPs (may include dried sludge and treated water) due to high uncertainty in demand. Thus, smaller towns find it difficult to install STPs of adequate capacity, and the gap increases in cities and towns with lower revenue. Community participation in Operation and Management (O&M) and multiple income-generating activities like agriculture and fisheries are suggested to improve the economic viability of STPs (CAG, 2017). However, such measures are very minimal. In contrast, with Decentralized Wastewater Treatment (DWWT), centralized systems have higher capital and O&M expenses attributed to more complicity in the systems employed, more technical expertise, and energy requirement (Jung et al., 2018). Finding appropriate land for Centralized Wastewater Treatment (CWWT) is difficult considering the higher land values in urban areas. In addition, the phased investment considering the population growth and land-use pattern is difficult in the centralized STP system, thus altering the opportunity cost and idle capacity (Jung et al., 2018).

The economic viability is the crucial factor hindering the performance of wastewater treatment systems in terms of adherence to environmental standards. The cost of STPs increases substantially with more advanced treatments that ensure reduced pollution. However, the direct economic benefits from the STP derived from the use of treated water in agriculture or fisheries are considerably low. This tempts the municipalities to succumb to the least efficient technologies in terms of environmental performance. Thus, there is a trade-off between environmental performance and economic viability (Kumar & Tortajada, 2020).

The average capital cost for STPs varies between 60 lakhs to 300 lakhs per MLD according to the technology used (CPCB, 2013). The cost of various land-based technologies like activated sludge process, waste stabilization ponds, oxidation ditches, aerobic ponds, and soil aquifer treatments is the function of the land area required for the treatment. The cost of land in Indian cities is exorbitantly high, affecting the economic viability of STPs. The choice of technology also varies with the temperature, altitude, soil, geo-hydrology, and the concentration of pollutant to be treated (Kumar & Tortajada, 2020). Besides the capital cost, operation and maintenance cost estimated per month involves a minimum of INR 30000 per MLD. Conventional treatment technologies (except natural treatment technologies) also need a considerably high amount and uninterrupted supply of energy and a greater number of skilled personnel for their proper functioning (CPCB, 2013). However, most of the fund flows into the newer infrastructure development in the form of capital expenditure and not in the operation and maintenance of existing STPs limiting their treatment capacity (Kakwani & Kalbar, 2020).

The private sector investments in wastewater treatment in India are deterred due to higher upfront capital investment and highly unpredictable revenue streams (FICCI Water Mission and 2030 WRG, 2016). There is a huge demand risk involved with the low water tariffs and little regulation governing user charges which makes the collection of user fees difficult. The water boards in non-metro cities are often financially weaker to pay the contractually agreed annuities further discouraging Public Private Partnerships (PPPs) in wastewater treatment (Nikore & Mittal, 2021). Though few residential complexes of higher income groups in India have started having an STP of their own, higher expenses limit their establishment in most of the housing areas. Moreover, the value of water is often

underrated. The users are unaware of the relationship between public health, hygiene, land, and water pollution (Kumar & Tortajada, 2020).

3.4.4 Technological challenges

India has an over-dependence on older technologies for handling wastewater (FICCI Water Mission and 2030 WRG, 2016). The limited funds and higher expenditures push the government to choose technologies with lower capital costs despite their poor performance parameters. The limitations of municipalities in handling wastewater lead to sewerage adulteration with industrial effluents, impairing treatment functions, and a further increase in avoidable repair costs (Nikore & Mittal, 2021). The lifecycle cost comparison is not performed to choose between the available technologies. The knowledge gap along with the ignorance regarding newer technologies further leads to the perpetuation of outdated and inefficient technologies (FICCI Water Mission and 2030 WRG, 2016).

The land area requirements of most of the wastewater processing technologies further impede its development. It is very difficult to avail land in most of the urban areas in the country where land is a limited and highly contested resource. The cost of land in urban areas is also phenomenally high. Moreover, people show resistance to setting up a wastewater treatment plant nearby their living area (Not in My Backyard Syndrome (NIMBY) (Fu et. al, 2022). The requirement for an uninterrupted and huge amount of power supply further affects technological choices (Kumar & Tortajada, 2020). The possibilities of alternate nature-based and decentralized technologies are yet to be explored (Kakwani & Kalbar, 2020). While setting up of plants and technological choices face many hurdles, there are many operational challenges as well. STPs are majorly run by personnel with inadequate knowledge about the running of STPs and know only the operations of basic equipment in the plant (e.g. pumps and motors). In such a state, operational parameters and day-to-day variation in performance are not monitored (CPCB, 2022). Such limitations bring additional challenges in the handling of domestic sewage. For instance, the flow of pathogens and organic constituents that are able to pass through the conventional WWTPs pose a threat to public health (Voulvoulis, 2018).

Conventional centralized wastewater treatment plants are designed only to remove Biological Oxygen Demand (BOD), Nitrogen (N), and Phosphorous. With rapid urbanization, the nature and type of contaminants are changing along with the emergence of new challenges. The knowledge gap regarding these changes and the scalability of newer technologies in the Indian context is a major challenge (Kakwani & Kalbar, 2020). Hence, it is clear that in the emerging catchments where more mixing of sewage with other contaminants took place, choice of technology is vital. Centralized systems with large upfront costs set limitations in choice of technology. In such occasions, decentralized systems offers arenas to phased investments, quicker adoption of technology based on the specific needs of urbanizing catchments.

3.4.5 Social challenges

The citizens are usually not well informed about the issues related to water scarcity and the positive outcomes of water reuse and recycling. In many cases, despite the awareness created, people are reluctant to use reclaimed water for both potable and non-potable purposes (Kakwani & Kalbar, 2020). Recycled water is very less likely to be accepted for drinking purposes compared to its non-potable purposes like irrigation of parks (Rodriguez et al., 2009; Villarín & Merel, 2020). People often have negative emotions of fear and disgust when it comes to the usage of recycled wastewater. These are deeply entrenched within individuals but are also linked with wider societal processes and social representations (Smith, et al., 2018). The negative attitude towards the usage of treated wastewater is also stemmed from the concerns related to associated health risks

(Saliba et al., 2018). The communication policies in place, end-market demands and requirements also affect social acceptance of wastewater reuse (Salgot & Folch, 2018). Aesthetic aspects of reclaimed water, such as colour, odour, and taste, and the cultural and religious background of consumers are other crucial factors that shape the public acceptance of treated water (UNESCO, 2017).

In many parts of the world, water reuse schemes are rolled back due to public opposition. However, with effective public engagement, the proportion of people in support of potable reuse increased considerably (Smith et al., 2018). Certain experiments show that there is a significant improvement in public perception with the change in terminologies used. In Singapore, the use of the term recycled water (marketed as NEWater) instead of wastewater resulted in a 74% social acceptance of to reuse of water (Timm & Deal, 2018).

Identifying and obtaining the location of wastewater treatment plants (WWTPs) is another crucial challenge as people do not prefer living near them (Huh et al., 2020). Despite the risks related to health, odour, noise, and aesthetic impacts, they are also likely to suffer from economic damage due to the depreciation of land values (Wang & Gong, 2018). In China, a huge deterioration of land values by around 7.5 times led to the promotion of underground WWTPs that are sealed underground to tackle the Not In My Backyard (NIMBY) sentiment (Wang & Gong, 2018). Underground WWTPs help eliminate negative environmental impacts (like noise, odour, and aesthetics), and sometimes people do not even notice their existence which helps to greatly avoid the resistance. However, the cost and complications involved in such processes increase the cost of implementation of WWTPs (Hu et al., 2020). The NIMBY sentiments and public litigations are quite common in India too since people do not trust the waste management services provided by the urban local bodies (CPCB, 2019). CPCB has introduced buffer zones around waste management facilities to protect people from the impacts of pollution/odour/noise and to ensure safe operations of these plants by maintaining their island nature. But there is no scientific basis available for the provision of buffer zones (CPCB, 2019), and buffer zones are limited to solid waste management facilities with no mention of WWTPs. Thus, one of the key lessons to improve the social acceptance is better delivery of services (or meeting standards) along with public participation.

Conventional centralized systems in India for wastewater treatment thus suffer from various challenges and there are planning and monitoring challenges at the institutional level. Multiple institutions working on the same entity-STP without coordination and overlapping roles increases the complexities. The complexities are further enhanced due to the larger spatial spread of catchments of STPs. In addition, with the diverse set of pollutants, regulatory mechanism suffers with the issues related to monitoring as well as in defining and enforcing proper standards with less parameters. Since the standards are set based on the pollution concentration and not with load, in larger catchments (in other words centralized STPs) pollution load gets bypassed taking advantage of large amount of freshwater (if available) from runoff or other inflows.

Centralized systems in India, also suffer from issues of higher upfront and O&M costs, while the demand (or market) for treated water is not developed. Thus, smaller towns and cities find it difficult to manage the wastewater, where decentralized systems help them by cost reductions provided proper demand need to be in place. Also, decentralized systems offer arenas to phased investments, quicker adoption of technology based on the specific needs of urbanizing catchments.

To summarize, centralized treatment systems suffer from issues of land acquisitions (large land requirement), local resistance due NIMBY sentiments and lack of social acceptance related to reuse of treated water. In such occasions, participatory approaches with the inclusion of local people provides a key to improve the delivery of services. For instance, in a decentralized system with less institutional overlaps, stakeholder participation can

help in easy setting up of plants (in addition to less upfront costs), better monitoring of water quality (thereby overcoming the staff shortages) and thus improves overall arena of wastewater treatment and reuse. The scope of such decentralized systems which is high in class 2 cities and small towns is yet to be explored in India.

4. Global innovative, cost-effective and sustainable solutions for UWM

4.1 Decentralized approach for UWM

The management of wastewater systems in developing countries is exacerbated by accelerating urbanization, and inadequate management and disposal of wastewater (Chirisa et al., 2017). Thus, the sanitation arrangements focused on centralized systems are unfeasible for many regions worldwide. Centralized systems collect and treat large wastewater volumes for entire communities and industrial/residential platforms (using large pipes, pumping systems, various access routes, constructions, equipment and treatment facilities) at one treatment establishment. While, decentralized systems individually collect, treat and dispose of, or on-site reuse the treated wastewater at, or near the generation source also allowing for flexibility in management (Sharma et al., 2013). From an ecological and economic perspective, treating wastewater as close as possible to its source is beneficial and without the need to construct extensive and often expensive sewer systems. The utilization of decentralized wastewater treatment systems (DWWTS) has become a focus of interest in places lacking sanitation services. The decentralization level of domestic wastewater treatment has several scales: from individual on-site systems (fully decentralized) to semi-centralized plants treating the effluents of isolated neighbourhoods (Iribarnegaray et al., 2018).

DWWTS can be divided into three types, (i) Natural treatment systems, (ii) Aerobic systems, and (iii) Anaerobic systems. Natural wastewater treatment systems, as part of nature based systems (NBS) can provide economical solutions for wastewater treatment. The simplest system is a pond system, where the algal–bacterial symbiotic relationship is used for wastewater treatment. Other standard systems work with natural media like soil and plants for filtration and biochemical reactions. These systems can be used either as a secondary treatment or as a combination of primary and secondary treatment. Some have also been used for tertiary treatment, such as duckweed pond systems (DPS), WSP, facultative pond, and constructed wetlands (CWs). These technologies are explained further in Section 4.2.

Aerobic treatment methods involve the use of oxygen by microorganisms for the degradation of organics into the simplest degradation products, i.e., carbon dioxide and water. These systems' footprint is small compared to natural systems, but the energy consumption is high. Compared with natural systems, aerobic systems can provide good quality effluents that can easily meet the effluent discharge standards. The most significant advantage of aerobic systems is that they require only semi-skilled personnel, which makes them a good choice of wastewater treatment technology in low-income and developing countries. Some well-documented and full-scale implemented aerobic systems include EA, MBBR, oxidation ditches, membrane bioreactor (MBR), submerged aerobic fixed film (SAFF) reactor, rotating biological contactor (RBC) and SBR.

Anaerobic treatment systems are low energy consuming biological treatment systems. Despite the low organic and nutrient removal capabilities, anaerobic treatment systems are cheap and simple and can be energy providers. However, these systems achieve only poor to moderate effluent quality and take a long time to start up (around 3–4 months), while aerobic systems have a much shorter start-up time (approximately 2–4 weeks). Most anaerobic treatment systems are followed by aerobic systems to meet the discharge standard. Examples of these types of system include UASB, anaerobic baffled reactor and septic tank, but most of the anaerobic systems are practiced with other aerobic/natural processes.

Case studies:

i. In India, 77 Decentralized Wastewater Treatment Systems (DEWATS) were installed until the year 2017 by the Bremen Overseas Research and Development Association (BORDA). The common treatment module is a settler, followed by an anaerobic baffled reactor (ABR) and anaerobic filter (AF). In a DEWATS plant installed by BORDA in Pune with a treatment capacity of 35 m^3/day, the wastewater from different sources is collected in decentralized septic tanks. The effluent from all the septic tanks is collected in a common collection tank near the treatment system, which consists of the settler, baffled reactor, anaerobic filter, planted gravel filter, and collection tank, as shown in Fig. 4.1.1. This plant has been operational since 2005 and serves a population of 300. The sludge of this plant is removed once a year and used as manure after treatment. Treated wastewater is used for gardening. The capital cost of this plant is Rs. 1.9 million, and the annual maintenance cost is Rs. 12,000 (Singh et al., 2019).

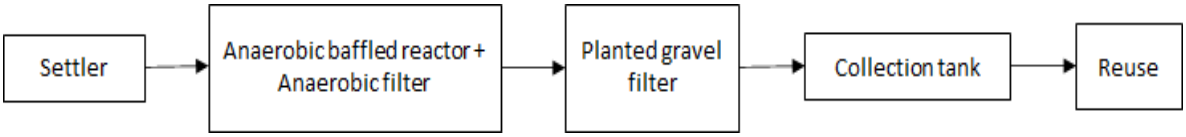


Figure 4.1.1 : Schematic representation of the DEWATS plant of Pune

ii. Soil Biotechnology is a terrestrial system for wastewater treatment that is based on the principle of trickling filters. In this system, a combination of physical processes like sedimentation, infiltration and biochemical processes are carried out to remove the suspended solids, organic and inorganic contents of the wastewater.

iii. A soil biotechnology unit has been operational at Gole Market, New Delhi, since 2017. It is a part of the New Delhi Municipal Council project of building ten decentralized sewage treatment plants across the city on the Public Private Partnership (PPP) model to reduce wastewater discharge into rivers. The system comprises an Inlet Chamber/Grit Chamber through which water enters the plant. Then, water goes into the raw water tank. This tank is further divided into three parts. The first part of the tank is fitted with a honeycomb like screen to filter out solid waste. The second part of the tank has tube settlers installed which help in further water treatment, then final storage of the tank collects water from the last two chambers. Then, water is pumped to the Bio Reactor I, which gets delivered to the plants with the help of sprinklers. Around 60% of treatment gets completed by the time the water flows out of the Bio Reactor I. The bio reactor is made up of different layers of brickbats, aggregates, and cultural catalysts. The water under the influence of gravity percolates through the bio reactor and gets collected in the Collection tank I. A motor then delivers the water to the Bio Reactor II. The Bio Reactor II is identical to the Bio Reactor I and intends to facilitate another filtration cycle. The water from the Bio Reactor II percolates into Collection tank II. The soil biotechnology set-up and site plan at Gole Market, New Delhi, are depicted in Fig. 4.1.2 and Fig 4.1.3. The design capacity of this unit is 200 m^3/day. Its capital cost is Rs. 2 million and annual O&M cost is Rs. 0.2 million (CSE, 2017).

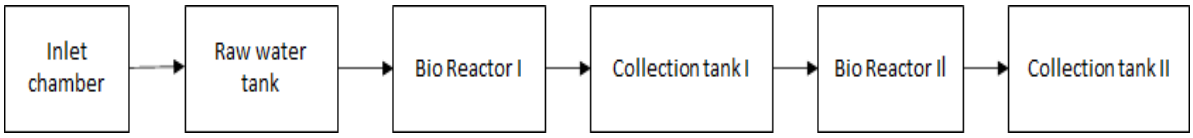


Figure 4.1.2 : Schematic representation of the soil biotechnology unit of Gole Market, New Delhi

Figure 4.1.3: Site location and plan of Soil biotechnology at Gole Market, New Delhi (Source: CSE, 2017)

4.2 Nature-based Solutions

Nature-based solutions (NBS) are defined by IUCN as "*actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" (Cohen-Shacham et al., 2016). They can also be defined as "*living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource-efficient and adaptable manner and to provide simultaneously economic, social, and environmental benefits*" (European Commission, 2015), including in wastewater management, with low inputs of energy and chemicals. More specifically, NBS are techniques that mimic natural processes in urban landscapes that use plants, soil, bacteria, and other natural elements and processes to remove pollutants from wastewater; this reduces chemical use and saves energy. To treat wastewater, these approaches are cost-effective, energy extensive, efficient, low-impact, simple and environmentally friendly. The developing countries can benefit from using these solutions under the decentralized wastewater treatment approach in areas with limited, low capacity or no access to the public sewage system or in water-scarce regions.

Over the last three decades, different NBSs have been implemented, including constructed wetlands, floating wetlands, green roofs, living walls, waste stabilization ponds, high-rate algal ponds, and vermifiltration (Fig. 4.2.1). Research on performance evaluation has been done through experimental tests on pilot scale systems and full-scale applications and simulations.

Figure 4.2.1: Nature-based solutions a) constructed wetlands, b) floating treatment wetlands, c) Green roofs, d) living walls, e) waste stabilization ponds, f) high-rate algal ponds, and g) vermifiltration

4.2.1 Constructed wetlands

Constructed wetlands (CW), also known as reed beds, artificial wetlands, planted soil filters or vegetated submerged beds, were the first nature-based solution adapted for wastewater treatment. CWs are artificially engineered systems designed and constructed to utilize the natural processes suitable to remove the pollutants from contaminated water within a more controlled environment.

The CW system comprises water, plants, growing media (substrate), soils, and microorganisms and utilizes complex processes to decontaminate wastewater. The wetland plants are herbaceous plants with rapid growth, high biomass and strong absorptive abilities. They can be classified according to their capacity to adapt to life in water as emergent, submerged, and floating macrophytes. Usually, CWs are planted with rooted emergent macrophyte species. Most commonly used plant species are cattails (Typha sp.), reeds (Phragmites sp.), bulrushes (Scirpus sp.), sedges (Carex sp.) and several broad-leaved species. CWs are categorized as free water surface (FWS), and subsurface flow (SSF) constructed wetland systems based on the water flow characteristics. In an FWS, the water slowly flows above the substrate medium, thus creating a free water surface and a water column depth of a few centimeters. On the other hand, in SSF systems, water flows inside a porous substrate. Based on the flow direction, the subsurface flow systems are further categorized as horizontal and vertical flow units.

The pollutant removal mechanism of constructed wetland includes physical, chemical and biological processes and is given in Fig. 4.2.2 and Table 4.2.1

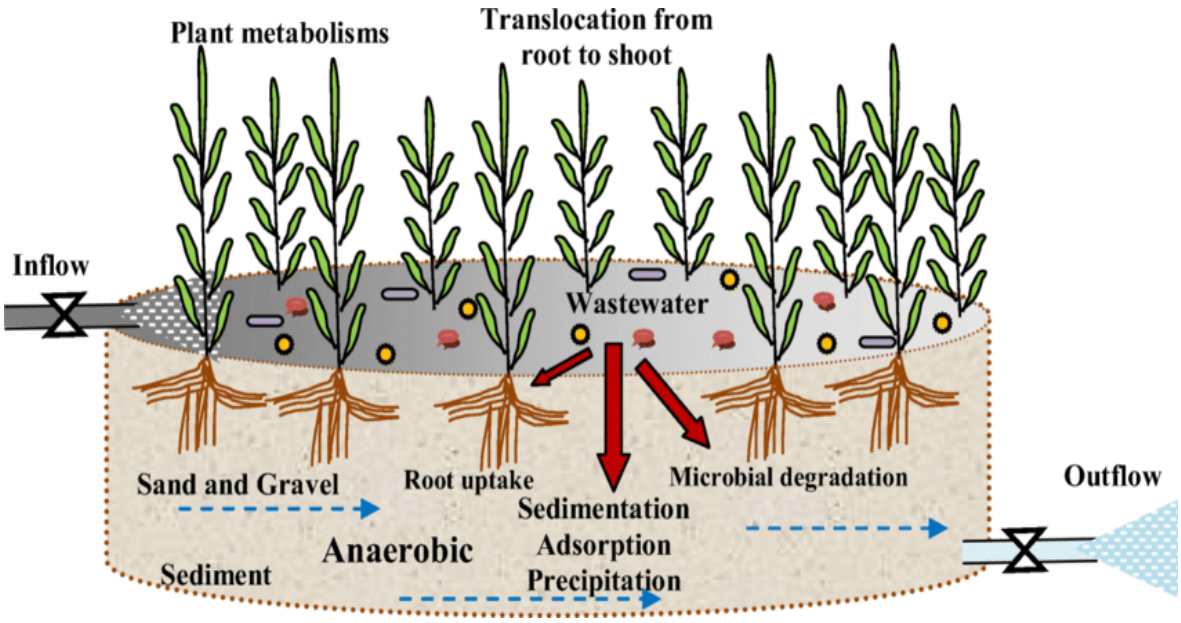


Figure 4.2.2: Pollution removal mechanism for constructed wetlands

Table 4.2.1: Processes for pollutant removal mechanism

Wastewater constituents	Removal Mechanism
Suspended solids	Sedimentation, Filtration
Soluble organics	Aerobic/ anaerobic microbial degradation
Phosphorus	Matrix sorption, Plant uptake
Nitrogen	Ammonification -Nitrification – denitrification, plant uptake, volatilization
Heavy Metals	Adsorption, plant uptake,
Pathogens	Sedimentation, filtration, natural decay, predation, excretion of antibiotics from roots of macrophytes

4.2.2 Floating treatment wetlands

Floating treatment wetlands (FTW) are an in-situ treatment option for the revival of water bodies that frequently receive wastewater. The structure of the FTW is similar to the other traditional wetlands, except that, in FTW, the plants are grown on a free-floating mat, and their roots are extended down to the contaminated water that acts as biological filters (Fig. 4.2.3).

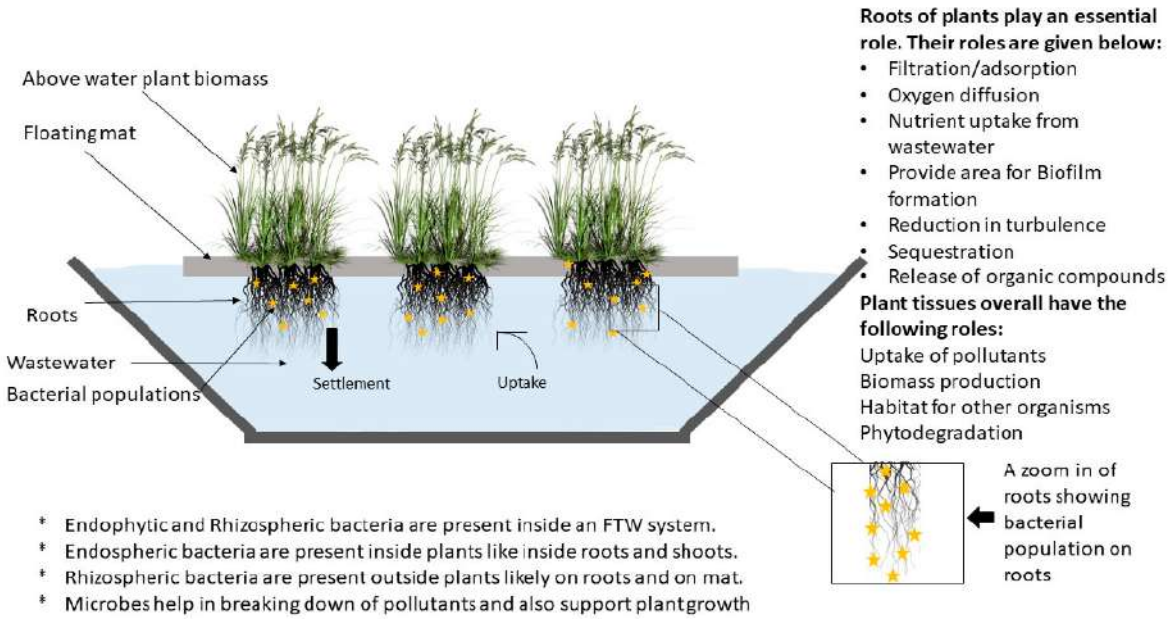


Figure 4.2.3: Schematic diagram of floating treatment wetland (Source: Wei et al., 2020)

The most commonly used floating macrophytes in the FTW are water hyacinth (*Eichhornia crassipes*) and duckweed (*Lemna minor*) for efficient contaminant removal. Though water hyacinth is an invasive plant, it is effectively used as a resource for wastewater management. It propagates and grows very rapidly. It can reproduce itself in 5-15 days under favourable conditions. The roots of water hyacinth participate actively in the treatment of wastewater where uptake of contaminants takes place. Water hyacinth has proven to survive in severe nutrient concentrations and assist in nutrient removal, along with removing faecal coliforms, suspended particles and heavy metals.

Duckweeds are smaller in size and are naturally present in almost all water ecosystems. The family consists of four genera–Lemna, Spirodela, Wolffia and Wolffiella. The growth rate of duckweed is almost three times faster (4 days) than the water hyacinth. Duckweeds contain at least twice as much protein, fat, nitrogen and phosphorus as water hyacinth and are more tolerant to cold. However, due to small size, they cannot form an extensive root mat as water hyacinth thus, limiting their role in treatment. Most of the biological activity is then caused by the microbes and other flora suspended in the water column.

The FTW are designed to maximize the formation of a biofilm. A combination of aerobic, anaerobic, and anoxic conditions occurs beneath the plants. The plant roots aid in achieving increased values of dissolved oxygen, whereas the plants and biofilm contribute to the uptake of nutrients and heavy metals, which also results in BOD and COD reduction.

One of the largest FTW in India has been installed in Neknampur Lake, Hyderabad, to clean the lake and support living species (Fig. 4.2.4). Previously the lake had been receiving untreated sewage from the nearby Alkapur township apartment, and residents of the surrounding area were also dumping waste in it. Dhruvansh, an NGO, along with the Hyderabad Metropolitan Development Authority (HMDA) and district authorities, installed a 3000 sq. ft. raft with 3500 sampling of cleaning agents on FTW such as -*vetivers, cattails, canna, bulrush, citronella, hibiscus, fountain grass, flowering herbs, tulsi and ashwagandha*. The treatment has thereby improved the quality of the lake.

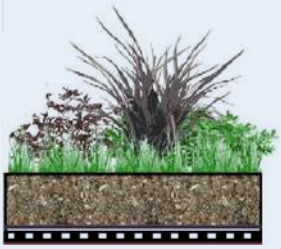
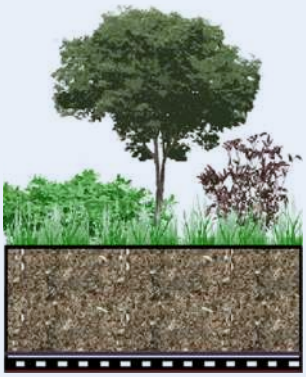
Figure 4.2.4: Floating treatment wetland at Neknampur Lake, Hyderabad

4.2.3 Green roofs and living walls

Green roofs and Living walls represent effective systems for urban reconciliation ecology (Francis & Lorimer, 2011) and are becoming integrated parts of modern architecture in many countries because the land for green infrastructure is very limited. They offer numerous ecological and social benefits to densely populated urban areas, such as improving aesthetics and liveability by cooling buildings and the surroundings, filtering pollutants from the air, managing stormwater, providing space-efficient urban greening and biodiversity conservation. Recently, their application of the use of greywater for irrigation as well as greywater treatment for other non-potable purposes has added another valuable water source to manage water scarcity and quality challenges in water-scarce regions.

Green roofs are a horizontal vegetation system consisting of a vegetation layer in a growing medium (substrate), a geosynthetic filtration layer, a drainage layer and a waterproof protective layer. A wide range of options are available for the type of planting, roof age and size, and growing media type that can be tailored to specific regions, their requirements and the purpose of use. Based on the depth of the growing media layer, green roofs are categorized as extensive, semi-intensive, and intensive green roofs, the characteristics explained in Table 4.2.2.

Table 4.2.2: Categories of green roof systems and their characteristics

Diagrammatic representation of types of green roof			
Types of Green Roof	**Extensive Green Roof**	**Semi-Intensive Green Roof**	**Intensive Green Roof**
Type of plants	Grass, shrubs, sedums, and succulents	Grass, shrubs, sedums, succulents, herbs, flowers, and shrubs	Grass, shrubs, sedums, succulents, herbs, flowers, shrubs and trees
Dry weight	60–150 kg/m^2	120–200 kg/m^2	180–500 kg/m^2
Depth of substrate	2-5 inches deep	5-8 inches deep	>8 inches deep
System type	Tray or layer system	Tray or layer system	Layer system
Purpose	Support biodiversity and provide environmental benefits	Support biodiversity and provide environmental benefits, and aesthetical purposes	Support biodiversity and provide environmental benefits, recreational and aesthetical purpose
Maintenance	Minimal	Occasional	Regular
Initial Cost	Low	Medium	High

Living walls, as an NBS, are vertical greenery systems, where a vertical surface, generally attached to internal or external walls of a building, is covered with plants of uniform growth. Living walls allow extensive and rapid coverage of vertical surfaces, reaching higher areas and adapting all kinds of buildings. As the surface area of the walls of buildings is always greater than the area of the roof, and with high-rise buildings, this can be as big as 20 times the roof area (Pérez et al., 2014), the living walls are a better sustainable solution compared to green roofs for wastewater treatment and recycling in the current modern style high-rise buildings setting.

Living walls involve a supporting structure for which different plant attachment methods are available (Fig. 4.2.5a). Living walls can either use a soil-based or hydroponic system for growing media. The living wall is separated from the building wall by a waterproof membrane that prevents dampness problems. As the system is vertical, the water storage capacity is low, and the only water available to the plants is through the growing media. An irrigation system, generally installed at the structure top, is vital for such systems, ensuring permanent wetness of growing media for plant growth. Generally, the choice of plants to be used for the green walls should be made considering the site location, climatic conditions and purpose of the design. The most commonly used plants for living

walls are climbers. Climbers can be self-supporting, attaching themselves to the vertical surface (e.g. root climbers and adhesive suckers) or be supported by a structure which they can hold (e.g., twinning climbers/creepers or scrambling plants).

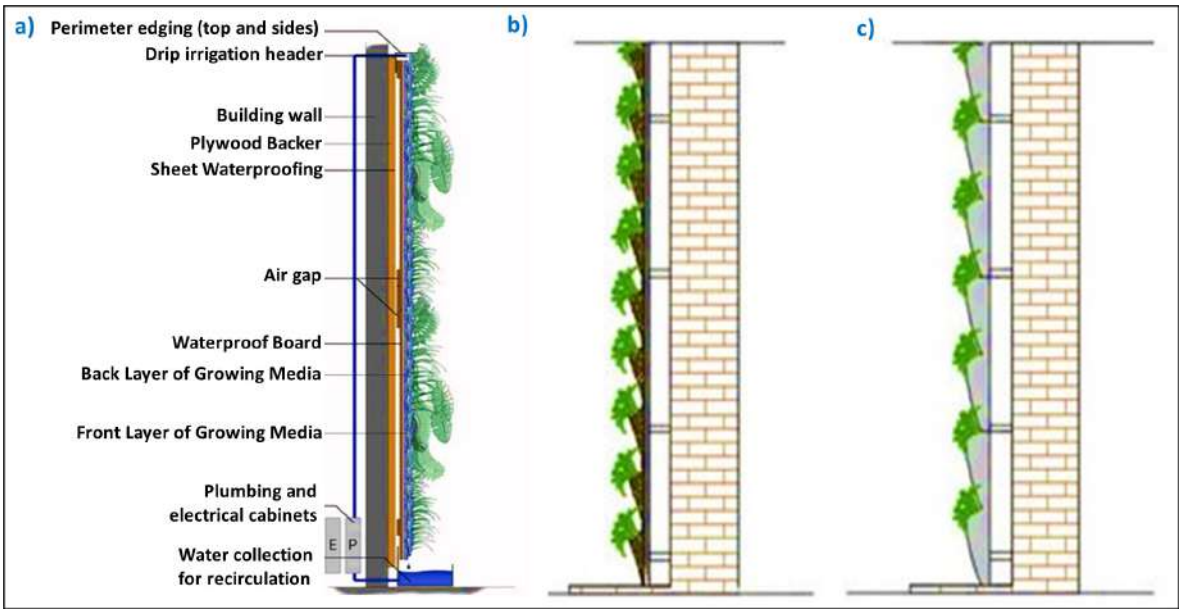


Figure 4.2.5 : Living walls structure and type a) Schematic representation of a living wall b) continuous living wall c) modular living wall

As per their application method, the living walls are classified as:

i. **Continuous living walls** do not have a growing media; instead, the plants are inserted individually in a lightweight permeable screen, supported by a base panel attached to a supporting structure, consisting of a frame that is indirectly fixed to the wall (Fig. 4.2.5b). These systems are commonly based on the hydroponic method, where the screens are constantly moist by the irrigation systems ensuring uniform distribution.

ii. **Modular living walls** have containers carrying substrate inserted into a supporting structure, one above the other (Fig. 4.2.5c). The containers can be trays, vessels, planter tiles, flexible bags or panels. The growing media consists of a mixture of a light substrate with granular material to obtain a good water retention capacity. As per the supporting structure, the irrigation can be provided through either a sprinkler, drip, or holes reaching the containers through tubes or connectors.

Under the Natural Water Systems and Treatment Technologies (NaWaTech) project, green walls are installed at the Maharashtra Jeevan Pradhikaran (MJP) head office in Pune to treat 125-250 litres/day of greywater and recover them for garden irrigation (Fig. 4.2.6). The resulting effluent quality was found suitable for reuse by land irrigation and toilet flushing following Indian regulations.

Figure 4.2.6: Living walls installed at the Maharashtra Jeevan Pradhikaran office, Pune (Source: Masi et al., 2016)

4.2.4 Waste stabilization ponds

Waste stabilization ponds (WSPs) are impoundments into which wastewater flows in and out after a defined retention period. WSPs are more suited for tropical and subtropical climates as sunlight, and ambient temperatures are vital factors in their process performance. Treatment relies solely on the natural processes of biological purification occurring in any natural water body. No external energy other than that derived from sunlight is required for their operation. Compared to other technologies, WSPs appear simple; however, they contain a complex ecological system consisting of algae, bacteria, viruses, fungi, protozoa, rotifers, insects, crustaceans and often chordate animals. Treatment is optimized by selecting appropriate organic loadings, retention periods and pond depths to promote the maximum growth of organisms beneficial to the treatment process.

A WSP system consists of a series of man-made earthen ponds, with each unit achieving the anaerobic, facultative and maturation roles (Fig.4.2.7). An individual pond functions like a complete mix series reactor. A series of ponds function as a series of completely mixed reactors, thereby achieving the benefits of a plug flow reactor. The anaerobic pond (i.e., the initial treatment reactor) is designed to reduce suspended solids and some soluble organic matter. The residual organic matter is further removed through algae and heterotrophic bacteria activity in the facultative pond. The final stage of pathogens and nutrient removal occurs in the maturation pond.

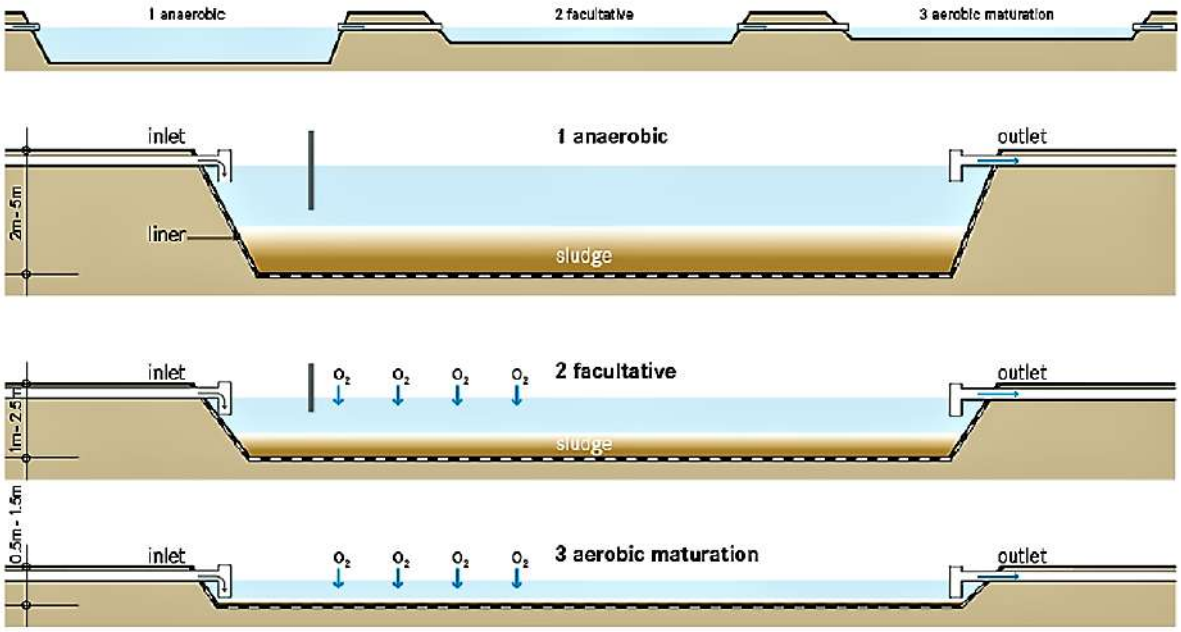
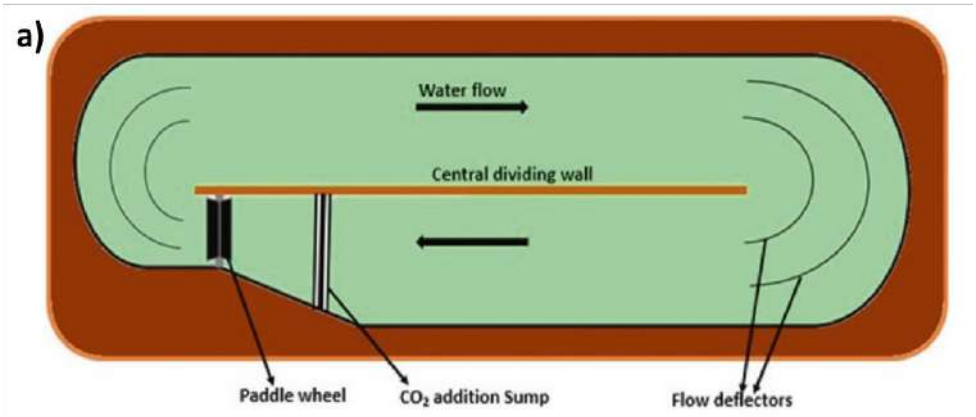


Figure 4.2.7 : Schematic diagram of a waste stabilization system (Source: Tilley et al., 2014)

4.2.5 High rate algal ponds

High-rate algal ponds (HRAP) are shallow, paddlewheel-mixed open raceway ponds used for wastewater treatment using algal species (Fig. 4.2.8) (Ranjan et al., 2019). Mixing in the HRAP is the most prominent factor differentiating it from the WSP. The process of mixing using a paddlewheel is done to achieve a mean horizontal velocity of 0.15 – 0.3 m/s that would assist in avoiding settling of the sludge in the bottom and promote algal circulation culture (Craggs et al., 2014). The HRAP performance is based on a symbiotic relationship between bacteria and microalgae in which the oxygen required for organic matter decomposition by bacteria is provided by the photosynthesis of algae, and the nutrient for algal growth is provided by bacterial decomposition of organic matter. The algal biomass generated during the wastewater treatment can be harvested for biofuel production.



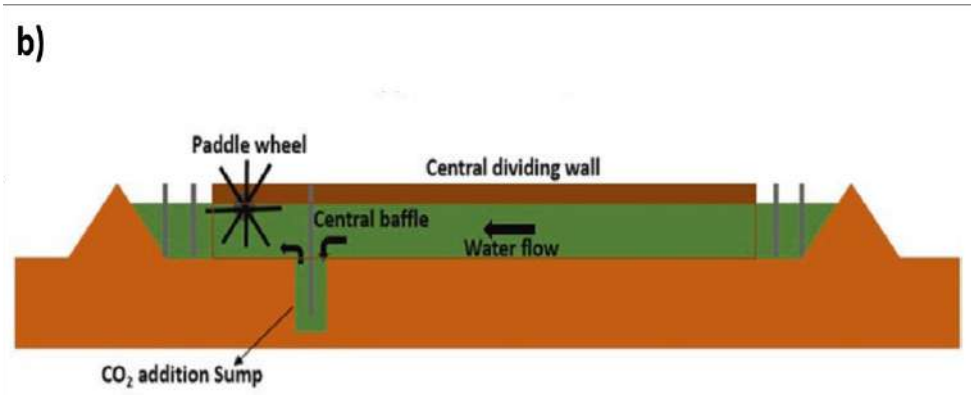


Figure 4.2.8: Schematic diagram of high rate algal ponds a) Paddle wheel in HRAP b) Side elevation view of HRAP (Source: Ranjan et al., 2019)

Comparing the two technologies–WSP and HRAP, it is observed that HRAP can treat the same volume of wastewater to the same level of nutrient and pathogen removal level as WSP, using just 40% of the area (El Hamouri et al., 2003). Cost-wise also, the HRAP are cheaper solution than WSP. The constant mixing in HRAP leads to more algal growth, enhancing pathogen die-off and nutrient removal and provides a more consistent treated water output than WSP.

4.2.6 Vermifiltration

Vermifiltration, a newly conceived technology, is a process of joint action of earthworms and microbes to treat wastewater. The vermifiltration system has two major components: vermibed and earthworms (Fig. 4.2.9). The vermibed made of porous material helps in screening wastewater and trapping solids. They provide a food source to the earthworms, which helps in the growth and reproduction of microbes due to the ingestion activities of earthworms. The most widely used earthworm for vermifiltration systems is Eisenia fetida, also known as the tiger worm or red worm. The species is known to utilize fresh human faeces with high moisture conditions and remove hazardous pathogens efficiently.

Both earthworms and microbes remove BOD, COD, TDS and TSS from wastewater through ingestion, biodegradation, and absorption via the body walls. Earthworms also secrete slimy fluids called 'mucus' from their body, which hosts several enzymes that help in the mineralization of pollutants present in wastewater. Besides, the movement of the earthworms in the filter bed improves oxygen penetration, creates favourable conditions for the aerobic activity of microorganisms and prevents the formation of doors and sludge.

The treatment systems like vermifilters fulfil multiple requirements, like simple design, application of non-sophisticated equipment, higher treatment potential, lesser production of sludge, and comparatively lower operating and capital costs. Vermifiltration is an odour-free process, and the resulting vermifiltered water is clean enough to be reused in parks and gardens and for farm irrigation.

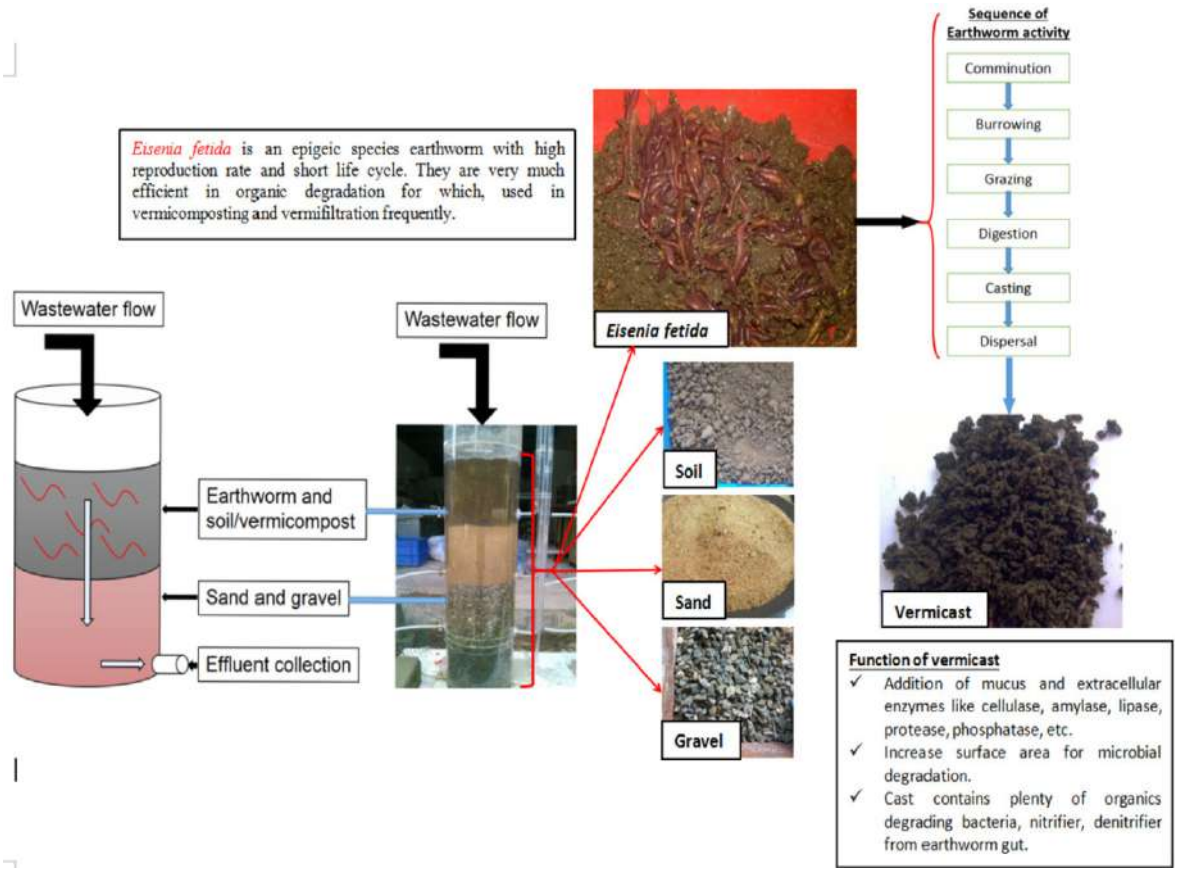


Figure 4.2.9: Schematic diagram of vermifilter (Source: Singh et al., 2019)

Under the toilet to tap project "*Sujala Dhara*" by Delhi Jal Board, Absolute Water company installed an 80 KLD capacity biofilter system at the Keshopur Sewage Treatment Plant, Delhi, in 2015 (Fig. 4.2.10). The plant treats 4000 litres per hour of sewage and converts it to drinking water quality, meeting the WHO and BIS standards, using vermifiltration and nanomembrane technology. The vermifilter can treat 85% of the sewage at the facility. After vermifiltration, treated sewage goes through a feeding tank and finally through membrane treatment and thus producing water fit for drinking.

Figure 4.2.10 : Biofilter treatment facility at Keshopur sewage treatment plant, Delhi

4.3 Innovative applications for wastewater treatment and reuse

4.3.1 Internet of Things (IoT) based applications

Traditional water quality monitoring (WQM) methods for an STP involve the manual collection of water samples at different locations, followed by laboratory analytical

techniques to characterize the water quality. These methodologies analyse physical, chemical, and biological agents. However, limited spatiotemporal coverage, labour-intensive, high cost (labour, operation, and equipment), and lack of near-real-time water quality information to enable critical decisions for public health and environment protection limit their application (Katsriku et al., 2015, Vijayakumar & Ramya, 2015). Therefore, there is a need for WQM systems that enable the reliable performance of STPs through effective data management and online near real-time monitoring capability.

The application of IoTs can aid to monitor various types of sewage treatment equipment, the city's sewage treatment nodes, production, and sewage in the running state. Online control of pipe valves by IoT can also solve the shortcomings in the existing sewage treatment model. Establishing the wastewater treatment system based on the IoT can achieve real-time control of treatment production of all kinds of resources by pre-set configurations (Su et al., 2020). It can further enhance the crisis response speed, standardized management, energy saving, and economic efficiency.

In recent years, the vision of the IoT, augmented with advances in software technologies, such as service-oriented architecture, software as a service, cloud computing, and others, has stimulated the development of smart water quality monitoring systems (SWQMSs) (Dong et al., 2015, Geetha & Gouthami, 2016). SWQMS is a new generation of systems architecture (hardware, software, network technologies, and managed services) that provides near-real-time awareness based on inputs from machines, people, video streams, maps, news feeds, sensors, and more. It integrates people, processes, and knowledge to enable collective awareness and decision-making where IoT devices can offer more advanced access to their functionality (Zhou, 2012). As such, event-based information can be acquired and processed on-device and in-network. This capability provides new ground for approaches that can be more dynamic and highly sophisticated, taking advantage of the available context.

Solinas, a deep tech start-up, are leveraging the use of robotics and artificial intelligence to develop solutions for the pipeline and sanitation industry. Their product *"ENDOBOT"* has been designed for internal condition assessment and defect detection in pipelines to identify and analyse leaks, corrosion, sediments, and dents in critical pipeline infrastructure, using Non-Destructive Testing (NDT) techniques. Another product , "*HOMOSEP*", is the first-ever septic tank cleaning robot in India that has replaced manual scavenging and cleaning of septic tanks

Wireless Sensor Networks (WSNs) have proven to be a very effective technology for numerous environmental monitoring applications. WSNs currently enable the automatic monitoring of air pollution (Yi et al., 2015), noise pollution (Noriega-Linares & Navarro, 2016), forest fires (Jadhav & Deshmukh, 2012), climatological conditions (Keshtgari & Deljoo, 2012), and much more over broad areas, something previously impossible. The use of WSNs for WQM is particularly appealing due to the low cost of the sensor nodes. These simple and low-cost networks allow monitoring of processes remotely, in near-real-time, and with minimal human intervention. Applying WSNs to WQM has opened up a new avenue of research toward developing decentralized SWQMSs that evolve with the changing wastewater infrastructure to meet the water requirements of smart cities (König et al., 2015). The advent of WSNs allows the replacement of traditional WQM methods or the expansion of existing wired SWQMS. Many studies have documented the use of such technologies, and it aids to discuss one.

Case study: The study by Martínez et al. (2020) presents the integration of a WSN in a wastewater treatment plant scenario of a low-cost water quality monitoring device in the close-to-market stage. This device consists of a nitrate and nitrite analyser based on the ion chromatography detection method. The analytical device is integrated using an IoT software platform and tested under real conditions in a wastewater treatment plant scenario. A decentralized SWQMS conceived and developed for wastewater quality

monitoring, and management is accomplished by doing so. This investigation is part of an ongoing research project called LIFE EcoSens Aquamonitrix, which aims to validate and optimize this solution to achieve a low-cost, fully automated in situ analyser for environmental water monitoring to be launched in the market after the project. The core of the analytical device is a portable ion chromatography system based on the method previously reported by Murray et al. (2019). This system employs a novel design of an ultraviolet light-emitting diode-based optical detector, enabling cost-effective direct in situ detection of nitrite and nitrate in natural waters.

Five different processes are involved in the operation of the SWQMS: system initialization, capture and storage of information, information modelling, data analytics and visualization, and management of information. In the EcoSens Aquamonitrix System (Fig. 4.3.1), the information collected from the sensors is decoded, pre-processed, and modelled for processing, analysis, and knowledge extraction.

This knowledge supports decision-making by government agencies responsible for environmental protection and wastewater plant operators. The achieved behaviour is possible thanks to the orchestration of the IoT services provided by the IoT platform, which allows the resources associated with the IoT devices to be searchable, accessible, and usable, thus maximizing their interaction with the user interface.

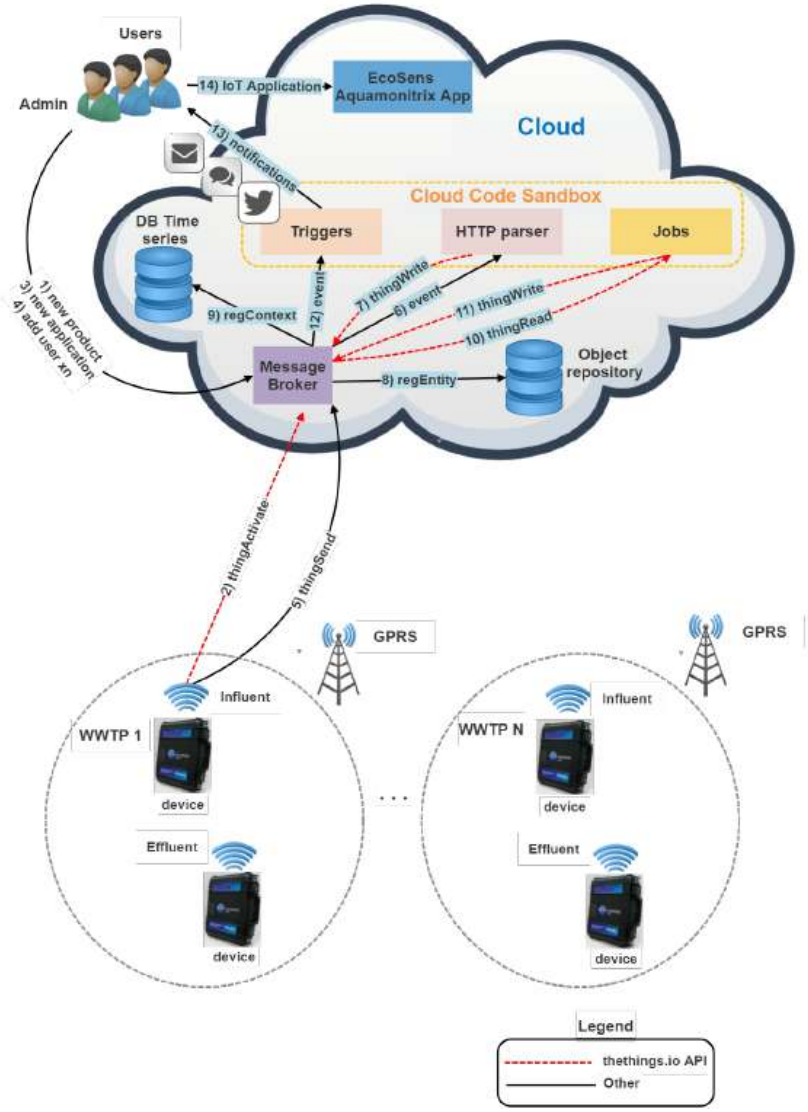


Figure 4.3.1: EcoSens Aquamonitrix Smart Wastewater Quality Monitoring System (Source: Martínez et al., 2020)

The first experiment demonstrated the features implemented at the IoT application level. To do this, eight devices have been deployed in four WWTP located in the Region of Murcia(Spain): Alcantarilla, Molina de Segura, Los Alcázares, and San Pedro del Pinatar. A device has been placed at the influent and effluent of each plant (Fig. 4.3.2). During the test, devices collected data on nitrate and nitrite concentrations during May 2019, twice a day, regardless of their location. This sampling frequency is appropriate for water quality monitoring applications, hence the term near-real-time. The data transmitted by the devices are captured, stored, analysed, and finally represented through the user interface employing different customizations that compose the IoT application hosted in the system platform.

Figure 4.3.2: Device deployment in Alcantarilla wastewater treatment plant (WWTP) (Source: Martínez et al., 2020)

The results from this experiment show that the implemented system provides features for online and near-real-time monitoring and management of wastewater quality parameters. The system architecture is extensible to include other features. Moreover, the scalability of the IoT ecosystem enables an increase in both the number of sensor nodes and storage and processing resources of the IoT platform. Regarding the preliminary validation of the device, the developed method was used to determine the nitrite and nitrate content in STP effluent. The advanced features of the developed IoT integrated system will enable massive sensor deployments in smart city water distribution systems, allowing end users to detect pollution events and adverse trends in near real-time. Thus, the private or public entities in charge of water quality monitoring and management will be able to act more efficiently and effectively to tackle the problems detected (i.e., pollution sources), reacting to the issues more quickly and minimizing the negative environmental impact.

4.3.2 GIS-based approach

Problems related to domestic wastewater management are difficult to monitor and manage due to a lack of quality observation data. Especially in developing countries like India, observation infrastructure is comparatively weak. In the lack of vital widespread information, the regional scale studies fail to provide dependable results. Remote

sensing and GIS-based (RS and GIS) approaches to minimize this data gap and support capturing, handing, and transmitting required information in a prompt manner. In addition, they help to acquire information at a fairly low cost compared to conventional techniques (Singh, 2019).

GIS-based approaches are widely used for various purposes in wastewater management including site selection for the construction of STPs, identification of hotspots of pollution, and site selection for treated wastewater irrigation. Various datasets needed for such analysis include topography, land use land cover data, information on geology, distance from major waterbodies and environmentally protected areas, climatic data, and required effluent wastewater characteristics. GIS is used to create and analyse several grids of different themes and finally in highlighting the areas of interest (or the areas which may satisfy the relevant criteria). The sizing and performance methods in GIS aid to compute the area requirement in terms of effluent discharge criteria (or effluent standard) as a function of climatic and demographic factors. The combination of these two methodologies at the study area level makes a simple check regarding the suitability of natural treatment systems and area requirements (Li et al., 2017). On similar grounds, Jassima and Abbasi (2019) conducted a study for the site selection of a wastewater treatment plant in Al Kufa city, Iraq using RS and GIS techniques. Parameters such as residential areas, sewage areas, roads, surface water bodies, green areas, slopes, and land use are considered as part of site selection. In the GIS-based method buffer zones for each parameter (e.g. minimum distance between an STP and a water body) can be added to the analysis based on the regulatory standards of locations. In addition, Analytic Hierarchy Process (AHP) (a multi-criteria decision-making model that employs weighting criteria and helps to build an evaluation model) was used to apply weights to each criterion to get the best result for finding the ideal site for construction. The weights were applied in a linear summation equation for making a unified weight map, which consists of the due weight of each input variable. In the final step, all weighted maps were reclassified in order to obtain the most ideal location for the construction of STPs.

The advantages of RS and GIS techniques can be further expanded to analyse the suitability of treated wastewater for different purposes. Irrigation water availability, distance from the treatment plant, and suitability of farmlands for crop cultivation are considered as the techno-economic sub-criteria while, quality of irrigation, water, soil, crop, and aquifer vulnerability is considered as the environmental sub-criteria in the decision-making process. The limiting factors of wastewater reuse are considered to be topography, land use, soil depth, and technically allowable distance for irrigation, and access to such data is often limited. Remote Sensing based maps following the criteria are prepared in a GIS environment and using the Analytic hierarchy process (AHP), which is a structured approach employing data based on pairwise data comparison. When integrated with GIS, it offers a powerful spatial decision support system in various fields including wastewater management. A detailed flow chart of site selection using the GIS-AHP model is given in Fig. 4.3.3. Weights are allocated for different parameters and final classification (on the suitability of land) is conducted. In addition to the suitability analysis, the model is capable of doing sensitivity analysis of different important parameters such as aquifer vulnerability, and microbial contamination (Zolfaghary et al., 2021).

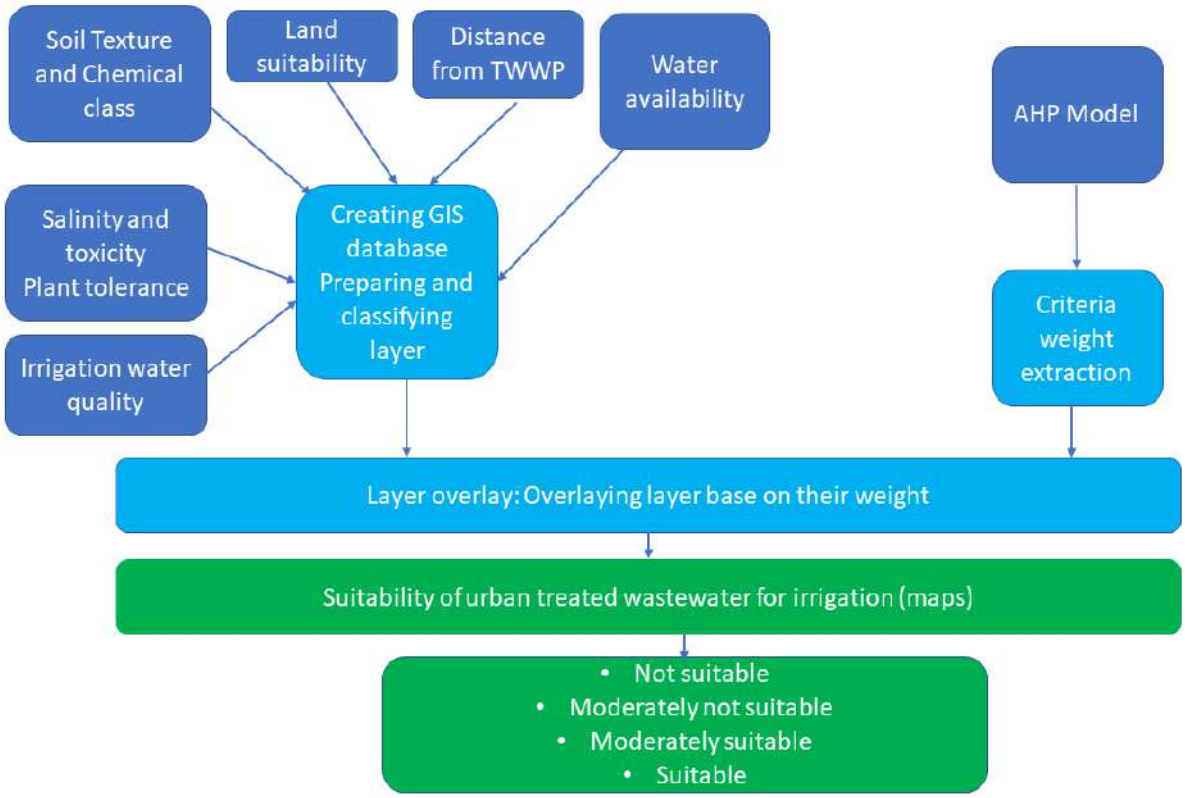


Figure 4.3.3: Methodological flow chart for site suitability analysis using multiple criteria decision making (MCDM) and Geographic Information System (GIS) (Source: Zolfaghary et al., 2021)

Table 4.3.1 shows a list of GIS-AHP techniques used around the world as a spatial decision support system for site selection for irrigation and evaluation of the quality of treated wastewater for irrigation. In developing countries like India, where observation infrastructure and data availability are comparatively weak GIS-AHP techniques can play an important role in wastewater management including reuse.

Table 4.3.1: List of selected works for spatial decision-making on wastewater management

Authors	Year	Method	Description
Anane, Bouziri, Limam, & Jellali (Anane et al., 2012)	2012	Fuzzy Analytical Hierarchy Process (FAHP)-GIS	The rank of suitable areas for treated wastewater irrigation Criteria: Land Suitability Resource Interactions Cost-Effectiveness Social Acceptance Environmental Impacts
Neji and Turki (Neji & Turki, 2015)	2014	Data analysis using a multicriteria decision technique (compromise programming)	GIS-based ranking of desirable areas for wastewater irrigation

Authors	Year	Method	Description
Bozdağ (Bozdağ, 2015)	2014	GIS-Analytical Hierarchy Process (AHP)	Evaluation of quality of irrigation water Based on: Water salinity Soil Permeability Toxicity Crops
Paul, Negahban-Azar, Shirmohammadi& Montas (Paul et al., 2020)	2020	Fuzzy Analytical Hierarchy Process (FAHP)-GIS	Evaluation wastewater irrigation Criteria: Agricultural Land (crop type) Climatic Conditions Irrigation Status Distance to wastewater treatment plants

4.3.3 Upgradation of traditional septic tanks

For the proper functioning of a septic tank, its location is essential. Sites with low porosity soil, high groundwater levels, or proximity to surface water bodies are not suitable for septic tank construction as they may lead to groundwater and surface water contamination by nitrogen, phosphorus, and pathogens. Also, the septic tank's effluent may outflow to nearby soil, groundwater, or surface water. Thus, the pollution problems caused by the poor performance of the septic tanks require new techniques to improve the blackwater treatment efficiencies. These septic tanks are often poorly constructed and tend to leak and overflow in the open environment creating unhygienic conditions and spreading diseases. The size of tanks is often oversized to avoid frequent emptying. Operation and management of soaking arrangements are seldom done. Practical steps should be taken to ensure that these septic tanks (containment systems) do not pollute the environment.

The variant of the conventional septic tank with Anaerobic Baffled Reactor (ABR) provides increased settling and sludge contact (Fig. 4.3.4). In this system, an increased number of chambers and a forced liquid flow through the accumulated sludge results in an enhanced reduction of organics and solids compared to a conventional septic tank.

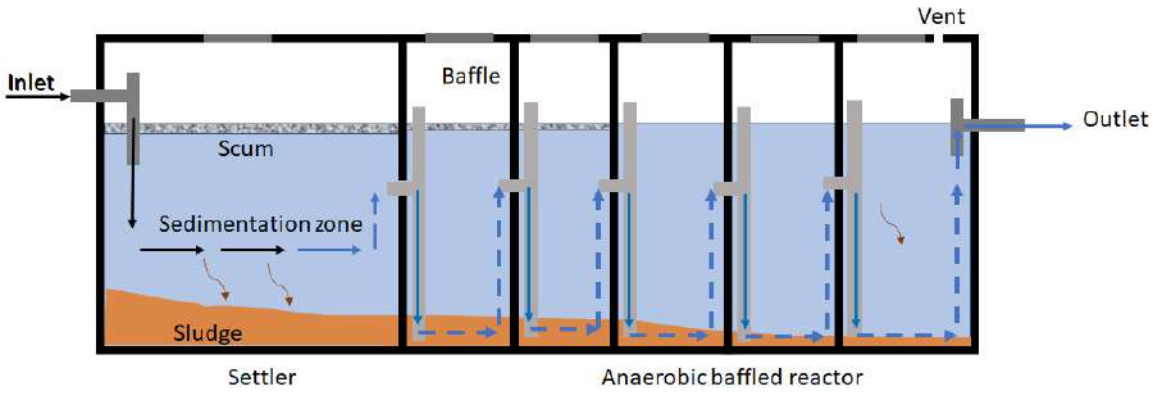


Figure 4.3.4. Anaerobic Baffled Reactor septic tank showing location of baffles and three distinct layers (scum (oil, fats, and grease), clarified water, and sludge (Source: Tilley et al., 2014)

The modified septic tank-anaerobic filter unit depicted in Fig. 4.3.5 is an example of another design to enhance effluent quality. An anaerobic filter is a further adaptation that incorporates a filter media (e.g., crushed rock or manufactured plastic) into a final chamber. After the first chamber, the wastewater is forced to flow through the filter as a final polishing step. Modified septic systems can contain other coupled mechanisms like anaerobic digestion and disinfecting chambers. Some modifications include a vertical baffled septic tank containing a filter and a disinfection chamber (Anil & Neera, 2016).

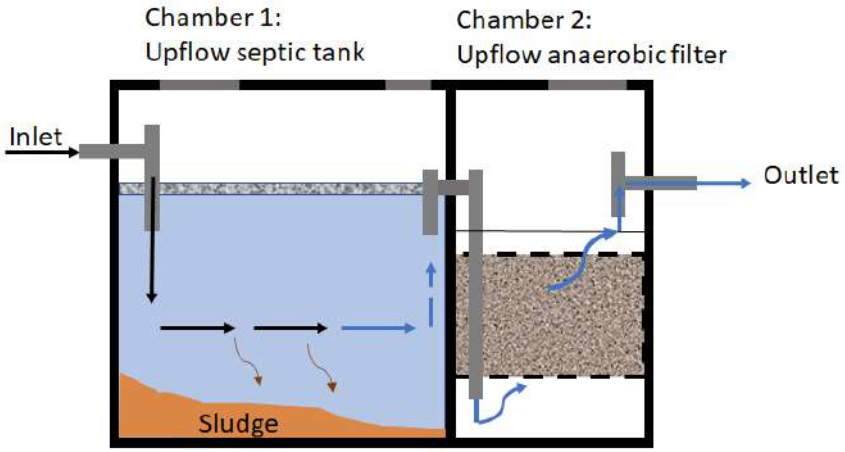


Figure 4.3.5: Modified septic tank-anaerobic filter unit as a two-stage on-site domestic wastewater treatment system

Along with technological advancement, on-site sewage treatment can be improved with management upgradation as mentioned below:

- Periodic audit of toilet facilities: To ensure proper containment and reduce pollution, ULBs need to identify the type of on-site sanitation systems. If they have septic tanks, whether these are connected to soak pits or not.
- Standardization of containment construction: Often, due to a lack of awareness, monitoring, and enforcement, people tend to build oversized tanks to avoid frequent emptying. ULBs must strictly enforce BIS standards of containment system in new/ reconstructed dwellings as part of the building plan approval process. The ULBs can also empanel and train masons to construct toilets, including containment systems according to BIS standards. ULBs can also educate people about their existing septic tanks and soak pits and encourage them to refurbish the same following BIS standards.
- In the case where no sewerage system exists and there is no space for soaking arrangements, overflow effluent from the septic tank may be collected in well-lined roadside drains as an interim measure. Efforts should be made to convey this effluent to a suitable place for off-site treatment through a decentralized wastewater treatment plant using the interception and diversion of these drains.
- Soak pits should be appropriately designed and maintained. ULBs should also highlight the necessity of converting all toilets into improved facilities.

4.4 Reuse of treated wastewater

The gap between sewage generation and treatment- reuse is huge and ever-increasing in the case of India.. The treatment capacity to the secondary level is only 37% of the generated sewage and out of which 40% of the capacity is not fully operational. The remaining sewage which is uncollected or untreated is released into water bodies and neighbouring lands (CPCB, 2022). Such practices lead to contamination of natural

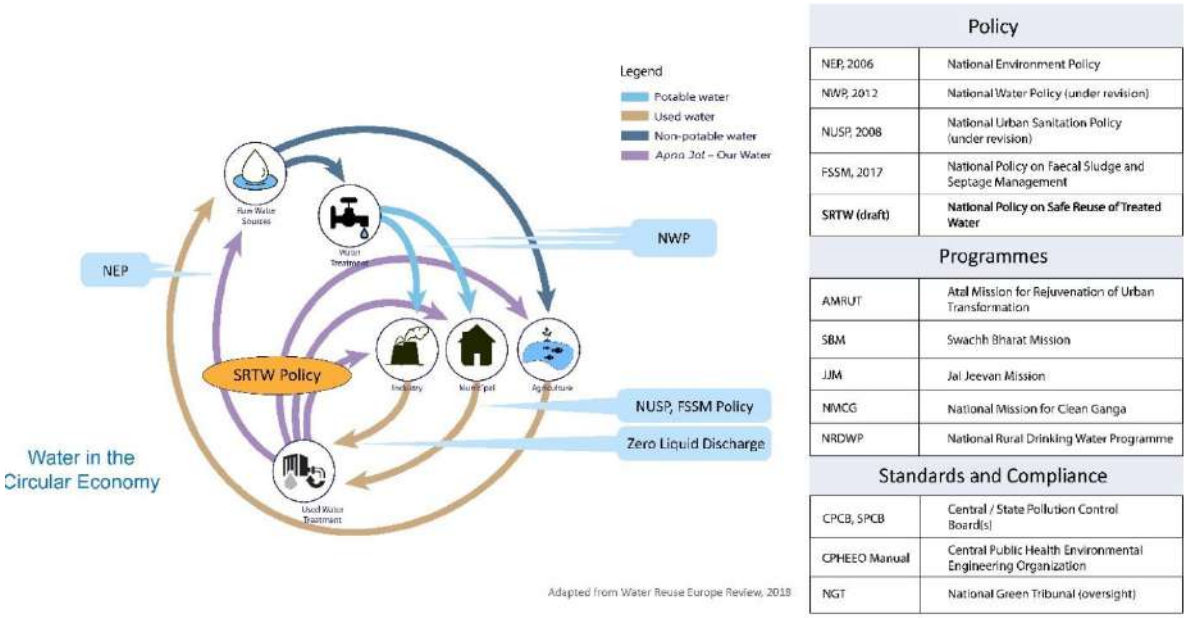
resources like soil and water and raise public health concerns and become a threat to freshwater systems, especially when the dilution levels are not adequate. Hence, the figures imply that there is a lacuna in the current scenario and in other words, potential for improving the current situation with proper methods. In addition, it is important to understand and create demand for reused water in order to develop the sector for utilization of scarce water resources in an optimal way.

Wastewater is a highly potential source of water for various purposes and is highly underutilized. If the country can utilize 80% of its untreated wastewater from 110 of its most populous cities, then 75% of the projected industrial water demand can be met by 2025. Usage of sludge from treated wastewater can be served to three million hectares of land annually, supplying essential nutrients for plant growth, while reducing the dependency on fertilizers by 40% (Nikore & Mittal, 2021).

Safe Reuse of Treated Wastewater (SRTW) over untreated water is much beneficial. Firstly, on the water quality front, it curbs the issue of soil degradation and groundwater contamination. Secondly, it reduces the human health hazards while dealing with contaminated water and consuming the food items grown from untreated water. Thirdly, it could replace or supplement the groundwater or surface water (or freshwater) irrigation and helps to curb alarming issues such as the over-extraction of groundwater. However, the market for SRTW is not developed even in cities falling under water-scarce regions, despite the fact that treated water is available at a cheap rate or no cost. At most, the treated wastewater is used in urban and peri-urban areas for watering trees and gardens in the urban settlements and partially for irrigation. The challenges can be attributed to the insufficient infrastructure for treatment (to the required level) and transportation of the treated water to areas in demand, possibly energy-intensive, depending upon the terrain. Also, people reject those plans due to concerns about hygiene, psychological aversion, and lack of trust in the public agency concerning water quality standards (Kakwani & Kalbar, 2020; Villarín & Merel, 2020). Therefore, considering the importance of the use of treated water for different purposes, the recent draft of the National Framework on the Safe Reuse of Treated Wastewater-2020 envisions the following:

"Widespread and safe reuse of treated used water in India reduces the pressure on scarce freshwater resources reduces pollution of the environment and risks to public health and achieves economic benefits by adopting a sustainable circular economy approach."

The scope of the policy covers the non-potable reuse of used water, by integrating with existing schemes and policies related to sanitation, re-use of industrial used water, faecal sludge management within a broader umbrella of river basin planning, and actions to address the concerns of climate change. Fig. 4.4.1 depicts the Safe Reuse of Treated Wastewater (SRTW) in relation to related policies and programs in the water cycle in India. As indicated in the figure, it needs to be well connected to various policies concerning water, sanitation, urban development, and the environment while adhering to the standards of various regulatory bodies such as the National Green Tribunal (NGT) and Central Pollution Control Board (CPCB). The distinct functions include non-potable reuse adhering to national standards, incentives (including funding) for uptake of the programs, and preparation of a model policy framework, with the enhancement of existing instruments for policy, regulation, and implementation. In addition, the policy also aims to guide the preparation of successful business models, while providing a better environment for innovation in technologies and institutional arrangements (MoJS, 2020)



Policy	
NEP, 2006	National Environment Policy
NWP, 2012	National Water Policy (under revision)
NUSP, 2008	National Urban Sanitation Policy (under revision)
FSSM, 2017	National Policy on Faecal Sludge and Septage Management
SRTW (draft)	National Policy on Safe Reuse of Treated Water
Programmes	
AMRUT	Atal Mission for Rejuvenation of Urban Transformation
SBM	Swachh Bharat Mission
JJM	Jal Jeevan Mission
NMCG	National Mission for Clean Ganga
NRDWP	National Rural Drinking Water Programme
Standards and Compliance	
CPCB, SPCB	Central / State Pollution Control Board(s)
CPHEEO Manual	Central Public Health Environmental Engineering Organization
NGT	National Green Tribunal (oversight)

Figure 4.4.1. SRTW Framework in relation to related policies and programs in the water cycle (MoJS, 2020)

As depicted in Fig. 4.4.1, the potential areas of reuse of treated water include industries, agriculture, municipal uses (such as toilet flushing, maintenance of public avenues and parks, and fire-fighting, environmental flows, aquifer recharge, construction, vehicle exterior washing, non-contact impounds, public amenities, golf courses, toilets, parks, and gardens in the divider of highways and other important roads). CPCB also recommends the use of treated wastewater for uses in the industrial zones, so that shall treat it further based on the requirement of the industry or plants (CPCB, 2021a). Considering the heterogeneity of uses, the level of treatment (secondary or tertiary) needs to be assessed using a feasibility study.

Other applications of treated wastewater include growing forest tree species and tree cover in urban areas for fuel and timer. This avoids the health hazards caused by sewage-fed agriculture. Also, the deep root systems of such plantations cause the interception of contaminants and improve the economic outcomes with the help of fuelwood production. Establishment of green belts with tree plantations around the cities in order to revive the ecological balance and improvement of environmental quality. It also facilitates the year-round utilization of wastewater. Similarly, treated wastewater can be used for floriculture and other commercial non-food crops (Minhas et al., 2022).

In the direction to achieve SRTW, AgroMorph Technosolutions Private Limited, a DPIIT recognised start-up and the winners of the 2021 AIM-ICDK Water challenge (Atal Innovation Mission – Innovation Centre of Denmark), are using algal technologies to improve the effluent quality, enabling on-site water recycling and rejuvenating water bodies impacted by sewage dumping.

4.5 Approaches for promotion and adoption of sustainable UWM solutions

The previous sections highlighted on increased application of cost-efficient, sustainable, multi-purpose and flexible solutions as a more promising approach to increase cities' resilience and sustainability than traditional grey solutions and, hence, able to effectively address urbanization pressures and water and wastewater challenges. It is to be noted that the adoption and scaling up of these solutions can be achieved by involving private investors, community/end user participation and having defined regulatory mechanisms.

4.5.1 Public private partnerships

Public Private Partnerships (PPP) or P3 are schemes in which a government service or private business venture is funded and operated through a partnership of the government and one or more private sector companies. PPP aims to increase fund flow and efficiency and to improve the quality of service delivery by leveraging the expertise of the private sector and raising the level of satisfaction among users.

PPPs have been common in the urban utility sector, except in the area of water, which is still governed by the state in most cases. Currently, STP projects are put to tender on Engineering Procurement and Construction (EPC) basis and have a limited role for the EPC contractor in the Operation and Maintenance (O&M) of assets. In many instances, the created assets are of relatively poor quality, inadequately maintained and do not comply with the required effluent treatment norms stipulated by the Pollution Control Boards. In order to ensure optimum utilization of funds deployed and proper creation and maintenance of assets, it is desirable to explore the option of PPP contracts wherein the long-term commitment of the private sector participants would be ensured due to the continued deployment of their funds.

Sewerage and sanitation services need huge capital investment, high cost for operation and maintenance of facilities and considerable human resources; this service is becoming increasingly expensive. Besides, the efficiency of the labour force employed in the Urban local bodies (ULB) is far from satisfactory. The high wage structure and inefficiency of the workforce result in a steep rise in the cost of service, yet the people at large are not satisfied with the level of service provided by the ULBs. Therefore, the local bodies must seriously consider private-sector participation in sewerage and sanitation services. With the state and central governments' past challenges in reach and funding, the reliance has been on adopting a collaborative model (Fig. 4.5.1).

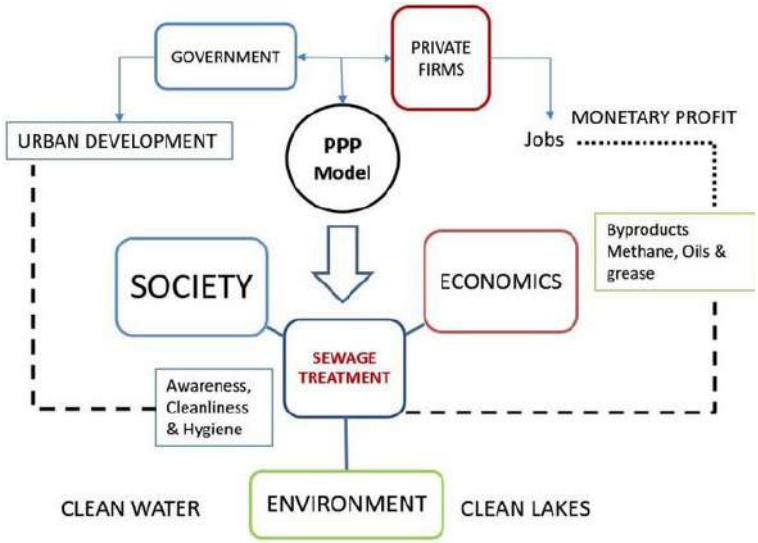


Figure 4.5.1: Public-Private Partnership (PPP) model for the sewage treatment business model (Source: Ashok et al., 2018)

Alandur in Tamil Nadu was the first ULB to attempt a PPP project in this sector. Between 2000 and 2005, about six projects were attempted on a PPP basis, including Alandur, Tirupur and four projects in Chennai. In the period between 2006-2011, the number of PPP projects increased significantly because of the availability of grant funding from the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and National River Conservation Directorate (NRCD) and the overarching policy thrust on PPPs in the infrastructure sector at the national level which percolated down to the states as well.

The Government of India is committed to improving the level and the quality of economic and social infrastructure services across the country. In pursuance of this goal, the Government envisages a substantive role for PPP as a means for harnessing private sector investment and operational efficiencies in the provision of public assets and services. The promotion of PPP has some advantages as highlighted in Fig. 4.5.2.

Figure 4.5.2: Key benefits of Public Private Partnership (PPP) model

In order to introduce PPP into the wastewater management sector in India, it is vital to look into the fundamentals concerns to increase private sector investments –

- Firstly, increasing water tariffs to a level to ensure that the sewerage system generates sufficient revenues to meet fixed and variable costs.
- Secondly, intergovernmental support, alignment, and oversight are essential for PPP development and managing political, regulatory, and financial risks.
- Thirdly, a credible discretionary regulatory mechanism must be implemented for PPP sustainability.

Recently, another P has been added to the PPP framework, i.e., People, and is now described as Public, Private, People Partnership and the new concept of PPPP or P4, is being applied. PPPP is a people (end-users) oriented approach where all stakeholders, including government, donor agencies, private sector and civil society, work together. It includes the end-user's perspective/role on PPP models. People are actively involved in investments and infrastructure development, aiming to increase a sense of ownership and enhance the sustainability of services.

4.5.2 Community participation

Most wastewater treatment interventions in India follow the top-down approach where the end-user communities neither have a role nor say in the type of service they want and what they are willing to pay for the same. As discussed in section 3.4, institutional framework governing the wastewater sector, the highly fragmented nature of the institutional structures has led to low levels of coordination amongst various agencies and limited citizen involvement in the planning, designing and managing of sewerage services. In order to have successful employment of appropriate technologies deep

understanding of the social dynamics of the community is required. This is only achieved through effective public involvement and community participation. Public involvement is best achieved through the participation and involvement of users in all parts of the project cycle, from planning and design to implementation and decision-making, which produces more efficient and sustainable projects/outcomes. When communities have influence and control over decisions that affect them, they have a greater stake in the outcomes and are more committed to ensuring success.

For community participation to be as inclusive and effective as possible, the diversity of people within the same community, in terms of gender, age, educational level, power, wealth, etc., should be acknowledged and dealt with. Effective public involvement begins with early contact with potential users through the actual inclusion of all stakeholders by initiating the listed measures:

- Public meetings, campaigns and awareness programs to define the project's need and the initiatives and benefits promised.
- Providing access to planning documents and other relevant information free of cost.
- Public discussions can help engineers fine-tune the treatment facility plans to fit the community.
- Monthly meetings with residential welfare associations (RWAs) to inform about the progress of the project as well as seek feedback
- Extensive consultations with stakeholders/ End-user community on tariffs and benefits.
- Form advisory committees to establish membership, responsibilities and resources of this committee
- Holding public workshops and training programs to discuss the benefits and risks of reuse
- Creating entrepreneurial opportunities to attract local investments in terms of input materials

Thus, equal participation of all stakeholders in research and project implementation can increase the potential, flexibility and creative innovation in responding to water insecurity.

Along with this, **special incentives and reward programs** can be provided to the end-user community who plan to use nature-based solutions. These could include providing development incentives, property tax reductions, grant money, rebates and installation financing directly to an individual user, property owners or community groups for adopting solutions to their property. Awards and recognition programs for successful examples will help increase public awareness and encourage the public to adopt such treatment systems.

Developing a web-based application for citizen science programs can increase public participation in the adopted solution, assist in on-site monitoring, and generate extensive datasets with spatial and temporal coverage. One such program is the "*Off the Roof Citizen Science Project*" from Colorado State University (USA) which has homeowners across the country testing their roof runoff for pathogens to determine how it could be best put to use. Another successful program is "*Chronolog*", where Birmingham University (UK) installed chronolog stations around the Bartle Constructed Wetlands complex, which involved participants taking a selfie and uploading it on their site. The goal was to create a timelapse compilation to observe seasonal changes in ecosystem processes, such as the greening of plants, water levels, etc., through the submitted selfies.

4.5.3 Performance evaluation of treatment plants

The performance efficiency of the treatment plant depends not only on proper design and construction but also on good operation and maintenance. Performance assessment of a treatment plant using natural/ conventional/advanced technology, is necessary to assess the compliance requirements, present efficiencies of existing treatment facilities and to know the present quality of treated sewage. As per the CPCB assessment, out of 1093 operational STPs, the compliance status of 900 STPs is available and only 578 STPs having a combined capacity of 12,197 MLD are found to comply with the consented norms prescribed by the SPCBs or the Pollution Control Committees (PCCs). In another study by CPCB, performance evaluation was carried out for 152 STPs under NRCD spread over 15 states in the country and having a total treatment capacity of 4,716 MLD. After the study, it was concluded that the plant efficiency utilized was 66% (3,126 MLD). Out of the 152 STPs, 9 STPs are under construction, 30 STPs are non-operational, and the performance of 28 STPs not satisfactory. In terms of the treated effluent quality, out of the 152 STPs, the treated effluent from 49 STPs exceeds the BOD standards, and for COD, 7 STPs are violating the general discharge standards. The study found that lack of maintenance and improper plant design are the key factors that affect the efficiency of treatment processes.. Therefore, to achieve these capacities existing treatment plant needs to be upgraded, which requires performance evaluation to decide the scope for expansion or process modification.

A proper monitoring plan, defining the testing schedules, locations, parameters of importance, testing methods and procedure, and discharge standards have to be established to facilitate performance evaluation. CPCB has published the guidelines for the same. To help in close monitoring of the STP performance, CPCB has developed a mobile-based "*STP Monitoring Application*" launched in September 2020. This App will facilitate information flow from STPs to Urban Local Bodies, States and the Central level, and 1600+ STPs will be linked. This App can be downloaded from the Mobile App Store. Information on capacity and qualitative parameters like pH, TSS, COD, BOD and FC will be reported, and the same will be updated every week.

Citizen science programs can also enhance the monitoring of decentralized and NBS solutions. Interested volunteers/ participants can be trained to monitor the water quality and submit observations through mobile apps or online forms. This can significantly increase the frequency of water quality data available.

5. Capacity building and raising awareness for UWM

To optimize social equity, efficiency, and environmental sustainability, capacity building, is an essential aspect of Urban Wastewater Management (UWM). UNDP (2009) defines capacity building as the *"process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their development objectives over time".* The aim of capacity building in the UWM sector should focus on raising awareness and building capacity for policymakers and planners who deals not only at the city level but also towards local, regional, and national level in managing wastewater. Through capacity-building activities the number of stakeholders and actors can be attracted or involved in managing wastewater (Ferrero et al., 2018).

5.1 Trainings and knowledge transfer/exchange

The knowledge about UWM and its role in managing the wastewater sector is quite relevant. However, the challenge appears to be in translating this knowledge into practice. One way to do so would require a thorough understanding of the city's wastewater from multiple perspectives–hydrology, governance, institutional mechanisms, economics, and social structures, among others. In general, training is provided to only people involved in operating, such as public or private utility, local government employees, and contractors directly involved in operation and maintenance. However, for a well-managed system, all categories and classes of people should also be included in the process, such as executives, senior managers, technical managers, community committees, and local resident caretakers responsible for wastewater management activities should be trained accordingly (Brown & Farrelly, 2009). Local health agencies should typically be accountable for independent surveillance of city wastewater activities. They should also cooperate with operators and agencies in planning and training preventive risk management methodologies (Ferrero et al., 2018).

5.2 Improving institutional and international collaboration

Out of 17 Sustainable Development Goals (SDG) adopted by UN member states on the 2030 agenda, 12 SDGs and pertinent targets directly link to wastewater management. In the past, most urban cities and towns in India have been able to organize some level of services for their citizens. In recent decades, many have struggled to keep up with the amounts of waste generated. Such an increase in wastewater amounts results from an ever-increasing urban population, primarily due to unprecedented rates of rural-urban migration and economic development accompanied by changes in consumption patterns (Rodić & Wilson, 2016). To facilitate improvement, the urban wastewater management involvement and coordination of all stakeholders and agencies are essential (Fig. 5.2.1). Regarding how to improve institutional collaboration, a few points have been focused on.

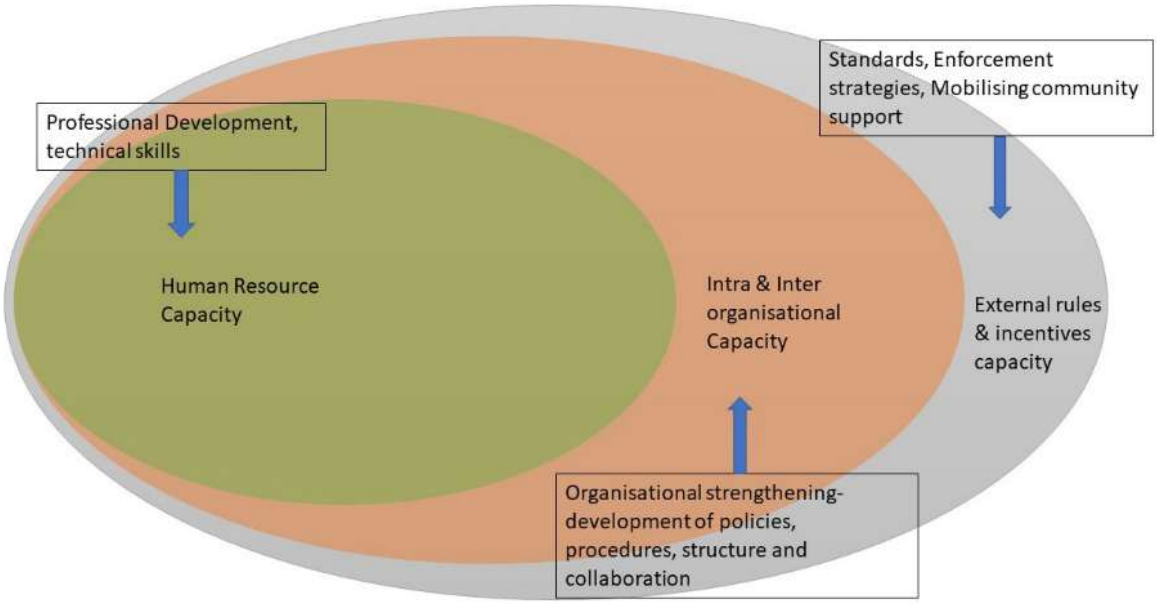


Figure 5.2.1: Institutional capacity-building framework (Source: Brown & Farrelly, 2009)

5.2.1 Formulation of a coordinating agency for managing/leading the efforts at the Municipal/state/national level

Implementing UWM requires a more significant number of actors or agencies in decision making, integration with urban planning, and understanding trade-offs between multiple competing objectives. This becomes far easier if there is an apex body to coordinate and manage these elements (UNESCO, 2021). To tackle these challenges, basic waste management infrastructure must be implemented in waste collection and sanitary landfilling. Furthermore, for people who already take care of waste management in one way or the other but are not yet part of a formalized waste management system should be formalized. This so-called informal sector needs to be recognized and gradually integrated into the formal waste management system. Clear and well-defined rules must be established to enable a level playing field for all parties involved. Introducing reforms gradually in the urban wastewater sector in case of policies, institutions, and practices can help in moving up the on-site and off-site wastewater management ladder (Fig. 5.2.2). Through these reforms the institution and their capacity become more critical in transforming to sustainable development.

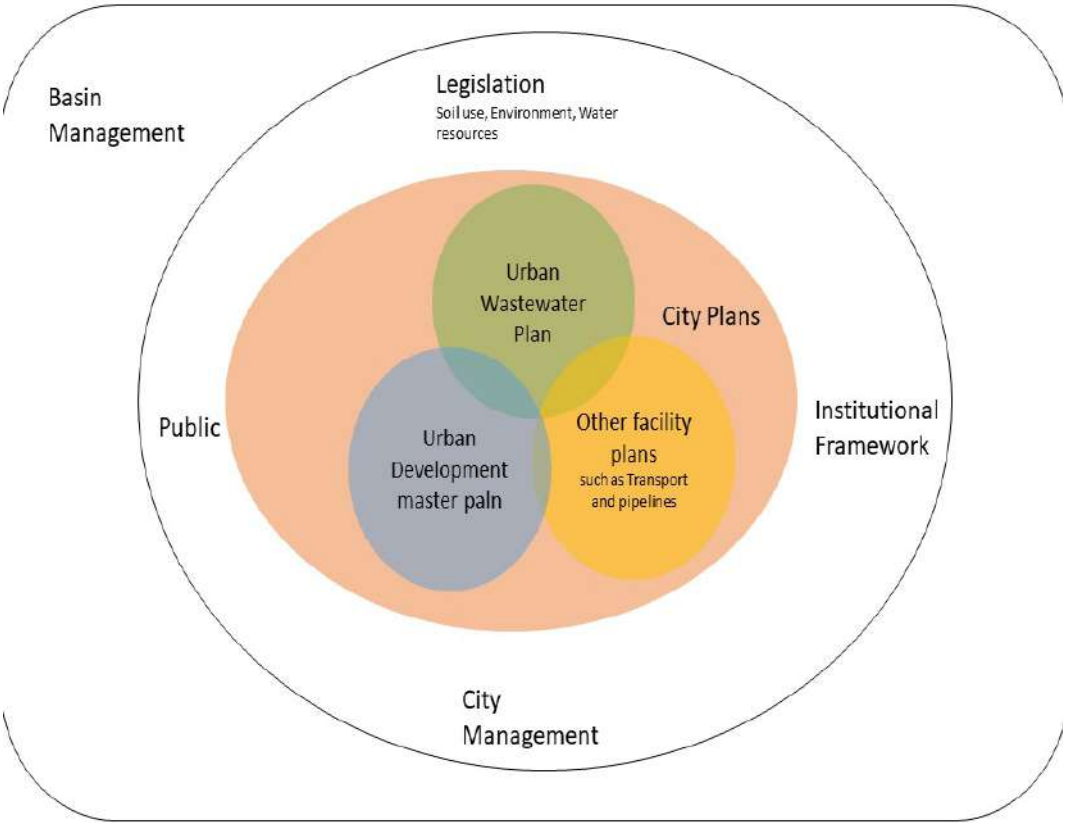


Figure 5.2.2: Institutional framework for UWM planning (Source: Tucci, 2010)

On this note, the following are significant steps taken by Government of India for solid-waste management in India during the last two and half decades:

1. National waste management committee: The main objective of the committee constituted in 1990 was to identify the recyclable contents in solid waste picked up by rag-pickers.
2. Strategy Paper: A manual on SWM has been developed by the MoUD in collaboration with the NEERI in August 1995.
3. Policy Paper: MoUD and the Central Public Health and Environmental Engineering Institute prepared a strategy paper for the treatment of wastewater, appropriate hygiene, SWM, and efficacy in the drainage system.
4. The master plan of Municipal Solid Waste: A stratagem was formulated by the combined efforts of MoEF, CPCB, and ULBs to develop a master plan for SWM with an emphasis on biomedical waste in March 1995.
5. High Powered Committee: In 1995, a High-Powered Committee constituted under the Chairmanship of Dr. Bajaj, to encompass a long-term strategy for Wastewater Management using appropriate technology.

All the above efforts culminated in the preparation of many acts and regulations to protect the environment, which came into force from time to time. The rules relevant to UWM in India are–Hazardous Waste (Management, Handling, and Transboundary Movement) Rules (1989, amended January 2003, August 2010), Biomedical Waste (Management and Handling) Rules (1998), Municipal Solid Waste (Management and Handling) Rules, 2000, The Batteries (Management and Handling) Rules (2001), Plastic Waste (Management and Handling) Rules, 2009, and E-Waste Management and Handling Rules 2011.

5.2.2 Collaborative efforts with local NGOs and CBOs

In India, the collaborative efforts are still nascent, and there is no success story under UWM. However, many companies took the UWM challenge as a business opportunity. About 40 projects are under collaborative efforts for different segments (segregation at community bin, collection, transportation including energy waste) of UWM in India.

Some Indian companies involved in UWM are Zen Global Finance Ltd (RDF), ESSEL Infra (UWM), Enkem Engineers Ltd (bio methanation in collaboration with Entec, Austria), and Future Fuel Engineers (India) Pvt. Ltd (bio digestion in collaboration with ECOTEC, Finland), Global Environmental Engineers Ltd (biodigestion in collaboration with PAQUES Pvt., Netherland), Hanzer Biotech (UWM), Thermax Ltd (Incineration plants in collaboration, Danskrodzone, Denmark and Thermal Process, US), Excel Industries (composting), EDL Power (India) Ltd (Sanitary landfill), SELCO International Ltd (RDF, TIFAC, DST), Ramky (Waste Management Services). Some other international companies working in Indian Market in the UWM sector are Nellemen, Neilsen, and Rauscvenberger of Denmark, Lunde, TBW, and BTA of Germany and Entec, Astria, Hitachi Zosen, Japan, etc. Attributes of a successful partnership are efficient implementation, better services, risk sharing, cost saving, and revenue generation. On the other hand, power sharing, loss of control of ULBs, cost enhancement, unaccountability, political risks, and lack of competitiveness are significant threats.

To overcome the complications associated with UWM, the public and private sectors should contribute vigorously. The efficiency of ULBs in handling Wastewater Management can be enhanced only with the cooperation of both sectors. The relations among various components of the PPP system, viz., sociological, economic, and managerial aspects, should be evaluated. The effectiveness of partnership, well-defined relationships, and clear demarcation of role, accountability, and adaptability due to dynamics among the various stakeholders are elementary necessities to make PPP work for UWM (Joshi & Ahmed, 2016). Kerala is one of the few Indian states that took adequate measures to address the waste menace by launching the Clean Kerala Mission in 2002. Later, in 2007, *the Malinya Mukta Keralam* campaign was launched, creating a conducive environment for a Mission Mode Action Plan to achieve the goal of Clean Kerala. Mission 2002 Strategy revolves around the time-tested Reduce, Reuse, Recycle and Recover slogan. Phase-I was implemented in 5 Corporations and 26 Municipalities.

5.3 Sensitization of the public

A well-informed body of decision-makers knows that waste management is needed as a basic public service for proper wastewater management. Hence, waste management must be an integral part of every locality's political decision process and other primary goals, such as safe drinking water supply, wastewater treatment, and all other elements of public infrastructure. The goal of the sensitization activity should focus on improving sanitation and, therefore, the quality of life for people, and quality of life includes health, privacy, convenience, and employment (Fig. 5.3.1).

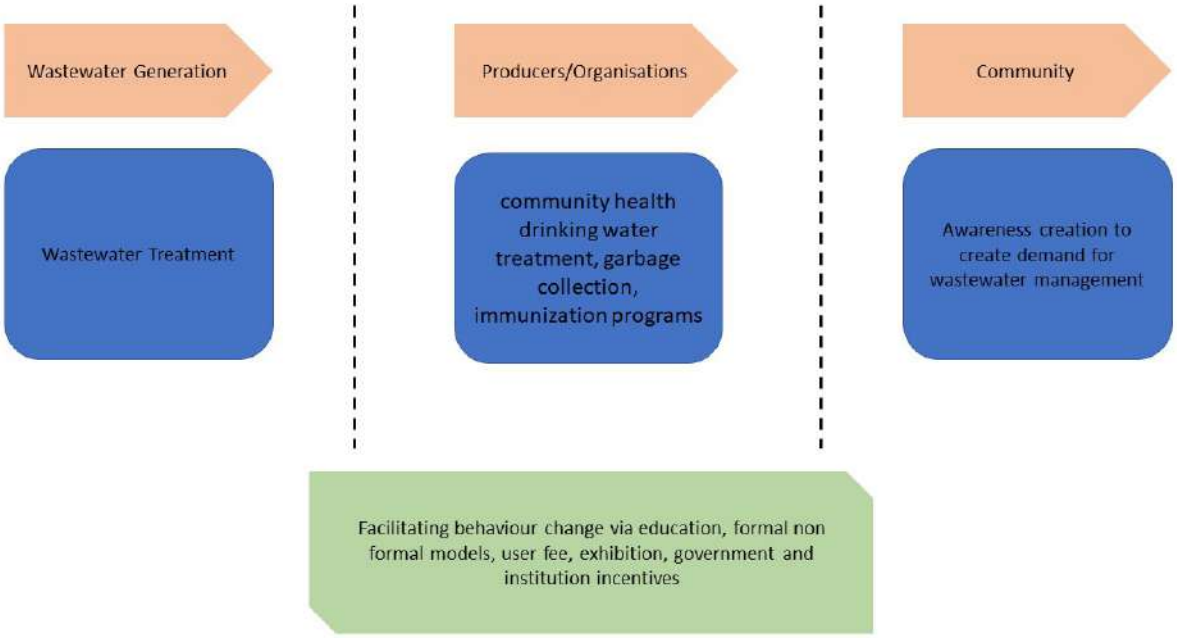


Figure 5.3.1: Sensitization framework for wastewater treatment and management (Source: Schellenberg et al., 2020)

5.3.1 Looking into the long-term benefits of wastewater treatment

Ensuring proper wastewater treatment and disposal is as important for protecting community health as drinking water treatment, garbage collection, and immunization programs. It is important to communicate the long-term benefits of wastewater treatment. Untreated wastewater can spread disease and contaminate drinking water sources. However, most communities give little thought to what happens to their wastewater, and the availability of safe, clean drinking water is often taken for granted. Cholera and other wastewater-related diseases are generally viewed as threats to other, less developed countries. To involve people and spread the benefits of wastewater treatment following measures can be adopted, including community surveys (to obtain a representative set of community opinions), Public meetings and presentations (involve public participation through organizing and presenting fun and interesting presentation), Newsletters (annual, biannual or quarterly newsletter which includes pictures, graphs figure, tables, and chart to attract people's attention), open houses (meetings between Community, employees and public officials to demonstrate their work) and Public service announcements (to promote environmental and safety messages to the public).

5.3.2 Campaign for user fee collection for effective O&M

Many cities in India have user fee collection methods for operation and maintenance (O&M) but suffer from the following contributing factors:

1. Poor ownership and awareness by communities about their rights and responsibilities
2. Poor capacities, willingness, and ownership by panchayats to maintain water supply systems
3. Limited accountability mechanisms for citizens to hold panchayats accountable for the provision of safe water
4. Lack of spare parts and tools
5. Limited availability of mechanics and lack of motivation/incentives.

The following demands can be addressed to improve the user fee collection for better operation and management.

1. The initiatives need to be institutionalized, keeping in view their sustainability, and the community needs to be mobilized to own and sustain these programs on urban water supply.
2. The development agents, like NGOs, CBOs, etc., and the community should be advocated appropriately to ensure effective social mobilization.
3. Considering this, a participatory demand-driven approach is highly warranted with a focus on necessary awareness generation amongst the community on the need for Urban Wastewater Management.

There comes the profound role of development workers/agencies to support the Government approach and activities to pave the way for bearing implementation to implement wastewater treatment plants to prevent water-borne risks and ensure Water Safety and Security for all.

5.3.3 National awareness fest/fair

Awareness raising is needed to involve a minimum level of citizens' cooperation. National awareness programs and fairs can help educate citizens and the Community towards sensitization of wastewater management. One way should be in the form of sanitation drives which can be conducted regularly to sensitize the Community, build engagement, and motivate them to adopt good health practices. The awareness program should also focus on two urgent reasons related to wastewater treatment, i.e., health and the environment, which are often neglected. According to the 2015 report of the CPCB, India can treat approximately only about 30% of its wastewater, most of it in urban India (CPCB 2015). An urgent need for community participation and government and private initiatives such as awareness programs are the needs of the hour.

5.3.4 Wastewater treatment courses at different levels of education

In India, it has been observed that the use of treated wastewater projects suffers with social acceptance. Very few people and the Community are comfortable using treated wastewater for non-potable purposes but are skeptical for personal use. Studies have shown that this can be addressed by sensitizing the people by educating them about the issue (Joshi & Ahmed, 2016). Including wastewater treatment courses at different levels of education can help address these issues.

5.3.5 Formal, non-formal, and informal education modules

The educational concept is based on raising people's awareness. The effective way of raising awareness is contained in formal, non-formal, and informal education. The form and method of teaching differ from each other but target different sections of people in the society (Fig. 5.3.2). The focus should be provided on building the educational concept to point out and resolve the problem we have with wastewater management.

Raising awareness can be achieved in two phases. The first phase of raising awareness would be achieved through the media and the internet. The target group for this phase is adults. Awareness is going to be focused on proper wastewater management and the rationale of the waste hierarchy. This concept is based on content such as demonstrating the main mistakes made, misconceptions related to treatment, and the benefits obtained by correct handling for achieving a higher rate of waste intended for energy utilization. The second phase of awareness is defined for a target group of educators, such as school teachers, waste management experts, or company directors,

through informal and non-formal educational mechanisms such as micro-training. Young children act as change makers in spreading awareness to bring about environmental sensitization in neighbouring communities towards natural resources. So, a formal education module to target young minds could be developed to involve school students to create awareness and bring a behavioural and attitudinal change towards wastewater generation, treatment, and reuse. Singapore's model is one example of educating its citizens through informal education. The informal education module involved giving people first-hand experience by having a tour of their wastewater treatment plant and organizing various programs to include students to build a sense of responsibility and acceptance of the treated wastewater. Similar programs have been seen across countries like the United States, Australia, the Netherlands, and China (Filho et al., 2016).

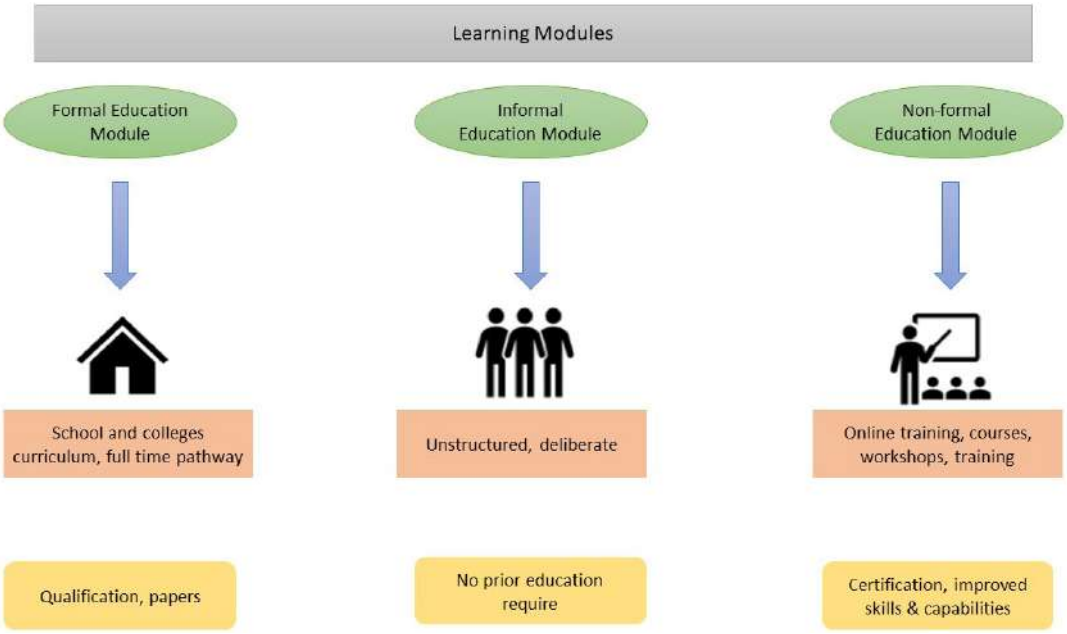


Figure 5.3.2: Formal, non-formal, and informal education modules

5.3.6 School-level exhibitions and competitions

Various studies conducted in India have observed that people are hesitant to accept wastewater treatment due to a lack of awareness and education. Interestingly it has also been observed that the significant source of information for these households was their school-going kids (TERI, 2020). Thus, it is important to create awareness amongst school students to leverage wastewater management in this location as a model for others in India. Various school-level competitions and exhibitions can improve in expanding the knowledge and transfer this knowledge to individual households to educate and sensitize the issues related to wastewater management (Fig. 5.3.3).

Figure 5.3.3: School-level exhibition and competition to create awareness

नमामि गंगे
गंगा स्वच्छता संकल्प दिवस
2 मई, 2017
गंगा स्वच्छता संकल्प दिवस
2 मई, 2017
स्वच्छता का संकल्प लें गंगा किनारे!
संकल्प रैली

6. Learning from case studies by National Mission for Clean Ganga, India

India's national river – Ganga, represents not just the collective consciousness and sentiments of the country, but is also the source of sustenance and livelihood of its people. The Ganga River Basin is the largest river basin in the country, constituting 26 per cent of the country's land mass, constituting 28 per cent of its water resources and supporting about 43 percent of its population. The main stem of the river traverses five major states namely, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal and travels a total length of 2,525 kms. In fact, the Ganga River basin, including all its tributaries, covers about a million square kilometres area in eleven states in the country.

Although the trajectory of the efforts to clean the river began as early as 1985, the launch of the Namami Gange mission in 2014-15 has been the game changer. Launched with a budgetary outlay of Rs 20,000 crores, the Namami Gange mission is an umbrella programme with an aim to integrate previous and currently ongoing projects and new initiatives planned as its part. Under the Mission, a total of 378 projects have been sanctioned worth Rs 31,173 crores. The National Mission for Clean Ganga, established as an Authority under the Authorities Order 2016, is the implementing agency of the Namami Gange mission. In 2022, Namami Gange II was approved for Rs 22,500 Cr for the period 2021- 2026. The focus shall be on sewerage infrastructure creation in Ganga tributaries, scaling up of public private partnership efforts, circular water economy model and fecal sludge and septage management.

The Mission comprises of five strategic areas of intervention which include - 'Nirmal Ganga' with a focus on pollution abatement, 'Aviral Ganga' with a focus on ecology and flow of river Ganga, 'Jan Ganga' with an aim of people river connect and 'Gyan Ganga' with a focus on research, policy and knowledge management. The fifth area of intervention is Arth Ganga, which is a self-sustainable economic model based on the symbiotic relationship between nature and society, by strengthening people-river connect, adopting an ecologically conscious sustainable development framework and acting as an economic bridge between the basin and livelihood opportunities of the people. The six verticals of intervention are zero budget natural farming, monetization of reuse of sludge and treated wastewater, promotion of livelihood generation opportunities, increased public participation, revival of cultural heritage and tourism and institutional building.

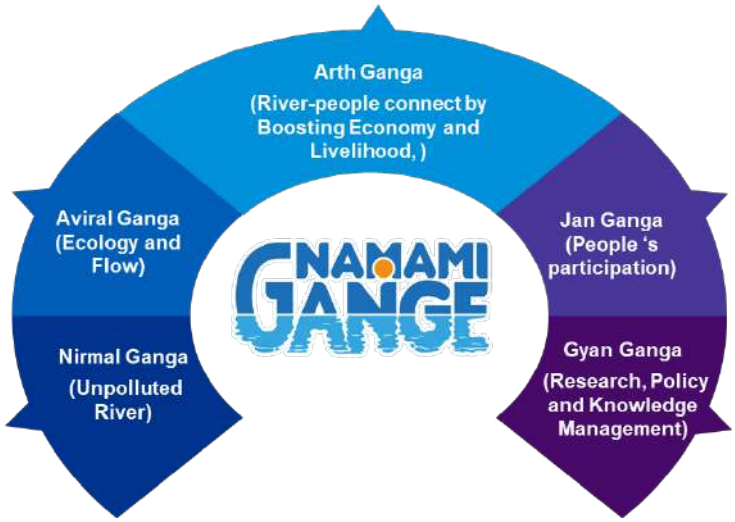


Figure 6.1: Five verticals under Namami Gange Mission

The following sub sections shed light upon some of the key learnings learnt from the

Mission.

6.1 Institutional arrangement of National Mission for Clean Ganga (NMCG)

Addressing the challenges of rejuvenating a transboundary river and driving an institutional reform, the Namami Gange Mission has a five-tier institutional framework with agencies at the national, state and district levels. This institutional arrangement supports NMCG in strengthening its governance structure to ensure successful implementation of its goals.

The roles and responsibilities of the five tier institutional framework has been elucidated below:

- National Ganga Council: The National Council for Rejuvenation, Protection and Management of River Ganga or the National Ganga Council, operates under the chairmanship of the Hon'ble Prime Minister with representatives of the state governments. It provides a platform for better coordination between the Government of India and state governments for river rejuvenation. The first meeting of the National Ganga Council was held on 14th December 2019 at Kanpur under the Chairmanship of Hon'ble Prime Minister and was attended by Members of Union Council of Ministers, Chief Ministers and Deputy Chief Minister of Ganga Basin States, among others.
- Empowered Task Force: The Empowered Task Force, under the Chairmanship of Union Minister for Water Resources, River Development and Ganga Rejuvenation is represented by Chief Secretaries of States on Ganga basin as well as secretaries from concerned departments of Government of India. The Empowered Task Force coordinates and advises on matters relating to Rejuvenation, Protection and Management of river Ganga and its tributaries and require the Ministries, Departments and State Government to frame Action Plan with specific activities timelines and mechanism for their implementation.
- National Mission for Clean Ganga: At the national level, the National Mission for Clean Ganga (NMCG) functions under the supervision and directions of the National Ganga Council and implements the Namami Gange Mission. NMCG is an empowered organization operating as a two-tier management system having interdependent administrative appraisals and approval powers. The Director General of NMCG, heads both the tiers of the organization. He is supported by four Executive Directors namely, Projects, Technical, Finance and Administration and a Deputy Director General. In 2016, the National Mission for Clean Ganga (NMCG) was notified as an authority with statutory powers under the Environment Protection Act, 1986 which gave it regulatory, financial and administrative empowerment.
- State Ganga Committees: The State Ganga Rejuvenation, Protection and Management Committee or State Ganga Committee, were constituted to drive programme implementation in all the five main stem states, through monitoring of the execution of plans, programmes, and projects of all district-level agencies. The State Ganga Committee headed by Chief Secretary of the respective State has representation of Principal Secretaries of relevant Departments of the State besides five experts from relevant fields nominated by the State Government.
- District Ganga Committees: The District Ganga Protection Committees or District Ganga Committees (DGC) have been constituted for district-level implementation and involvement of the local community in river rejuvenation.

The DGC is headed by the District Magistrate of the district abutting river Ganga, which has representation of two nominated members from Municipalities and Gram Panchayats of the District, one member each from concerned Departments such as, PWD, Irrigation, Public Health Engineering, Rural Drinking Water and State Pollution Control Board. The Divisional Forest Officer is Convenor of the Committee. From April 2022 onwards, DGC-4M meetings (District Ganga Committee – Monthly Mandated Minuted Monitored meetings) are being regularly conducted in all districts of the basin. This has increased the people's participation in the implementation of Namami Gange mission.

6.2 Current technologies and practices for UWM

The Namami Gange mission is technology agnostic. While encouraging the adoption of innovative technologies, it mandates that all the guidelines and norms of CPHEEO guidelines are adhered, and the end-products are compliant to the stipulated standards.

The initiatives undertaken by NMCG encompass focused interventions in both rural and urban areas, as well as centralised and decentralized solutions.

Treatment of Sewage

Under Namami Gange mission, a total of 163 sewerage infrastructure projects have been sanctioned (which includes components of sewage treatment plans as well as sewerage infrastructure) for creation and rehabilitation of 5016 MLD of STP capacity and laying of around 5134 KM sewerage network in towns located along river Ganga and its tributaries. Out of these a total of 96 projects have been completed, which has led to the creation/rehabilitation of 1770.85 MLD treatment capacity and 4174.43 km sewer network. The coverage extends to over 100 cities and towns in the basin. The focus is also now on decentralized small scale STPs like the Johkasou model to ensure sewage treatment in smaller towns and even in compact residential colonies in major cities.

Another area of intervention has been bioremediation and in-situ abatement of pollution in various drains flowing in the hinterland. A total of 14 projects have been sanctioned worth Rs 238.38 Cr. Against this, two projects have been completed and the remaining are under various stages of completion.

One of the important pillars under the new initiative of Arth Ganga is the monetization of reuse of treated wastewater and sludge. Also, under the India-EU partnership, a framework for safe use of treated wastewater has been prepared by NMCG.

With regards to decentralized solutions, the Government of India formulated the National Faecal Sludge & Septage Management (FSSM) Policy in 2017 to emphasize the importance of treating faecal sludge from on-site sanitation systems. Resultantly, select State Governments have issued their state level FSSM policies/ guidelines. Several states are also increasingly opting for other sewage treatment technologies such as FSSM, FSTP, phyto-remediation, bioremediation, bio-digesters etc. Successful implementation of FSSM projects has been achieved in States such as Andhra Pradesh, Maharashtra, Odisha and Telangana by adopting combination of FSTP, co-treatment in STP, cluster approach. Odisha has given O&M of the FSTPs to the Self-help women groups which resulted in better utilization of the existing infrastructure. This has also resulted in the improvement in the water quality of rivers in some instances. Thereby, States/ Union Territories which are yet to formulate or implement their state level FSSM policy have also been encouraged to do so on a priority basis.

For instance, in rural areas, concerted efforts have been made for sustainable solid and liquid waste management through adoption of nature-based solutions. Thus, Namami Gange mission has collaborated with the Department of Drinking Water and Sanitation,

Ministry of Jal Shakti has constructed over 12.38 lakhs independent household toilets to make 4,507 villages along the Ganga River Open Defecation Free (ODF).

Similarly, in urban areas, efforts are being to make Ganga basin cities river and water sensitive. Some of the initiatives include promotion of Zero Liquid Discharge in context of Ganga Basin cities, setting up Centre of Excellence on Water Reuse, organizing awareness campaigns for strengthening of people river connect and others. In collaboration with our partners such as Centre for Science and Environment and Indian Institute of Public Administration, the mission is also conducting capacity building programs. Several guidelines and strategic frameworks have been released such as *Strategic Guidelines for Making River Sensitive Master Plans', 'A Strategic Framework for Managing Urban River Stretches in the Ganga River Basin: Urban River Management Plans', 'Guidance Note for Environmentally Sensitive, Climate Adaptive and Socially Inclusive Urban Riverfront Planning and Development', 'Urban Wetland/ Water Bodies Management Guidelines'.*

Treatment of Industrial Effluents:

Namami Gange mission has also established/ under process for setting-up Common Effluent Treatment Plants for specific industrial pollution abatement.

- Textile Cluster: Work for upgradation of existing 6.25 MLD CETP in Mathura is under progress. Tender preparation is under progress for 7.5 MLD CETP at Gorakhpur. For Farrukhabad, a new Textile Park has been proposed which will have a 1.5 MLD CETP for effluent treatment, and the Third-Party Assessment for the same has been approved. The Textile Cluster Association has accepted the proposals for CETPs with ZLD based system. For Rooma and Pilkhuwa textile clusters, Detailed Project Reports have been received.
- Tannery: There are 3 main tannery clusters present on the main stem of river Ganga namely Jajmau, Banthar & Unnao; having total of around 400 units) connected to CETP Jajmau Kanpur, Banthar & Site-II Unnao respectively. Under the mission, 20 MLD CETP at Jajmau and 4.5 MLD CETP at Banthar are under construction, and tendering is completed for upgradation of 2.15 MLD to 2.6 MLD CETP at Unnao project.

Under Aviral Ganga, NMCG has also made concerted efforts for industrial pollution abatement which is a major source of concern for River Ganga and its tributaries. Some of the initiatives include release of Charters for implementation of cleaner technology, upgradation of treatment facility and adoption of waste minimization practices in the major industrial sectors such as Pulp & Paper, Distilleries, Sugar and Textile. This has resulted in significant reduction in wastewater discharge and pollution load. Examples include Charter for Water Recycling & Pollution Prevention in Pulp & Paper Industry (Specific to Ganga River Basin States), Charter for Zero Liquid Discharge (ZLD) in molasses-based distilleries, Charter for Sugar.

NMCG also conducts annual inspection of Grossly Polluting Industries through Third Party Technical Institutes comprising of IITs, NITs, CSIR Institutes etc Compliance verification of Grossly polluting industries (GPIs) having potential to discharge into river Ganga and its tributaries is being carried out through third party institutes (TPIs) are carried out since 2017. Stringent action is taken by CPCB/SPCBs Pollution Control Committees against the GPIs discharging into main stem of Ganga River & its tributaries which are non-complying with respect to the prescribed norms. During 2021-22 (5th round of annual inspection of GPIs), an inventory of 1051 Grossly Polluting Industries (GPIs) including 09 common effluent treatment plants (CETPs) operating in five river Ganga main stem states has been updated in consultation with concerned State Pollution Control Board (SPCBs)/Pollution Control Committees (PCCs). Inventory of GPIs for river Yamuna basin was also finalized to 1655 GPIs including 33 CETPs. It was carried out by 24 reputed technical institutes (TPIs).

Action is being taken by seven respective SPCBs/PCC i.e., Uttarakhand, Uttar Pradesh, Haryana, Delhi, Jharkhand, Bihar & West Bengal. All the 2706 GPIs have been inspected. As on 5th August 2022, actions were taken against 2543 GPIs. Out of 2543 GPIs, 2059 GPIs were found operational, 319 GPIs temporary closed and 165 GPIs permanent closed. Out of 2059 GPIs, 1621 GPIs were found complying and 438 GPIs non-complying. Concerned SPCBs/PCC issued show-cause notices to 396 non-complying GPIs and closure direction to 42 non-complying GPIs.

6.3 Approaches for promotion and adoption of the sustainable UWM solutions

The introduction of the Hybrid Annuity based PPP model and One City One Operator model has been a game changer in the wastewater sector in the country and has given a much need push to PPPs in the sector.

- HAM Model: Launched in 2017, the model comprises of 100% central government funding through NMCG, for the development as well as operation & maintenance of the STPs for a period of 15 years. In alignment with the PPP procurement process followed by the Government of India for infrastructure related projects, a suitable concessionaire for the development & operation of STPs is selected through competitive bidding under HAM. 40% of the capital cost is paid during construction and the remaining 60% is paid over a period of 15 years as annuities with interest on outstanding balance along with operation and maintenance expenses. The bidding is based on lowest quote for the development, operations, and maintenance of the STP for 15 years. The rationale behind the increased responsibilities was to sustain the level of the performance and accountability of the project for the entire life cycle. The model's exclusivity stems from the various advantages it offers viz. assured government funding, continued performance, distinct accountability and ownership for performance over an extended period of time. As on date, 30 HAM projects have been sanctioned.
- One City One Operator: The model incorporates the development of new STPs along with the existing treatment infrastructure in the ULBs with the vision of complete elimination of untreated sewage entering River Ganga. The projects have been rolled in various cities such as Kanpur, Prayagraj, Mathura, Patna, Kolkata, Howrah-Bally-Kamarhati-Baranagar Bhagalpur, Farrukhabad, Mirzapur, Ghazipur, Agra, Bareilly, Burdwan, Durgapur, Asansol, etc. and are under various stages of completion.

In addition, NMCG in collaboration with Central Pollution Control Board is closely monitoring emissions and effluents from discharge points of industrial units through the Online Continuous Effluent Monitoring Stations. The analysers are installed on stacks/ chimneys and at the outlets of Effluent Treatment Plants/ Sewage Treatment Plants. The parameters being monitored include – i) for effluents–pH, BOD, COD, TSS, Flow, Chromium, Ammoniacal Nitrogen, Fluoride, Phenol, Cyanide, Temperature, AOx and Arsenic ii) For emission PM, Fluoride, NOx, SO2, Cl2, HCl and NH3.

6.4 Innovative applications and technological solutions for UWM

NMCG has adopted several innovative GIS based approaches and solutions for not just UWM but also to support its holistic river rejuvenation initiatives. Some of such interventions have been mentioned below:

- Catch the Rain Campaing: As part of the nationwide Catch the Rain Campaign, with the tagline Catch the Rain: Where it falls, when it falls, Namami

Gange also took active part in rejuvenation of small streams and rivulets, restoration of lakes and water bodies on the Ganga basin.

- Bhuvan Ganga Portal: In 2015, MoU has been signed between National Remote Sensing Centre, Hyderabad and NMCG for Bhuvan Ganga Geoportal which provides a platform to manage, access, visualize, share and analyse geo spatial data as well as non-spatial data products and services. The platform supports NMCG to achieve its objectives of environmental and ecological improvement within the Ganga River basin. It is being widely used by NMCG in drain monitoring.
- Green Ganga app is being used by NMCG for geotagging of afforestation activities conducted under the mission. NMCG has collaborated with Survey of India, the oldest survey and mapping department of the country, to use GIS technology for mapping Ganga basin in high resolution generating Digital Elevation Models (DEM). Deliverables of mapping include Digital Elevation Model/ Digital Terrain Model, GIS ready dataset, outlet/vent of sewerage and other discharge from all dwelling units, industrial, commercial and all type of other institutions, public drainage network, crematoria, ghats, RFD, solid waste disposal sites, STP/ETP/CETP etc. The models provide valuable information for making urban river plans, identifying the baseline of river flood plains and regulating them for their restoration and preservation critical pollution hotspots and facilitate policy to make informed decisions through the data generated. The mapping area is 43,084 km^2 along the 10 Km buffer of River.
- Sand Mining Mapping: Two projects are being conducted with IIT Kanpur:
  - A pilot project is being conducted using UAV Technology that focuses on a small stretch of the main Ganga River between Raiwala and Bhogpur in Uttarakhand.
  - A research project on "Geomorphic and Ecological Impacts of Sand Mining in Large Rivers as revealed from high resolution historical remote sensing data and drone surveys: Assessment, Analysis and Mitigation.
- Water bodies mapping using UAV technology by QCI: The project "Census Survey of Water Bodies in Ganga Basin" uses drone technology to map of all the water bodies in 31 Ganga districts (3189 villages) of Uttar Pradesh, Uttarakhand, Bihar, Jharkhand and West Bengal for improvement/ rejuvenation of water bodies that are either dried up or working less than their full efficiency.
- Reconstructing the Ganga of the Past from Corona archival imagery is being implemented by IIT Kanpur.
- Spring Rejuvenation using Remote Sensing, GIS & UAV technology
  - Pilot study on spring rejuvenation for Tehri Gadhwal district of Uttarakhand – under implementation by Survey of India/ Central Ground Water Board. CGWB. A schematic mapping of Tehri Garhwal district is being conducted for inventory of springs using LiDAR technology, hydro-geomorphic & liniment studies for identification of different type of springs & their recharge zones and implementation of spring rejuvenation by constructing rainwater harvesting and artificial structures.
  - Rejuvenation of dying springs in Tokoli Gad catchment of Tehri Garhwal District using Geo-chemical & Geo-physical techniques by IIT Roorkee. Under the project, the impact of land use, land cover change and natural or anthropogenic precipitation variability are being assessed.
- GIS based Mapping of Microbial Diversity by NEERI is being conducted to

understand the water quality of river Ganga along the stretch with the specific focus on parameters that indicates the interactions of river with its varied environment.

- Climate change scenario mapping using Weather Research and Forecasting Model by IITD. This will enable NMCG to map out high resolution climate scenarios for basin-scale water resources management. It aims to develop high-resolution (10 km X 10 km) datasets of current climate and future climate scenario and demonstrate its applicability for water resource management problems in the Indo-Gangetic plain.
- Environmental Flow Assessment for River Yamuna is being conducted using GIS, RS, Survey by NIH, Roorkee
- Identification of Critical Soil Erosion Prone Areas and Preparation of Catchment Area Treatment Plan is being conducted by IIT Roorkee.
- A GIS based inventory of small rivers is being created with additional component in form of district wise list of small rivers. Majority of these small rivers are seasonal rivers and often have been hydrologically degraded both due to non-availability of flows during non-monsoon or due to water quality issues. The rejuvenation of these rivers is one of objective of the programme as these small rivers impact the flows, both quality and quantity of River Ganga.
- NMCG in partnership with INTACH is carrying out the cultural mapping of the main stem of the Ganga from origin to Ganga Sagar using GIS technology.
- The GIS Cell of NMCG has developed a prototype geoportal on "Ganga Water Quality information system" with help of ESRI India. This geoportal shall enable NMCG to make informed decision making with regards to compliance and non-compliance status of STP & trend analysis of water quality of Ganga River based on manual water quality monitoring stations.

6.4.1 Improving institutional and international collaborations under NMCG

NMCG collaborates with local NGOs and organizations to reach out at the grassroot level to raise awareness, impart livelihood training and skill development, etc. For instance, it is closely working with Himalayan Environmental Studies and Conservation Organization (HESCO) to promote livelihood opportunities in the Ganga basin and use nature-based solutions for sustainability and restoration of riverine ecosystems. Another example, is the collaboration with Say Earth to share knowledge for rejuvenating, restoring and management of ponds and waterbodies.

With regards to international collaboration, NMCG is closely working with countries such as Denmark, Israel, Netherlands, South Korea and Japan for water partnerships and knowledge exchange. A Memorandum of Cooperation was signed with Ministry of Environment, Government of Japan for the promotion of Johkasou model of decentralized solutions. Teams of officials from central government ministries and state governments have been sent to Israel for training on water conservation and management practices.

6.4.2 Sensitisation of the public under NMCG

Jan Ganga or strengthening people river connect has been a key focus area under the Mission. Regular public outreach programs are organized with the support of the dedicated cadres of Ganga saviours such as Ganga Doots, Ganga Praharis, Ganga Vichar Manch, etc. to raise awareness and sensitize grassroot level communities. Some of the initiatives undertaken include:

- Ganga Utsav (Ganga Festival): Since 2017, Namami Gange has been

celebrating Ganga Utsav (River Festival), to commemorate the declaration of River Ganga as the national river. In 2021, Ganga Utsav was organized from 1st to 3rd November 2021, to celebrate not just for River Ganga but all other rivers across the country. The festivities included cultural performances, Ganga dialogues, Kahani Junction, Live Paintings, Photo Exhibitions, etc.

- Ganga Quest: Initiated in 2019, Ganga Quest is a bilingual international quiz competition designed with an aim to sensitize people about the national River Ganga, its significance, cultural and historical values, diversity and its ecosystem. The objective is not just building knowledge among participants, but also to connect them emotionally by sensitizing about rivers' present condition and its past reverence. In the years 2020 and 2021, it drew an overwhelming response with more than a million participants. This year Ganga Quest 2022 had over 7 lakh registered participants, against which around 1.73 lakh participated in the competition from India and 180 countries
- Ghat Main Yoga: In 2022, Namami Gange celebrated International Yoga Day by organizing yoga sessions in Ghats along the river. With over 10 lakh participants, the sessions were organized in over 100 locations across all five main stem states, with the support of 131 District Ganga Committees.
- Ganga Amantram (River Rafting Expedition): A unique social awareness initiative to connect with people, the 34-day long river rafting expedition from Devprayag to Ganga Sagar raised awareness regarding river rejuvenation and water conservation.
- 'Rag-Rag Mein Ganga': In association with Doordarshan (Prasar Bharti), Namami Gange mission aired two seasons of 'Rag-Rag Mein Ganga'-a travelogue series on Ganga on DD National. The travelogue series covered the cultural, mythological and historical aspects about the river from Gaumukh to Ganga Sagar, and the efforts undertaken by the Mission for its rejuvenation.
- Sponsored Thesis Competition–'Re-Imagining Urban Rivers': In collaboration with the National Institute of Urban Affias, Namami Gange mission has organized two editions of a national-level thesis competition. The competition is a first-of-its-kind initiative to engage young minds to research and envisage solutions for urban river issues.
- Ganga Connect Exhibition: Organized jointly by Namami Gange, cGanga and High Commission of India, the Ganga Connect Exhibition was a global exhibition and an outreach platform, which showcased the multiple facets of the river system and connected with a range of interested partners. The 17- day long exhibition began in Glasgow, Scotland and travelled through various cities in the United Kingdom including Cardiff, Birmingham, Oxford and London. The exhibition helped connect the Indian diaspora and international community with the river.

7. The Way Forward

Urban wastewater management, even though local, requires globally co-created solutions. Urban wastewater generation in India is set to continue increasing in the future due to population increase, migrations and development perspectives, which leads to the need to update existing wastewater treatment infrastructures. This whitepaper had documented current trends and had identified scope for improvement and augmentation to support India's development in a sustainable and long-lasting manner. Through this whitepaper, it is understood that there are some documented success stories for urban wastewater management, however it is important to understand that there is "No-one-size-fit-all" solution and availability of land for such solutions is limited. Future infrastructures should aim to bridge the gap of wastewater generation and treatment by using sustainable solutions. Each urban centre (city/town/community/building/individual) has different requirements of land, capital and human resources and thus require site specific technological solutions. This should include innovations in science and technology with considerations on centralised or decentralised infrastructure, conventional or advanced or nature-based solutions and has to be tailor made keeping the holistic picture of water-land-people and ecosystems.

Holistic urban wastewater management requires data from all key stakeholders and environmental conditions. Monitoring data is one such key data, which is the need of the hour in order to utilise the wastewater as a resource – e.g. for using wastewater before or after treatment. Data driven approach requires large volumes/frequency of data, however, currently the data on wastewater is scarce. Development of affordable data monitoring tools can aid in these scenarios for effective monitoring and also to sensitize stakeholders on load generation/reuse. There is tremendous support from the Government of India on Agriculture 4.0 and Industry 4.0 techniques that require the use of IoT, ICT, IoE with good internet connectivity. Such devices and government support should be used for urban wastewater monitoring, reuse and recycling efforts, which can aid with more water for agriculture and industrial applications. Involvement of techniques using IoTs, WSNs, RS and GIS approaches can also help in providing real- time data and can increase higher spatiotemporal resolutions of the data. A Web-based data-driven decision support system (DSS) can aid policy makers to take scientifically validated best management plans. Public participation is necessary for managing natural resources and in treating waste water. Added local participation and involvement of private sector improves the scale of investment, managing risks and delivering better services at affordable costs. Involvement of the stakeholders/end user community can also fine tune the future infrastructure projects as per the requirements and understanding of its user. The aforementioned data connectivity models (e.g. ICT, IoTs) should be used for increasing public participation in crowd sourcing of wastewater monitoring data and monitoring of waste generation, which can also be used to sensitize the need for urban wastewater treatment solutions and for increased acceptance of reusing and recycling wastewater. Such public participatory engagement can also aid in increasing the capacity building efforts and for improving the training capacity of locals through interactive media (e.g. guided multilingual tutorials). Trainings and awareness programs on promoting the reuse of the wastewater is much needed to manage the water related challenges in water scarce areas, across the globe.

There is a need to setup Apex bodies (with participation from Government agencies, academia, industry and public organisations) to manage wastewater treatment systems through extensive collaborations. It is necessary to update best management practices for urban wastewater scenarios, with active participation from global communities to avoid technology duplications and to quickly learn and reapply from success stories. This whitepaper aims to create pathways for such collaborations and engagements between countries to develop sustainable and affordable urban wastewater management solutions for all.

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Almost 80% of water supply flows back into the ecosystem as wastewater. This can be a critical environmental and health hazard if not treated properly but its proper management could help the water managers in meeting the city's water demand. Currently, India has the capacity to treat approximately 37% of its wastewater, or 22,963 million litres per day (MLD), against a daily sewage generation of approximately 61,754 MLD according to the 2015 report of the Central Pollution Control Board. Moreover, most sewage treatment plants do not function at maximum capacity and do not conform to the standards prescribed.

आज़ादी का अमृत महोत्सव

सत्यमेव जयते

Ministry of Housing and Urban Affairs
Government of India

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Swachh Bharat Mission - Urban 2.0

Making Cities Garbage Free

Operational Guidelines
October 2021

"... स्वच्छ भारत मिशन २.० का लक्ष्य है
गार्बेज फ्री शहर, कचरे के ढेर से पूरी तरह मुक्त,
ऐसा शहर बनाना ..."

Shri Narendra Modi
Prime Minister of India

[Excerpt from the address of the Prime Minister on the occasion of launch of Swachh Bharat Mission – Urban 2.0, on 1st October, 2021]

MESSAGE FROM HON'BLE UNION MINISTER

हरदीप एस पुरी
HARDEEP S PURI

सत्यमेव जयते

आवासन और शहरी कार्य मंत्री
पेट्रोलियम एवं प्राकृतिक गैस मंत्री
भारत सरकार
Minister of
Housing and Urban Affairs; and
Petroleum and Natural Gas
Government of India

Message

The Swachh Bharat Mission – Urban launched in October 2014 by the Hon'ble Prime Minister resulted in the most fundamental behavioural change brought about in Urban India, primarily because the Mission was not implemented as a Government programme but as a "Jan Andolan".

The second phase of SBM-Urban launched by Hon'ble Prime Minister on 1 October 2021, with a total outlay of ₹1,41,600 crores – nearly 2.5 times of the SBM-Urban - is a reaffirmation of the confidence placed on us by the people of India to take them to the next level of Swachhata over the next five years. The fact that the SBM-Urban 2.0 has been launched during India's 75th anniversary of independence, under the overall ambit of Azadi ka Amrit Mahotsav, provides an added historical significance to Urban India's tryst with sanitation and swachhata.

In this context, I am happy to see the operational guidelines for SBM-Urban 2.0 issued by the Ministry of Housing & Urban Affairs, which is not only a testament to how far we have travelled in our quest for a clean India but also provides Urban Local Bodies and State Governments with comprehensive directions to fast track their journey towards becoming "**Garbage Free** cities" by 2026.

New Delhi
25 October 2021

(Hardeep S Puri)

Office:- Room No. 104-C, Nirman Bhawan, New Delhi-110011; Phone: 011-23061166, 23061162, 23062089 (Fax)

MESSAGE FROM HON'BLE MINISTER OF STATE

कौशल किशोर
KAUSHAL KISHORE

सत्यमेव जयते

आवासन और शहरी कार्य राज्य मंत्री
भारत सरकार
Minister of State, Housing & Urban Affairs
Government of India

महात्मा गाँधी जी ने जिस स्वच्छ भारत का स्वप्न देखा था, आज उसे माननीय प्रधानमंत्री के मार्गदर्शन और स्वच्छ भारत मिशन के द्वारा पूरा किया जा रहा है। आज हमारा शहर पहले की अपेक्षा ज्यादा साफ, सुदंर और स्वस्थ हो गया है। आज स्वच्छ भारत एक मिशन ही नहीं, बल्कि एक जन आंदोलन बन गया है। आज स्वच्छ भारत मिशन 1.0 की सफलता और जन भागीदारी को देखते हुए तथा देश को और भी बेहतर और सशक्त बनाने के लिए हमारे माननीय प्रधानमंत्री जी ने 1 अक्टूबर 2021 को स्वच्छ भारत मिशन 2.0 की शुरूआत की है।

स्वच्छ भारत मिशन 2.0 में ठोस अपशिष्ट प्रबंधन, प्रयुक्त जल प्रबंधन, फीकल स्लज मैनेजमेंट, सैनिटेशन जैसे अन्य कई विषयों पे ध्यान दिया जाएगा। इस मिशन के तहत अर्बन लोकल बॉडीज, उनके कर्मचारी और हमारे सफाई मित्र की क्षमता निर्माण पे विशेष ध्यान दिया जाएगा। स्वच्छ भारत मिशन 2.0 न केवल अर्बन लोकल बॉडीज बल्कि देश को भी सस्टेनेबिलिटी की दिशा में ले जाएगा।

इन सब को ध्यान में रखते हुए आज मैं गर्व से कहना चाहता हूँ कि स्वच्छ भारत मिशन 2.0 की गाइडलाइंस, जोकि एस.बी.एम-अर्बन मिशन प्रबंधन विभाग के द्वारा लांच किया गया है, जो न केवल शहर बल्कि देश को एक नए आयाम की तरफ ले जाएगा। आने वाले समय में हम सब देशवासी मिलकर इस स्वच्छ भारत मिशन 2.0 को सफलतापूर्वक अपनाएंगे और देश को पूर्ण रूप से स्वच्छ और स्वस्थ बनाएंगे।

जय हिन्द।

Office:- 202 Narmada Bhawan, Dr. Bishambar Das Marg, New Delhi-110001; Phone : 011-23312123

MESSAGE FROM SECRETARY – MoHUA

दुर्गा शंकर मिश्र
सचिव
Durga Shanker Mishra
Secretary

भारत सरकार
आवासन और शहरी कार्य मंत्रालय
निर्माण भवन, नई दिल्ली–110011
Government of India
Ministry of Housing and Urban Affairs
Nirman Bhawan, New Delhi-110011

Foreword

The last seven years has witnessed a radical change in the Urban sanitation scenario in India. Our cities, streets, neighbourhoods have become visibly cleaner, and there has been a marked positive change in attitudes and mindsets of citizens towards 'swachhata'. In fact, Swachh Bharat Mission has emerged as the largest behaviourial change programme in the world.

In order to sustain the outcomes achieved under SBM-Urban, we have now embarked on the second phase of our swachhata to realise the vision of Hon'ble Prime Minister. In the second phase, our efforts towards complete Solid Waste Management will continue, with greater focus on issues such as remediation of all legacy dumpsites, where approximately 15,000 acres of land can be reclaimed through remediation of 16 crore tonnes of legacy wastes, setting up Construction & Demolition (C&D) waste plants and procuring mechanical sweepers in large cities, setting up Material Recovery Facilities and waste processing plants, and strengthening of Plastic Waste Management through focus on reuse and recycle of plastic waste and reduction in single use plastic usage, in order to achieve the ultimate vision of Garbage Free cities. Additionally, a new component has been added in this phase - that of used water management, in smaller cities (with less than 1 lakh population). Over the next 5 years, our focus will be on ensuring that no untreated used water is discharged into open lands and water bodies and significant amounts of treated waste water are reused. Parallely, we will be focusing on formalising the informal sector of waste collectors and sanitation workers by integrating them into the formal waste management chain, capacity building, especially for smaller ULBs, and sustaining the *Jan Andolan* i.e. for large scale citizens engagement

I hope that States/UTs and Urban Local Bodies (ULBs) will find these guidelines extremely helpful, to facilitate speedier implementation towards achieving the vision of "**Garbage Free**" India.

Durga Shanker Mishra

New Delhi
25TH October, 2021

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MESSAGE FROM NATIONAL MISSION DIRECTOR, SBM (URBAN)

रूपा मिश्रा
संयुक्त सचिव एवं मिशन निदेशक
ROOPA MISHRA
Joint Secretary & Mission Director
Swachh Bharat Mission - Urban

सत्यमेव जयते

भारत सरकार
आवासन और शहरी कार्य मंत्रालय
निर्माण भवन, नई दिल्ली-110011
GOVERNMENT OF INDIA
MINISTRY OF HOUSING AND URBAN AFFAIRS
NIRMAN BHAWAN, NEW DELHI-110011

Preface

The success story scripted under Swachh Bharat Mission – Urban over its 7-year journey has poised urban India for its leap into the next level of 'Swachhata'. Swachh Bharat Mission - Urban 2.0, launched by Hon'ble Prime Minister on 1st Oct 2021 on the eve of Swachhata Divas has raised the aspirations of citizens, with the ambitious vision of creating "Garbage Free Cities".

2. For time-bound realization of this vision, it was felt necessary to further streamline existing systems and processes so that States/UTs, ULBs and parastatal bodies can duly accelerate the pace of implementation. The new guidelines are based on the following principles: (a) saturation approach with inclusion and "people first" at its core – to ensure that every category of citizen is covered; (b) ease of governance – where Mission is completely technology-agnostic, with sufficient flexibility and discretion given to States/ UTs ; (c) transparency and accountability – through extensive use of digital interventions for ease of user access and real-time information flow; (d) equity – to ensure that smaller ULBs are provided with adequate opportunities to improve their cleanliness status; and (e) outcome focused – by emphasizing on capacity building and behavior change, and financial support tied to achievement of specific deliverables; to ensure that the Mission's vision is realized, within the defined time frame of 2021-26.

3. These guidelines have evolved after multiple rounds of stakeholder consultations, and incorporating their feedback. This is a dynamic document which can be supplemented from time to timebased onthe changes in ground realities. I sincerely hope that these Guidelines will constitute the bedrock to achieve the goals of SBM-U 2.0 that will in turn shape the face of urban transformation in India, and collectively, we will realise the vision of "Garbage Free Cities".

(Roopa Mishra)
Joint Secretary & National Mission Director
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New Delhi
26th October 2021

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INTRODUCTION

Provides an overview of achievements of SBM–Urban, so far, and introduces SBM Urban 2.0.

1.1 Background

The Sustainable Development Goals (SDGs) place significant emphasis on sanitation, cleanliness and hygiene. There is evidence globally that better sanitation, hygiene and cleanliness helps in effective control of various vector borne diseases, parasite infections and nutritional deficiencies. There have been studies linking cleanliness and hygiene with reduction in respiratory disorders, gastrointestinal diseases (especially diarrhea), psychological issues and allergic conditions.

Decades ago, Mahatma Gandhi said that '*sanitation is more important than political freedom*'. The launch of Swachh Bharat Mission on 2nd October 2014 by the Honb'le Prime Minister Shri Narendra Modi was a historic moment for India. It not only placed the issue of sanitation at the centre of the Government's developmental agenda, but also sent out a resounding message- through the Prime Minister's address from the ramparts of the Red Fort.

Swachh Bharat Mission (Urban) (SBM-U) had three major objectives: (a) achieving 100% Open Defecation Free (ODF) status, (b) ensuring 100% scientific Solid Waste Management (SWM), and (c) behavior change through '*Jan Andolan*', by 2nd October 2019, in all statutory towns. The outlay of the Mission was ₹62,009 crores, including GoI share of ₹14,623 crores, and minimum State share of ₹4,874 crores. Balance funds (₹42,535 crores) were to be generated through individual beneficiary contribution, PPP and other sources.

1.2 *Achievements*

This Mission has achieved significant levels of success against the above objectives, with massive engagement of citizens across all categories of society.

1.2.1 **India's journey in Solid Waste Management**: the launch of SBM-U, coupled with the promulgation of SWM Rules 2016 C&D waste rules, Plastic Waste Management rules etc, all combined to set the stage for India

to accelerate its progress on effective Solid Waste Management. Where unsightly heaps of garbage dotting the urban landscape, wreaking havoc on citizens' health used to be a common phenomenon prior to 2014, today there have been noteworthy improvements. Cities have become visibly cleaner, thanks to the fleet of more than 2.5 lakh collection vehicles that travel from door to door, collecting household and other solid waste. Source segregation of waste, which was negligible earlier, have now captured the imagination of citizens and being adopted by more and more households. An enabling eco-system has been created through policy reforms designed to encourage conversion of waste to value added products. Awareness has also been generated on critical issues such as source segregation of waste, effective management of construction & demolition waste, reduction in single-use plastic usage, etc.

The results are there for all to see. At the time of its launch, the Municipal Solid Waste (MSW) treatment capacity was 26,000 TPD of waste (18%). This has been enhanced substantially in the last 7 years, and presently, waste processing capacity stands at nearly 1 lakh TPD (70%). Door to door collection and source segregation have gone up from negligible levels in 2014 to cover 86,228 wards (97%) and 72,493 wards (85%) respectively. Economically weaker sections of society, especially women self-help group members from urban poor communities have more livelihood options, and over 90,000 informal waste workers have been formalized into the waste management value chain.

1.2.2 **India's ODF journey**: Urban India has become Open Defecation Free (ODF) under SBM-Urban: a fitting tribute to Mahatma Gandhi's vision. Not only has the sanitation objective of the Mission been fulfilled, but lakhs of citizens, especially women, have been provided dignity and safety, and significant reduction in vector borne diseases with consequent improvement in health parameters have been experienced, setting Urban India on the path of holistic cleanliness. Sanitation workers and SafaiMitras, a largely ignored section earlier, have become a key stakeholder for the Mission, with initiatives being taken to ensure safe, healthy and improved living conditions for them, and providing them with

better livelihood options, dignity and respect. In terms of tangible outcomes, all Urban areas of 35 States/ UTs have become ODF (except 1 ULB of West Bengal), i.e. 4,371 ULBs (out of 4,372) have become ODF. This has been achieved through the construction (including under construction) of 66.86 lakh Individual Household Toilets (113% progress), and 6.40 lakh seats of Community/ Public toilets (CT/ PT) (126% progress).

1.2.3 **Third party assessments & standardized protocols**: In order to sustain the ODF status and ensure that no slippage occurs, MoHUA has introduced the ODF+ and ODF++ protocols. ODF+ protocol focuses on O&M of CT/ PTs by ensuring their functionality and proper maintenance for continued usage. ODF++ protocol focuses on addressing safe containment, evacuation, transportation and processing of fecal sludge from toilets and ensuring that no untreated sludge is discharged into open drains, water bodies or in open fields. Water+ protocol helps ensure that no untreated waste (used) water is discharged into the open environment or water bodies. Till 2nd October 2021, 3,309 cities have been certified ODF+, 960 cities have been certified ODF++, and 9 cities have become Water+, through third party verification.

ODF+
ODF++
WATER+

1.2.4 **Behavior change through Jan Andolan**: SBM-U has emerged as the largest urban sanitation behaviour change program in the world and has been able to accelerate India's progress in ensuring availability and sustainable management of water and sanitation for all (SDG 6). Under SBM-U, the sanitation discourse has been brought onto the centre stage of the nation's development agenda and has helped to transform a government mandate into a '*Jan Andolan*'. Through the personal leadership and involvement of the Prime Minister, SBM has been able to put the sanitation discourse into a 'Jan Andolan', a people's movement. Massive mass media campaign, intensive outreach programs, stringent monitoring of Information, Education and Communication (IEC) fund spend, multiple stakeholder involvement including by celebrity brand ambassadors and influencers have been the pillars of its behavior change strategy. However, the major trigger for

behaviour change has been the ownership that people from the community have taken when it comes to leading and sustaining change on the ground. Through a judicious use of traditional, digital, social media campaigns and intensive interpersonal communication, SBM-U has been able to activate all categories of citizens - community volunteers, youth, students, home makers, senior citizens, celebrities, elected representatives, media and the industry. Till date, over 20 crore citizens have been engaged in the Mission, which is testimony to the '*Jan Andolan*' that has been created.

1.2.5 Innovations

A variety of innovations have contributed to the success of the first phase of the Mission, as given below.

1.2.5.1 ***Swachh Survekshan:*** An innovative survey conducted by the Ministry of Housing and Urban Affairs (MoHUA) under the SBM-U, to rank cities on various sanitation and cleanliness parameters. The survey has been successful in enthusing cities with a spirit of healthy competition towards the concept of 'swachhata'. Swachh Survekshan has now emerged as one of the largest Urban sanitation surveys in the world, with participation from crores of citizens. As on 2nd October 2021, 6 rounds of surveys have been conducted, in which Indore has been adjudged the cleanest city for four years in a row. The 7th edition has now been announced, and is set to kick-off.

1.2.5.2 ***Star rating protocol for Garbage free cities:*** The protocol, based on various SWM parameters follows a SMART framework – **S**ingle metric, **M**easurable, **A**chievable, **R**igorous verification mechanism and **T**argeted towards outcomes. The indicators include all components of SWM, viz. source segregation, scientific processing of waste, dumpsite remediation, penalties & spot fines for littering, compliance by bulk waste generators, cleanliness of drains & water bodies, plastic waste management, and managing construction & demolition waste, etc. which are critical for cities to achieve garbage free status. Till date, 6

cities have been rated as 5-star cities, 86 cities as 3-Star and 65 cities as 1-Star.

1.2.5.3 ***Citizen connect through ICT initiatives:***

• MoHUA has partnered with Google to map all public toilets on Google maps, thereby improving ease of access of sanitation facilities to citizens. Till date, more than 65,500 public toilet blocks across more than 3,100 cities are accessible through Google maps covering more than 70% of India's urban population.

• More than 2 crore citizens have downloaded Swachhata App (citizens' grievance redressal platform for all sanitation and waste management related complaints). Nearly 2.22 crore complaints have been registered and 2.08 crore complaints have been resolved with more than 90% resolution rate.

• MoHUA has deployed e-learning platform to train municipal functionaries across India. The platform hosts over 175 modules on various topics covering sanitation and waste management. More than 90,000 municipal employees and other users have actively used the platform, and successfully completed over 8.8 Lakh certifications (including 7.56 lakh certifications to govt. employees).

1.2.5.4 ***Swachhata becomes everybody's business:***

The Mission engaged with a wide variety of stakeholders, from celebrities as brand ambassadors, engaging with influencers in society, partnering with industry partners and corporate entities, as well as social entrepreneurs, citizens, students and youth, women SHG groups, homemakers and senior citizens, to make 'swachhata' everybody's business.

1.2.5.5 ***Equity, inclusiveness, addressing special requirements:***

In order to ensure that benefits of the Mission accrue to every citizen in an equitable and inclusive manner, standardized protocols were put in place. For example, the ODF+ protocol specified mandatory gender-friendly, child-friendly, divyang-friendly features to be included in every CT/PT. These protocols, along with mapping of all CT/PTs on Google maps ensured that every citizen's needs were catered to, with nobody left behind.

1.3 *Need for SBM-U 2.0*

NSSO had undertaken an impartial assessment of the Mission in 2018. In its report of the 76th Round (with theme of Drinking Water, Sanitation, Hygiene and Housing Conditions of India: July – December 2018), the study found that 98% of toilets are being used in urban areas. Further, NITI Aayog has evaluated various Centrally Sponsored Schemes, including SBM-U, in its report dated 18th January 2021. Its recommendations include the following:

a) need for continued investment in IHHLs and CT/PTs;

b) need for focusing on entire sanitation value chain for inclusive sanitation, which also includes collection, containment, treatment, disposal and recycling of faecal waste and waste water;

c) need for managing different types of solid wastes (including plastic, C&D and sanitary waste);

d) need for budgetary support for disposal of legacy waste, management of plastic waste, C&D waste.

The above recommendations suggest, inter alia, the need for Mission to continue.

Moreover, the achievements under SBM-Urban need to be sustained in the long run with creation of adequate infrastructure, and their implementation needs to be accelerated manifold.

Hence, SBM-U 2.0 is needed, with the following areas of focus:

- to achieve the vision of a "Garbage Free" Urban India, more focus is required to be given to issues such as source segregation, collection & transportation, and processing, including effective management of Construction & Demolition waste, plastic waste management including reduction in single use plastic, and remediating all legacy dumpsites;
- to sustain the ODF status and prevent slippage, there is a need to ensure that all fecal sludge and waste(used) water are safely contained, transported, processed and disposed off, so that no untreated fecal sludge or used water pollutes the ground or water bodies;
- intensified focus is required to be given to IEC and behavior change through citizen outreach and *jan andolan*, as well as capacity building and skilling of all relevant stakeholders, towards achieving the Mission's objectives.

1.4 Mission is now being extended for a period of 5 (five) years, from 1st October 2021 to 1st October 2026, as Swachh Bharat Mission (Urban) 2.0 (SBM-U 2.0), for completing the work remaining, institutionalizing 'swachh' behavior and making it sustainable. The Government of India in partnership with States/ UTs and ULBs is committed to make all cities '**Garbage Free'** under SBM-Urban 2.0 in order to contribute to the achievement of the Sustainable Development Goals (SDG) 2030, which will ultimately improve the quality of life and ease of living of urban populations, thus leading to urban transformation.

SBM–U 2.0 will be implemented by MoHUA through States/ UTs in all statutory towns (as per Census 2011, and statutory towns added subsequent to that), in accordance with these guidelines.

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OVERVIEW OF SBM-U 2.0

Sets out the overall approach for achieving the Mission's vision of creating a "Garbage Free" Urban India.

Salient features of SBM-U 2.0 including Mission components, funding pattern and guiding principles are detailed in the following sections.

2.1 Mission : Overall Vision, and Specific Objectives

SBM-U 2.0 will be implemented with a vision of achieving "**Garbage Free**" status for all cities. This will involve the following:

- all households and premises segregate their waste into "wet waste" (from kitchen and gardens) and "dry waste" (including paper, glass, plastic, and domestic hazardous waste and sanitary waste wrapped separately);
- 100% door to door collection of segregated waste from each household/ premise;
- 100% scientific management of all fractions of waste, including safe disposal in scientific landfills;
- all legacy dumpsites remediated and converted into green zones;
- all used water including fecal sludge, especially in smaller cities are safely contained, transported, processed and disposed so that no untreated fecal sludge and used water pollutes the ground or water bodies.

In order to achieve this vision, the following specific objectives are targeted to be achieved:

In order to achieve this vision, the following specific objectives are targeted to be achieved:

a) Sustainable Solid Waste Management
   i. ensuring cleanliness and hygiene in public places to make all cities clean and garbage free, with 100% scientific processing of MSW;
   ii. reducing air pollution arising out of SWM activities;
   iii. phased reduction in use of single-use plastic.

b) Sustainable Sanitation and treatment of used water
   i. holistic Sanitation, with end-to end solutions (from discharge, containment, evacuation, transportation to safe disposal of all effluents from toilets);
   ii. treatment of used water[1] before discharge into water bodies, and maximum reuse of treated used water;
   iii. eradication of hazardous entry into sewers and septic tanks, and sustaining

[1] *Henceforth, wastewater will be referred to as 'used water' in the document and in all subsequent communications.. All formal communication on wastewater management from Centre, States/ UTs and ULBs may refer to "used water management" instead of wastewater management.*

elimination of manual scavenging, through mechanization of sewer and septic tank cleaning operations;

c) awareness creation along with large scale citizen outreach to create '*jan andolan*', and institutionalize 'swachh' behavior.

d) create institutional capacity to effectively implement programmatic interventions to achieve mission objectives

2.2 Mission Components for Funding

2.2.1 Sustainable Solid Waste Management

Objective: To make all cities clean and garbage free, with 100% scientific processing of Municipal Solid Waste

The following components would be eligible for funding:

i. setting up of waste processing facilities such as *MRFs, transfer stations, composting plants*, *bio methanation plants*, *RDF processing facilities*, *plastic waste processing facilities, waste to electricity*, *sanitary landfill*, etc.

ii. procuring *mechanized sweeping equipment* and setting up *processing facilities for effective management of Construction and Demolition (C&D) waste* (in 154 cities - as per list given in **Annex 1**)

iii. *bio-remediation/ capping* of all legacy dumpsites in all ULBs

Note: No Central Government funds will be available for cost of setting up primary collection & transportation (C&T) systems, including modernization of existing systems.

2.2.2 Sustainable Sanitation

Objective: To sustain Open Defecation Free status in all Statutory towns

The eligible components for funding are (i) construction of Individual Household Latrines (IHHL), (ii) construction of Community and Public Toilet (CT and PT) seats, and (iii) construction of urinals, along with retrofitting of insanitary toilets.

2.2.3 Used water management

Objective: To ensure that no untreated fecal sludge or used water is discharged into the environment, and all used water (including sewerage and septage, grey water and black water) is safely contained, transported and treated, along with maximum reuse of treated used water, in all cities with less than 1 lakh population.

The following components would be eligible for funding:

i. desludging equipment, for scheduled and need-based desludging of all septic tanks;

ii. interception and diversion of drains (I&D) (including last mile connectivity for nearest sewer network);

iii. construction of Sewage Treatment Plants (STPs)/ STP cum Fecal Sludge Treatment plants (FSTPs) for used water treatment.

2.2.4 IEC/ BCC

Objective: To ensure awareness creation along with large scale citizen outreach to intensify 'Jan Andolan' and institutionalize swachh behavior and related set of actions, towards achieving the vision of "Garbage Free" cities

The following components would be eligible for funding:

a) National Level – A part of the overall IEC funds would be retained by MoHUA for the following:
   i. hiring of professional IEC/ BCC agency (on an outsourced basis) for developing IEC strategies, collaterals, content and tools and managing Social Media outreach;
   ii. dissemination of national level campaigns regarding various components of SBM Urban;
   iii. promotion of national level initiatives such as Swachh Survekshan, ODF+/ ODF++/ Water+ and Garbage Free certifications etc;
   iv. organisation of national level people centric events to raise advocacy for Garbage Free India.

b) State/ ULB level – the balance funds can be utilized at State/ULB for:
   i. dissemination of State/ ULB level campaigns regarding various components of SBM-U 2.0, including through interpersonal communication
   ii. empanelment and engagement of NGOs/ CBOs/ CSOs for grassroots mobilization and sensitization regarding SBM-U 2.0;
   iii. promotion of good practices at household/ individual level, collectives, RWAs, schools/ colleges, market associations etc;
   iv. organization of promotional events (such as 'plog' runs, mass triggering activity, competitions etc.) related to SBM-U 2.0.

2.2.5 Capacity Building (CB)

Objective: To create institutional capacity to effectively implement programmatic interventions to achieve mission objectives

The following components would be eligible for funding:

a) National Level – A part of the overall CB funds would be retained by MoHUA for the following:
   i. establishment of Center of Excellence (CoE);
   ii. funding Chair Professor positions in selected academic institutes and selected areas of expertise;
   iii. training of PHE officials and technical staff of MoHUA
   iv. engaging knowledge partners, empaneling and hiring professional organizations to provide handholding and capacity building support to States/ UTs and ULBs;

v. creation and maintenance of eLearning portal;

vi. hiring of technical experts and professional agencies for smooth implementation of Mission, development and maintenance of ICT initiatives, creating videos and documentation for good practices, conducting national/ international exposure visits etc;

vii. funding Innovative pilots/ Startups as identified by relevant expert committees (subject to approval of NARC);

viii. organizing workshops and lectures;

ix. procuring third party vendors for field assessments and certifications for Swachh Survekshan, ODF+/ ODF++/ Water+ protocols, Garbage Free Star Rating protocols, etc;

x. procurement of Mission Management Unit (MMU);

xi. hiring interns for supporting SBM-U 2.0 at various levels;

xii. creating and supporting digital outreach tools such as Swachhta App 2.0, Swachh Manch 2.0, etc;

xiii. skill development activities as required;

xiv. any other activity required for creating institutional capacity

b) State level- the following components would be eligible for funding:

i. procurement of Program Management Unit (PMU) at State/ UT level;

ii. procurement of vendors/ agencies for Information & Communication Technology (ICT) initiatives, carrying out gap analysis, social audits, conducting workshops, lectures, exposure visits etc;

iii. hiring young professionals and interns for augmenting their internal human resources and also integrating the youth with SBM-U 2.0;

iv. hiring of NGOs/ CBOs/ CSOs for grassroots capacity building;

v. hiring technical institutions for training of manpower at State/ UT levels.

c) ULB level- the following components would be eligible for funding:

i. hiring young professionals and interns for augmenting their internal human resources and also integrating the youth with SBM-U 2.0;

ii. procurement of vendors/ agencies for ICT initiatives, carrying out gap analysis, social audits, conducting workshops, lectures, exposure visits etc;

iii. hiring of NGOs/ CBOs/ CSOs for grassroots capacity building.

It may be noted Administrative and Office expenditure in a year should be kept as a proportion of actual expenditure / output rather than as a percentage of indicative outlay.

2.3 Duration of the Mission

The Mission will be in force for five years, from 1st October 2021 to 1st October 2026.

2.4 Mission Coverage: Cities and Target Population

All Statutory towns in India will be covered under the Mission

2.5 Mission Implementation:

Memorandum of Understanding: States/ UTs and ULBs have signed a tripartite Memorandum of Understanding (MoU) with MoHUA. This MoU represents collective intent of MoHUA, State/ UT and ULBs for creating "Garbage Free Cities", through focus on complete source segregation, complete processing of all waste fractions, including processing of construction & demolition waste, plastic waste along with phased reduction of single use plastic, and remediation of all legacy dumpsites. MoHUA, States/ UTs and ULBs shall align themselves to the roles and responsibilities as per the MoU.

2.6 Mission Strategy: Guiding Principles

Drawing on learnings from SBM-U, the following guiding principles and strategies are proposed to be adopted for implementing components of SBM-U 2.0, towards achieving the ultimate vision of a "'Garbage Free" Urban India.

2.6.1 Jan Andolan: Equity and Inclusion at the heart of 'swachhata'

a) Bringing citizens to the centre of the Mission, by engaging all categories of citizens (e.g. women and homemakers, students and youth, senior citizens and retired personnel, religious leaders, social media influencers, celebrities and brand ambassadors, SHG groups, market and other industry associations, RWAs, elected representatives, etc.);

b) All Self-help groups, especially women SHGs, either affiliated to Government programmes (e.g. NULM, NHM) or otherwise, to be used for ground level/ community level facilitations and interpersonal communication initiatives under SBM-U 2.0;

c) Women leadership to be promoted in various phases of sanitation and waste management, from planning to O&M;

d) ULBs to give special focus on sanitation and waste management needs of the urban poor (especially slum dwellers) and other vulnerable groups (senior citizens, girls, pregnant and lactating mothers, especially abled, third gender groups, migrants, homeless, construction labour etc.);

e) All infrastructure created under the Mission, be it toilets, and waste processing facilities, as well as work places to have gender friendly and divyang-friendly features, for ease of access for all;

f) All infrastructure/ assets created under the Mission to be disaster resilient.

g) Recyclers and scrap dealers (both formal and informal sectors) to be integrated into the SWM recycling value chain;

h) Continued focus on behaviour change, with focus on functional outcomes (e.g ODF sustainability, regular desludging of septic tanks, ensuring cleanliness and hygiene in public and community toilets, and source segregation of household waste);

i) Ensuring safety and well-being of sanitation workers, through

   i. Elimination of hazardous entry for sewer and septic tank cleaning through mechanization of cleaning operations, provision of protective gear/ PPE kits to sanitation workers, etc;

   ii. Setting up of helpline numbers to enable citizens to register their request/ complaints and suggestions regarding desludging of septic tanks;

   iii. Enabling social welfare benefits for all sanitation workers (formal, informal and contractual) such as life and health insurance, supporting formation of sanitation workers' collectives;

   iv. Mandatorily setting up Responsible Sanitation Authority (RSA) and Sanitation Response Units (SRUs) covering all ULBs.

   v. All categories of Sanitation workers to be given special focus through recognition as Champion safaimitras, and institutionalizing mechanisms for identifying and acknowledging their services.

2.6.2 Competition for Impact: Leveraging healthy competition among cities, with special focus on ULBs of aspirational districts

The Swachh Survekshan in SBM-Urban has demonstrated how a competitive monitoring framework can help to accelerate implementation, while also evolving into a governance tool. This approach will be continued through annual ranking survey Swachh Survekshan, for continuous monitoring and enabling agile governance for delivery of sanitation and waste management services to all citizens, including in aspirational districts.

2.6.3 Swachhata Standards

MoHUA has introduced several standardized protocols which include the ODF, ODF+, ODF++, Water+ and Star Rating Protocol for Garbage Free Cities to ensure standardized outcomes in sanitation and solid waste management across Urban India under SBM-U. These protocols have provided a standard uniform framework to evaluate cities on 'Swachhata' criteria and is acting as a guiding document for cities and city representatives. These standardized protocols (ODF+, ODF++, Water+, Star Rating protocol for Garbage

Free Cities, etc) with independent third-party assessment and certification will be continued for standardization of Mission outcomes.

2.6.4 Capacity Building

Building capacity for sustainable outcomes and aligning ULBs with Mission will be taken up in a focused manner, through:

i. Strengthening of e-Learning and other proven platforms to build institutional and individual capacities in technical as well as governance aspects;

ii. Focus on skill development in the sanitation and waste management sector.

2.6.5 Partnerships

The Mission will actively engage with all development partners, knowledge partners, sector partners and industry to leverage their support and assistance to accelerate Mission outcomes on the ground, as well as to strengthen institutional capacities in the SWM and Used water management sectors.

2.6.6 Digital Enablement

Robust ICT enabled governance, already a key feature under SBM-Urban, will be continued with intensified focus, to enable real-time monitoring of assets, to ensure their full capacity utilization, and make the Mission **digital and paperless**. It shall be mandatory for all projects and services to deploy digital tools to provide real time data on efficiency parameters in the operation phase.

2.6.7 Technology promotion, innovation and encouragement for social enterprises

The Mission will encourage adoption of locally innovated, cost-effective solutions and business models in sanitation and solid waste management by small scale and private entrepreneurs and start-ups, through investments in R&D, technology challenges, and facilitation for inclusion in GeM, in order to take forward the government's vision of an "AatmaNirbhar Bharat", and "Make in India".

2.6.8 Focus on planning:

ULBs will be required to draw up and submit various action plans, based on gap analysis, viz.

a) City Solid Waste action plans (CSWAP) including inter-ministerial convergence with Government of India programs such as SATAT (MoPNG) (refer **Annex** 2 for action plan format);

b) City Sanitation Action Plans (CSAP) for sanitation and for sewage and septage Management (refer **Annex 3A and 3B** for action plan format), including inter-ministerial convergence with Government of India program of Namami Gange (National Mission for Clean Ganga);

c) States/UTs would be required to aggregate the action plans to charter the overall journey for **Garbage Free** cities.

2.6.9 **Focus on functional outcomes and their monitoring**

A key feature of the Mission will be Outcome - based fund releases, where first and second instalments of funds of Central share will be released to States/ UTs subject to achievement of specified targets/ outcomes by States/ UTs and ULBs. The SBM-U MIS portal will be capturing ground-level data to monitor the extent to which the guiding principles are being taken forward in practice.

2.6.10 **Urban-Rural convergence**

Infrastructure projects will be taken up on cluster basis to cater to groups of neighboring ULBs and rural areas, so that common waste processing facilities are utilized efficiently.

2.6.11 **Creation of enabling environment, through:**

a) creation of Model RFPs that States/ UTs and ULBs can refer to prepare their tender documents;

b) facilitating procurement by States/ ULBs through GeM;

c) encouraging start-up ecosystem/ Public Private Partnership in the States/ ULBs: Under SBM-U 2.0, projects under PPP mode are encouraged, to invite private capital in urban infrastructure as well as to bring in private sector efficiency in delivery of urban services and O&M. It is also understood that in the current scenario, there may be a requirement for viability gap funding. For Solid Waste Management, revenue streams such as Compost from organic waste, recycled construction material from C&D waste, etc. can be leveraged, while for used water Management, revenue streams such as compost from fecal waste, sale of recycled waste water, etc. can be leveraged for PPP projects.

2.6.12 **Leveraging 15th Finance Commission Grants (both tied and untied) to achieve outcomes**

Under 15th FC, cities with 10 lakh population and above are provided with a Challenge Fund of ₹13,029 crores over a 5-year period for meeting service level benchmarks on sanitation and Solid Waste Management. Further, out of total grant of ₹82,859 crore for ULBs with less than 10 lakh population, 40% of grants are untied, while 60% is tied to national priorities including sanitation and Solid Waste Management. States/ UTs and ULBs should leverage the 15th FC grants in addition to the SBM-U funds, for meeting Mission outcomes. However, it is to be noted that 15th FC grants shall not be used by State/ UTs to meet their minimum share, as given in Table 4.5.2.

2.6.13 **Aligning with National Missions and National Priorities:**

The SBM-Urban 2.0, through its implementation components will strive to align with national priorities, Missions and programmes, a few indicative examples of which are given below:

- dust mitigation through C & D waste management would align with **National**

Clean Air Program (NCAP);

- focus on encouraging start-ups and social entrepreneurs as part of the Mission's private sector engagement strategy would dovetail with mandates of **Start-up India** & **Make In India;**
- given its intensified focus on digital enablements to accelerate Mission outcomes and citizen outreach, and integrated approach for monitoring all Mission outcomes, the Mission will be aligning with the mandates of **Digital India**, **National Urban Digital Mission (NUDM)** and **Smart Cities Mission**;
- intensified focus on capacity building with skill development at its core will be aligning to mandates of **Skill India;**
- special focus on Ganga towns and accelerating their Solid Waste Management initiatives will align with the **Namami Gange** programme;
- special focus on bio-methanation of wet waste is proposed to be undertaken in alignment with the **SATAT** programme of Ministry of Petroleum & Natural Gas;
- focus on sanitation workers and SafaiMitras to ensure their safety, well-being and improved livelihood options will align with the mandates of **Ministry of Social Justice and Welfare;**
- additionally, Mission will work to ensure that all government offices, work places and premises adhere to the standards of Garbage Free protocol, so that 'swachhata' and Garbage Free becomes everybody's business.

2.7 Overall Funding

The estimated cost of implementation of SBM-U 2.0 for its various components is **₹1,41,600 crores**. The Government of India share will be **₹36,465 crores**. The balance amount shall be contributed by individuals as beneficiary contribution, States and UTs/ ULBs/ Private Sector under PPP. Wherever private sector funding is not available, State/ UT will need to provide the necessary funds. Balance funds are to be generated through various other sources of funds including Corporate Social Responsibility (CSR) funds from public/ private sector, external assistance etc.

2.8 Mission Outcomes

The following measurable outcomes are expected to be achieved by the end of the Mission tenure:

i. All statutory towns are certified at least 3-star Garbage Free, or higher;

ii. All statutory towns become at least ODF+;

iii. All statutory towns with less than 1 lakh population become at least ODF++;

iv. At least 50% of all statutory towns with less than 1 lakh population become Water+.

स्वच्छ
सर्वेक्षण

SEWER
SEPTIC TANK
SAFAIMITRA
SURAKSHA
CHALLENGE

GARBAGE FREE CITIES
STAR RATING

MISSION MANAGEMENT STRUCTURE

Sets out the overall approach for creating a multi-level governance structure that is empowered to facilitate speed and ease of implementation, including fund release, along with adequate oversight and checks for quality .

SBM-Urban 2.0 will have a four-tier mission management structure as follows:

3.1 National Level

3.1.1 National Advisory and Review Committee (NARC)

NARC, headed by Secretary-MoHUA and comprising representatives of SBM-Grameen and other relevant line ministries will be notified by MoHUA. NARC will consist of the following members:

i. Secretary – MoHUA: Chairman
ii. National Mission Director, SBM-Urban (MoHUA): Member Secretary
iii. Joint Secretary & Financial Advisor, MoHUA: Member
iv. Advisor/ Joint Advisor, CPHEEO: Member
v. Director, NIUA: Member
vi. Members from :
   a. Ministry of Jal Shakti / Department of Drinking Water and Sanitation (DDWS);
   b. Ministry of Environment, Forests & Climate Change;
   c. Ministry of Chemicals and Fertilizer;
   d. Ministry of Petroleum & Natural Gas;
   e. Ministry of New & Renewable Energy;
   f. Ministry of Social Justice;
   g. Department of Expenditure;
   h. NITI Aayog;
   i. DAVP (Ministry of I&B);

The Chairman-NARC may, at his discretion, induct any other members based on requirement.

NARC will meet at least twice a year. The functions of NARC will be:

i. overall planning for Mission progress;
ii. reviewing and approving State/ UT action plans to achieve SBM-U 2.0 targets;
iii. advising States/ UTs to explore avenues for innovative resource mobilization of private financing and leveraging land for PPP in sanitation projects;
iv. approving installments and release of installment of funds for States / UTs by Central Government under SBM (Urban) 2.0;
v. facilitating inter-ministerial convergence for accelerating Mission progress;
vi. monitoring outcomes and performance of projects sanctioned under SBM (Urban) 2.0;
vii. any other issue which may be referred to it by the Government.

NARC may delegate, as it considers appropriate, some of the functions within prescribed limits,

to the National Mission Director (NMD) of the SBM National Mission Directorate to ensure speedy implementation of the Mission.

3.1.2 **National Mission Directorate (NMD)**

- SBM National Mission Directorate will be headed by a National Mission Director (NMD) who will not be below the rank of Joint Secretary to the Government of India;
- NMD will be the overall in-charge of all activities related to SBM-U 2.0 and will be supported by a suitable team of officers at the National Mission Directorate. Further, NMD will be Member-Secretary of NARC;
- NMD shall be supported by a dedicated Project Management Unit (PMU)/ Technical Support Unit (TSU) with adequate numbers of experts and support staff mainly on an outsourced basis. Technical support to NMD to achieve Mission objectives will be provided by Central Public Health & Environmental Engineering Organisation (CPHEEO).

3.2 **State Level**

3.2.1 **State High Powered Committee (SHPC):**

- SHPC under the chairpersonship of the State's Chief Secretary, and with members drawn from concerned departments shall be responsible for the management of SBM-Urban 2.0 at the State/ UT level;
- An indicative composition of SHPC is given below:

i. Chief Secretary: Chairman;
ii. Principal Secretary (Urban Development): Member;
iii. Principal Secretary (Public Health & Engineering): Member;
iv. Principal Secretary (Finance): Member;
v. Principal Secretary (Housing): Member;
vi. Principal Secretary (Environment & Forest): Member;
vii. Chairman – State Pollution Control Board: Member;
viii. Representative of MoHUA: Member;
ix. Mission Director of SBM-Grameen at State/ UT level: Member;
x. State Mission Director: Member Secretary;

The SHPC may co-opt/ induct any other members based on requirement.

- The SHPC will play a majorly strategic role, including oversight of regulatory compliances, and will include:
  - Planning
    i. approving overall plan for achieving SBM objectives;
    ii. planning for fund flow in the short, medium and long term;
    iii. planning for additional resource mobilization;
    iv. selection of clusters so that common infrastructure could be shared between a group of cities/ towns/ contiguous rural areas;
    v. planning for encumbrance free land to be made available for setting up necessary infrastructure.

- Review and Implementation of project progress
  i. ensuring convergence of action for sanitation and waste management in the urban and rural areas of the State and bringing about inter-departmental coordination for this purpose;
  ii. conducting independent review and monitoring during execution of projects;
  iii. ensuring timely audits of funds released and reviewing the "Action Taken Reports" on various audit reports of the mission and other similar reports.
- Capacity building of stakeholders
  i. facilitating capacity building of parastatal bodies that would help ULBs to implement used water management;
  ii. reviewing the progress of capacity building initiatives, IEC and public awareness activities under the mission.
- Miscellaneous
  i. addressing violation of norms and conditions;
  ii. reviewing legal issues, if any;
  iii. taking up any other matter relevant for the efficient implementation of the mission, or matters referred to it by the SBM National Mission Directorate.

3.2.2 State Level Technical Committee (SLTC):

For review and sanctioning of projects, there will be a State Level Technical Committee (SLTC), under the Chairpersonship of Principal Secretary – Urban Development, and State Mission Director- SBM as Convenor. An indicative composition of SLTC is given below:

i. Principal Secretary: Chairman;
ii. State Mission Director: Convenor;
iii. Pr. Secretary in charge of SBM-Grameen: Member;
iv. Pr. Secretary (PHE): Member;
v. Pr. Secretary (Finance): Member;
vi. Pr. Secretary (Environment & Forest): Member;
vii. Representative, SPCB: Member;
viii. Representative of MoHUA: Member;
ix. Representative of relevant parastatal entities.

The SLTC may co-opt/ induct any other members based on requirement.

The role of SLTC will include:

i. preparation of State action plans with annual timelines to create ULBs ODF+, ODF++, Water+, 3-star Garbage Free;
ii. helping ULBs to prepare ULB level CSAP and CSWAP for sanitation, used water and SWM for all cities covered under SBM-Urban 2.0;
iii. facilitating use of IT enabled tools and solutions for preparation of DPRs;
iv. reviewing DPRs and projects relating to Sanitation, Solid Waste Management, used water management, IEC and CB as recommended by the ULBs;
v. approving projects for uploading on Proposal Tracking System (PTS) for fund release.

It is recommended that the SHPC meet at least twice a year, or more, while SLTC meets at least once in 3 months, or more frequently, based on frequency of receipt of proposals from ULBs.

3.2.3 SBM State Mission Directorate

- The SBM State Mission Directorate will be headed by a State Mission Director (SMD) of appropriate seniority. The SMD will also function as Member-Secretary to the SHPC, and Convenor to the SLTC;
- The State Mission Directorate shall be supported by a dedicated PMU on deputation/ outsourced basis. The funding for the same can be met from the Capacity building funds under SBM-U 2.0 allotted to State/ UT.

Role of State Mission Director will include the following:

i. creating / notifying a uniform structure across the state for the planning, designing, project preparation, appraisal, sanction and implementation of sanctioned projects under the mission at the ULB level;

ii. reviewing CSAP, CSWAP for all cities covered under SBM-U 2.0;

iii. putting up consolidated State level plan (summation of all ULBs' plans) in terms of physical and financial targets, to SLTC

iv. planning for additional resource mobilization;

v. developing IT enabled tools and solutions for preparation of DPRs, or facilitate use of existing tools provided by MoHUA for DPR preparation;

vi. planning for fund flow in the short, medium and long term under guidance of SHPC;

vii. recommending proposals for release of instalments of funds for projects under the Mission;

viii. ensuring convergence of action for sanitation in the state and bring about inter-departmental coordination for this purpose as and when required;

ix. ensuring timely audits of funds released and review the "Action Taken Reports" on various audit reports of the mission and other similar reports;

x. empaneling agencies for conducting independent review and monitoring during execution of projects;

xi. technical scrutiny of DPRs received from ULBs and facilitating convening of SLTC meetings under chairmanship of principal secretary(UD);

xii. supporting Additional Chief Secretary/ Principal Secretary/ Secretary (Urban Development) in developing and placing agenda for SHPC meetings.

xiii. any other matter relevant for the efficient implementation of the mission, or matters referred to it by the SBM-U 2.0 National Mission Directorate.

3.3 District Level

- A District Level Committee (DLC) under the Chairpersonship of the District Collector will be set up at the District headquarters;
- The DLC will be responsible for overseeing all aspects of convergence between SBM-

Urban 2.0 with SBM-Grameen, while implementing the respective Missions.

3.4 ULB Level

- The Municipal Commissioner (MC)/ Executive Officer (EO) of a ULB shall be the administrative authority responsible for implementing all components of the Mission at the ULB level.
- The MC/ EO will also be responsible for smooth and seamless implementation of all Mission components.
- The responsibilities of the MC/ EO will include the following:
  - i. facilitating capacity building of Municipal staff;
  - ii. conducting gap analysis and preparation of CSAP and CSWAP;
  - iii. preparation of DPR;
  - iv. coordinating with State for getting sanctions from SHPC/ SLTC, and fund release for projects;
  - v. implementing projects in a time-bound manner, along with continuous monitoring to ensure sustained functionality;
  - vi. collection of user charges for ensuring financial sustainability of operations;
  - vii. awareness and citizen engagement;
  - viii. setting up City Sanitation Committees with participation of selected citizen representatives for periodically reviewing and monitoring efficient functioning of assets created.

Public Financial Management System - PFMS
O/o Controller General of Accounts, Ministry of Finance
Login
As the Nation celebrates
Azadi Ka Amrit Mahotsav
Let us
SING THE NATIONAL ANTHEM
Participate Now
Todays Transactions
Count: 5,42,216
Amount (Crores): 47,484
FY 2021 - 22 Transactions
Count: 85,09,20,985
Amount (Crores): 19,63,009
Know your Payments
Track NSP Payments
Get Login Details If Agency is already registered
What's New ?
Publications
Help Desk
Manage Registered Agency
Direct Benefit Transfer
Centrally Sponsored Schemes
Central Sector Schemes
Others

Public Financial Management System - PFMS
O/o Controller General of Accounts, Ministry of Finance
Login
Promotes good governance
Todays Transactions
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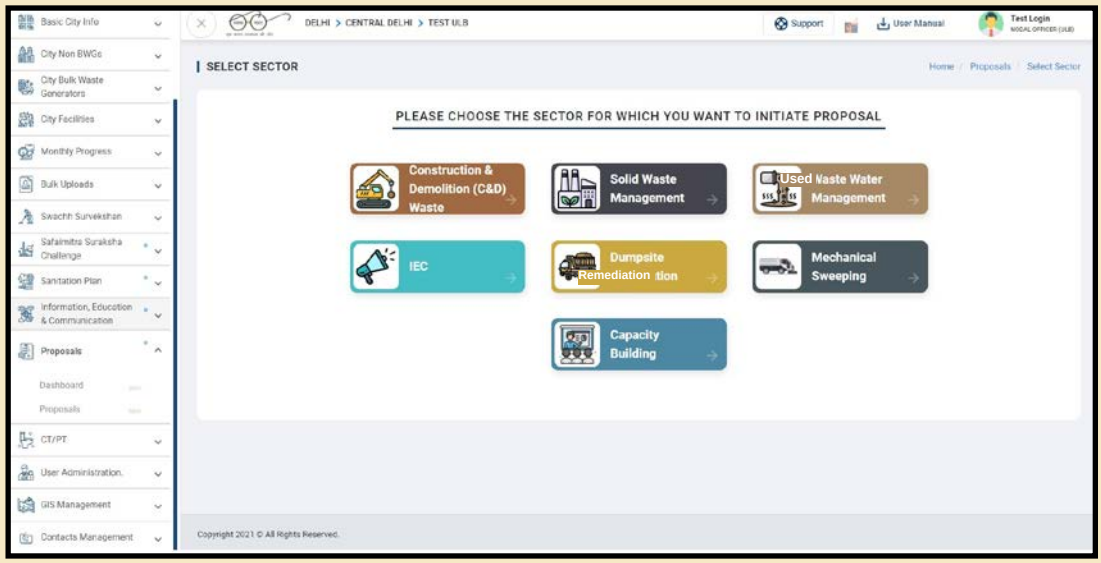
What's New ?
Publications
Help Desk
Manage Registered Agency
Direct Benefit Transfer
Centrally Sponsored Schemes
Central Sector Schemes
Others
Direct Benefit Transfer
Transferring subsidies directly to the people through their bank/Post office account is Direct Benefit Transfer. It aims to timely transfer of benefit to the citizen by bringing efficiency, effectivenoss, transparency and accountability in the Government system. Through the DBT Government intend to achieve electronic transfer of benefits, reduce delays in payments and most importantly, accurate targeting of beneficiaries, thereby curbing leakages and duplication.


DELHI > CENTRAL DELHI > TEST ULB
Support
User Manual
Test Login
SELECT SECTOR
Home / Proposals / Select Sector
PLEASE CHOOSE THE SECTOR FOR WHICH YOU WANT TO INITIATE PROPOSAL
Construction & Demolition (C&D) Waste
Solid Waste Management
Used Waste Water Management
IEC
Dumpsite Remediation tion
Mechanical Sweeping
Capacity Building
Basic City Info
City Non BWGs
City Bulk Waste Generators
City Facilities
Monthly Progress
Bulk Uploads
Swachh Survekshan
Safaimitra Suraksha Challenge
Sanitation Plan
Information, Education & Communication
Proposals
Dashboard
Proposals
CT/PT
User Administration
GIS Management
Contacts Management
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FUNDING PATTERN

Sets out the overall principles for release of funds by Centre to States/ UTs, and leveraging of 15th FC grants by States/ UTs and ULBs to augment their fund availability for various Mission components.

Fund allocation under SBM-U 2.0 to States/ UTs, along with entry conditions for ULBs to receive funding, fund sharing pattern and method of leveraging funds from other sources to fund Mission components are outlined below in this chapter.

4.1 Entry level conditions

In order to participate in SBM-U 2.0, the following entry conditions would need to be mandatorily fulfilled by States/ UTs and ULBs:

4.1.1 aligning property tax floor rates with market rates, with periodic revisions in line with GSDP, as recommended by 15th FC * (refer Note below)

4.1.2 levy and collection of user charges for services provided, to recover operational costs, with periodic increase; * (refer note below)

4.1.3 adoption of Public Financial Management System (PFMS) by all ULBs.

* **Note:** Notification of property tax floor rate by States / UTs along with its adoption by ULBs and notification of user charges to recover a component of operational cost will be made mandatory conditions for Central Assistance. The States/UTs will have to implement them in first two years from launch of continuation Mission to be eligible for Central assistance from third year onwards

For user charge collection against 4.1.2 above, ULBs may, at their discretion, cross-subsidise urban poor families and economically weaker sections, the quantum of subsidy to be decided by the ULB.

4.2 State Nodal Account (SNA) and PFMS

To receive funds under SBM-U 2.0, all transactions will have to be made through DBT and/ or EAT modules, as applicable. In this respect, revised procedure for fund release as per Ministry of Finance OM number F. No. 1(13) PFMS |FCD/ 2020 dated 23rd March 2021, or as updated from time to time, will be applicable.

4.3 Public Private Partnership (PPP)

4.3.1 Under SBM-U 2.0, projects under PPP mode are encouraged, to invite private capital in urban infrastructure as well as to bring in private sector efficiency in delivery of urban services and O&M. It is also understood that in the current scenario, there may be a requirement for viability gap funding. For Solid Waste Management, revenue streams such as Compost from organic waste, recycled construction material from C&D waste, etc. can be leveraged, while

for waste water Management, revenue streams such as compost from fecal waste, sale of recycled waste water, etc can be leveraged for PPP projects.

4.3.2 All ULBs must first explore possibility to take up the projects in a PPP mode (including cluster level projects catering to ULBs of varying population categories) for the above reasons. Government of India funds as per prescribed funding pattern will be available for claiming VGF. Payment of VGF from Central assistance will be 50% of the gap funding subject to maximum of 30% of project cost, or as could be the prevalent Central government guidelines. This could be paid in normal PPP mode or Hybrid Annuity Model (HAM) through escrow account. Government of India guidelines for financial support to PPP projects under VGF scheme can be referred for this purpose.

4.3.3 Release of VGF grants will be as per contractual arrangement with the private partner and as approved by State Government. However, it will be ensured that funds do not remain parked with the State Governments.

4.3.4 For cluster projects taken up on EPC mode, the fund release will be on pro-rata basis, depending on population category of ULBs proposed to be covered under the cluster.

4.3.5 State Governments can also add or generate funds for ULBs as additional funds over and above the minimum share prescribed for each component, required to make the projects viable.

4.3.6 Adequate funds will be released on acceptance of the proposal of the State Government for Toilets, SWM and Used water management projects.

4.3.7 States will release the Central Government share of VGF after adding their share in conformity with the contractual requirements of the project taken up on PPP mode.

4.3.8 In case State Government feels that a project is not suitable to be taken under PPP methodology, it may then consider the GoI share (as per funding pattern) to be treated as Grant from GoI to the ULB. It will be up to the State Government and ULB to arrange for the balance resources for the project, which must be ensured at the time of approving a project. Government of India guidelines for posing, implementation & monitoring of Externally Aided Projects (EAP) can be referred for this purpose.

4.4 **Allocation of funds:**

4.4.1 The mission will be implemented with the following classification of funds for various components:

S. No.	Classification	Total Amount for Mission Period (₹ in crore)
1.	Project Fund (for sanitation, SWM and Used water management)	1,25,430
	• For SWM	39,837
	• For sanitation	5,610
	• For used water Management	79,983
2.	Public Awareness & IEC Activities	6,271
3.	Capacity Building & A&OE	3,763
4.	Committed Liability (Carried over from SBM-U)	6,136 *
5.	**TOTAL OUTLAY**	**1,41,600**

** It may be noted that the 'Committed liabilities' will only be valid for release till 31st March 2023, beyond which the unclaimed amount would lapse.*

4.4.2 The funding for SWM has been decided in a manner as to leverage the investments already made under SBM-Urban in SWM, whereas for used water management, the funding has been decided keeping in view the fact that it is a new component, requiring considerable ground work to be done.

4.5 Fund Sharing

The Centre: State distribution of the Project fund will be as under:

- 90%:10% for ULBs in NE/Himalayan States,
- 100% for UTs without legislature,
- 80%: 20% for UTs with legislature,
- 25%: 75% for 10 lakh plus ULBs
- 33%: 67% for ULBs with 1 lakh to 10 lakh population (both included),
- 50%: 50% for ULBs with less than 1 lakh population

The structure of fund sharing among Centre and States/ UTs for various components are given below:

4.5.1 For IHHLs

S. No	Type of State/ UT	Central Share per unit (₹)	State/ UT share per unit (₹)
1.	UTs without legislature	4,000	1,333 (to be borne by Centre)
2.	UTs with legislature	4,000	1,333
3.	North East and Hilly States	10,800	1,200
4.	Other States	4,000	2,667

***Note:** - The estimated cost of IHHL is assumed to be ₹30,000 per unit*

4.5.2 **For CT/ PT/ Urinals/Used water management / SWM**

Sl No	Type of State/ UT	Central Share per unit * (%)	Minimum State/ UT share per unit (%)	Balance (from 15th FC funds, ULB share, pvt sector share)
1.	UTs without legislature	100	0	-
2.	UTs with legislature	80	20	-
3.	North East and Hilly States	90	10	-
4.	Other States: ULBs with population of above 10 lakh	25	16	59
5.	Other States: ULBs with population between 1 - 10 lakh (both included)	33	22	45
6.	Other States: ULBs with population of less than 1 lakh	50	33	17

4.5.3 **For IEC and CB**

Sl No	Type of State/ UT	Central Share (%)	State/ UT share (%)
1.	UTs without legislature	100	0
2.	UTs with legislature	80	20
3.	North East and Hilly States	90	10
4.	Other States	60	40

4.5.4 It is to be noted that the Central share of funds will be released in two (2) / three (3) instalments. Release clauses for each component have been detailed out in the respective chapters for each component. For IHHL, release clauses for 2 instalments are described in Section 5.1.6.1 and 5.1.6.2; for CT/PT/ Urinals, the clauses are described in 5.2.7.3 and 5.2.7.4; for SWM, the clauses are described in Sections 6.9.2, 6.9.3 and 6.9.4; for used water management, the clauses are described in Sections 7.10.2.1, and 7.10.2.2, and 7.10.2.3; for IEC, the clauses are described in Sections 8.7.3 and 8.7.4; and for CB, the clauses are described in Sections 9.16.3 and 9.16.4.

4.6 **Others**

4.6.1 The total funds allocated for IHHL, CT/ PT and Urinals will be part of a

consolidated package, with States/ UTs having the flexibility to interchange their fund requests between any type of toilet. It may be noted that 25% of the allocated amount will be kept aside as 'floating funds' at GoI for sanitation, to cater to additional funding requests from States/ UTs for additional toilets (IHHL, CT/ PT/ Urinals)

4.6.2 For the balance amounts required for all the above component, States/ UTs and ULBs will need to leverage 15th FC funds, private sector participation or any other source of funds.

4.6.3 MoHUA will endeavour to earmark at least 10% of total fund allocation for each year for NE and Himalayan States.

4.6.4 Distribution of Project Fund across States/ UTs are at **Annex 4.** The distribution is calculated on the basis of weighted average of (a) percentage of urban population of State to total urban population of India (90% weightage), and (b) percentage of area of State to total area of India (10% weightage).

4.6.5 Sanction of projects (DPR):

4.6.5.1 Projects will be sanctioned by SLTC as prescribed in these guidelines.

4.6.5.2 Only new projects will be considered under the Mission and it will be ensured that there is no duplication. Projects will be considered as "new" if they are not already sanctioned and ongoing under State and central schemes and externally-aided programmes/ projects.

4.6.5.3 For Detailed Project Reports (DPRs) to be prepared for project sanction, fund release and monitoring, the cost of DPR preparation and their vetting through empaneled agencies/ institutes for the projects under the Mission shall be reimbursed from the project funds of respective components. Cost of DPR preparation should be discovered through open competition, and subject to an upper limit as may be prescribed separately by MoHUA from time to time.

4.6.5.4 States/ UTs will be required to present their consolidated action plan for achieving all Mission components to NARC within 6 months of submitting their State vision for the specific component.

4.6.5.5 States/ ULBs are encouraged to use IT-enabled solutions for DPR preparation.

4.6.6 Emerging/ innovative solutions and technologies may be shared by States and ULBs for consideration by the Technology Evaluation Committee (TEC) for Solid & Liquid waste management set up by MoHUA. Some of these potential technologies would be extended financial support to test them on pilot basis subject to recommendations of the TEC, and approval of NARC.

4.6.7 **Amendment in nature of projects:**

4.6.7.1 The SLTC will have the flexibility to re-determine the targets for IHHLs and CT/ PTs/ Urinals, subject to State-wise overall funds envelope (sum of allocation for IHHL and CT/ PTs for the entire mission period) remaining unchanged.

4.6.7.2 Under special circumstances, States/ UTs may change nature (costing, type) of projects for which funds have already been released by MoHUA, but before actual expenditure is incurred. In order to effect such changes, the amendments of the project should be approved by SHPC and sent to MoHUA for concurrence, before the revised project is implemented.

4.6.7.3 States/ UTs may also redistribute released funds among its ULBs, subject to SHPC approval of such redistribution, and subsequent concurrence by MoHUA, before actual expenditure. This will ensure fungibility of funds and optimum utilization of resources towards achieving the Mission objectives.

TOILETS (IHHL, COMMUNITY/PUBLIC TOILETS, URINALS)

Sets out a saturation approach to ensure that every citizen of Urban India has access to safe sanitation infrastructure, along with access to safe containment facilities for fecal sludge.

5.1 Individual Household Latrines (IHHL)

5.1.1 Target Group

The target group for construction of Individual Household Latrines (IHHLs)/ Toilets is:

(i) new independent households;

(ii) all new households who might have migrated to urban areas;

(iii) all households with previous access to community toilets, who might want to have their own facility;

(iv) all households with insanitary latrines.

5.1.2 Selection of Beneficiary Households

5.1.2.1 Selection of Beneficiary Household shall be as per following guiding principles:

i. ULBs to conduct gap analysis to evaluate the number of new IHHLs required;

ii. In case a family has received funds for construction of IHHL under any earlier scheme, the same family would not be eligible to receive funds for toilets again;

iii. A ULB which has been declared at least ODF+ may also request funds under SBM-U 2.0 provided the survey reveals the need for additional IHHL units.

5.1.2.2 Eligible beneficiary households will be provided toilets under this scheme irrespective of whether they live in authorized/ unauthorized colonies or notified/ non-notified slums. Under SBM-U 2.0, tenure security issues are to be de-linked from benefits.

5.1.3 Construction & Design

5.1.3.1 Household toilets constructed will have two main structures: (i) toilet superstructure (including pan and water closet), and (ii) substructure with septic tank and soak pit (on-site treatment system), or a connection to an existing underground sewerage system. The on-site disposal system comprising of a septic tank with soak pit will be designed as per IS -2470 Pt-1 & 2 (in the event that a sewerage system is not available within 30 meters from the proposed household toilet).

5.1.3.2 Wherever a sewerage system is available within 30 metres from the proposed household toilet, only the toilet superstructure may be constructed and toilet connected to the existing sewerage system. In case there are more than one house beyond 30 meters from nearby sewer line, ULB will endeavor to connect these houses with nearby sewerage system by pooling resources

from beneficiary households including from State/ UT & ULB's shares.

5.1.3.3 All IHHL being constructed should be built in tandem with water supply arrangements in ULBs. Beneficiaries will be responsible for the operation and maintenance of the household toilets. Additionally, ULBs may explore innovative household toilet models brought out by private sector players/ entrepreneurs, as long as they meet the accepted scientific standards of safe disposal.

5.1.4 **Operation & Maintenance**

ULB will need to carry out periodic desludging of pits (as per ODF++ protocol) to prevent slippage or slide-back to OD practices.

5.1.5 **Application for IHHL**

5.1.5.1 ULB must ensure Aadhar seeding of all IHHL beneficiaries. All financial incentives (government and/ or private) for this component will be deposited directly (by electronic clearing service) into the Aadhar-linked bank accounts of the beneficiary households;

5.1.5.2 Application for IHHL may either be made through UMANG app, or through the mSBM app and uploaded online on the SBM portal. Final verification of the construction of the household toilet should be supported by location- based technologies, wherein geo-tagged photographs of the construction, along with the applicant are taken.

5.1.5.3 These photographs must be uploaded through the UMANG or mSBM app, to the SBM-Urban 2.0 MIS;

5.1.5.4 The ULB shall verify each application for genuineness of requirement before releasing any funds. Verification of the application should be completed within 7 working days of its submission by the beneficiary.

5.1.6 **Fund Release Mechanism for IHHL** (as mentioned in section 4.5.4)

5.1.6.1 50% of the Central Government funds will be released to the State/ UT as 1st instalment, on fulfilment of the entry conditions given in Section 4.2, and following additional condition:

- ULBs to upload their latest progress data on the MIS portal.

5.1.6.2 The remaining 50% of Central Government funds as 2nd instalment shall be released to the State/ UT, along with fulfilment of following conditions:

- Documentary evidence of 50% completion of construction target (State/ UT level);
- State has expended 75% of State/ UT share;
- UC submitted by State / UT for 75% of first instalment released.

5.1.6.3 States/ UTs to invite private sector funds/ CSR to the maximum extent possible for any additional IHHL that may be required.

5.2 Community Toilets (CTs)/ Public Toilets (PTs) & urinals

5.2.1 Target Group

While CT/ PTs and Urinals have been constructed under SBM-U, it is expected that there will still be some households which are at considerable distances from the nearest CT. Higher influx of floating population is also expected in Urban areas. Hence, additional number of CTs, PTs and Urinals will be targeted for construction under SBM-U 2.0 for better accessibility and functionality, even if ULB is at least ODF+ certified. In this context, it may be noted that ULBs should prioritise IHHL access for all households, and only in cases of land constraints should CTs be provided, with seats earmarked for selected families so that they the families feel a sense of ownership and maintain them as their own.

5.2.2 Location of CTs, PTs, Urinals

5.2.2.1 ULBs will need to identify all possible Open Defecation/ Open Urination vulnerable points (yellow spots) ("OD/ OU hot spots") and make provisions for adequate numbers of CTs/ PTs and Urinals at easily accessible distances, which in turn will lead to elimination of hotspots.

5.2.2.2 **ULBs should ensure that:**

i. every household dependent on CTs has access to one within a maximum distance of 500 metres from their homes, and

ii. every public place (bus stops, petrol pumps, metro stations, market places, religious and tourist locations, health centres, citizen centres) has at least one PT/ Urinal available within 500 metre distance, and that the facilities are kept clean, functional and open for public use.

5.2.3 Aspirational toilets

ULBs will have to provide additional **PTs** in **all tourist destinations/ places with high footfall/ iconic cities/ religious destinations, etc**. It is suggested that these additional PTs be made in "aspirational category", with the following indicative features:

a) Walls and floors are clean and stain / graffiti free

b) Low height toilets/Indian toilets and basins for children

c) Plants / shrubs in the vicinity of toilet complex are well maintained

d) Space earmarked for advertisement for revenue generation

e) Hand dryer / paper napkin available

f) Ladies' toilets have vending machine for sanitary napkins

g) Incinerator facility available for disposal of used sanitary napkins for toilet having > 10 seats

h) Toilet identification number, name of ULB under which jurisdiction toilet is covered, ward number and maintenance authority prominently displayed for each toilet block

i) SMS based feedback with number displayed on which SMS has to be sent

Annex 9 details out all the features that are required for a toilet to be as "aspirational toilet".

5.2.4 Central assistance as per the norms outlined in paragraphs 5.2.5.2 & 5.2.5.3 below will be provided for such PTs. ULBs will be required to indicate the additional footfall expected at these tourist locations while preparing the DPRs for fund release.

5.2.5 **Construction & Design**

5.2.5.1 Care should be taken to ensure that all CT/ PT/ Urinals being constructed under SBM-U 2.0 are built in tandem with water supply arrangements of the ULB. These facilities should also have adequate provision for separate toilets & bathing facilities for men, women, transgenders, and the disabled, as provided in the ODF+ protocol.

5.2.5.2 CT/ PT blocks will consist of a given number of toilet seats (as per requirements), toilet superstructure including the pan and water closet, and a substructure (either an on-site treatment system, or a connection to underground sewerage system) shared by all the toilet seats along with facilities for hand wash.

5.2.5.3 The norms for connection of the superstructure to an on-site system or connection to an underground sewerage system as defined in paragraph 5.1.3 above will apply here.

5.2.6 **Operation & Maintenance**

There should be a digital system for capturing user feedback on a regular basis, multiple times per day, for each CT/ PT, with each feedback tagged to a unique user ID. Additionally, the Swachhata App may be used to provide feedback/ register complaints regarding poorly maintained or non-functional CT/ PTs.

5.2.7 Fund Release Mechanism for CT/ PT/ Urinals (as mentioned in section 4.5.4)

5.2.7.1 Central government funds for the construction of CT/ PT seats & Urinals will be in the following form:

- 90% for ULBs in NE/ Himalayan States,
- 100% for UTs without legislature,
- 80% for UTs with legislature,
- 25% for 10 lakh plus ULBs,

- 33% for ULBs with 1 lakh to 10 lakh population (both included),
- 50% for ULBs with less than 1 lakh population

5.2.7.2 The unit cost of CTs/ PTs will be calculated at ₹1,50,000 per seat, and at ₹2,50,000 per seat for aspirational PTs, while base unit cost of Urinals will be calculated at ₹32,000 per seat wherein the VGF/ Grant will be as per the proportions given in paragraph 5.2.5.1 above. ULBs may also provide mobile toilets or eco-friendly toilets for use as CT/ PTs.

5.2.7.3 The **1st instalment** of 40% of allotted Central share from MoHUA will be released to the State/ UT provided the entry conditions specified in Section 4.2, and following additional conditions are satisfied:

- City Sanitation Action plans (CSAP) Part 1 (approved by SLTC) along with gap analysis;
- ULB to upload their latest progress data on the MIS portal
- declaration from Municipal Commissioner/ EO of ULB that all existing CTs/ PTs & Urinals in the ULB are fully functional, with provision for water;
- SLTC approved & complete proposals for a city (based on gap analysis), along with O&M plans for at least 5 years for maintaining functionality of CT/ PT;.
- ULB has provided for encumbrance free land for construction of the CT/ PT complexes and Urinals.

5.2.7.4 The **2nd instalment** of 60% of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the following conditions are satisfied:

- Documentary evidence of 30% completion of construction target;
- UC for 75% of first instalment fund released;
- State has expended 75% of its allotted share;
- City has been certified as ODF+ (or above) at least once.

5.3 Expected Outcome

It is envisaged that at the end of the Mission, all ULBs will become ODF+.

SOLID WASTE MANAGEMENT

Sets out the overall approach to be taken by ULBs to put in place systems and processes to ensure that Urban India becomes Garbage Free.

6.1 Municipal Solid Waste and its management

Approximately 1,32,000 Metric Tonnes of MSW is generated from all urban areas of the country, which translates to about 300-550 grams per person per day. The waste generation is higher in larger cities and lower in smaller cities. The general trend of per capita waste generation is as follows:

S. No.	ULB Population Class	Typical Per Capita Waste Generation (in grams)
1.	>10 Lakh	550
2.	1 to 10 Lakh	450
3.	< 1 Lakh	300

6.1.1 Components of MSW Management:

The table below gives a tabular depiction of various components of Solid Waste management systems:

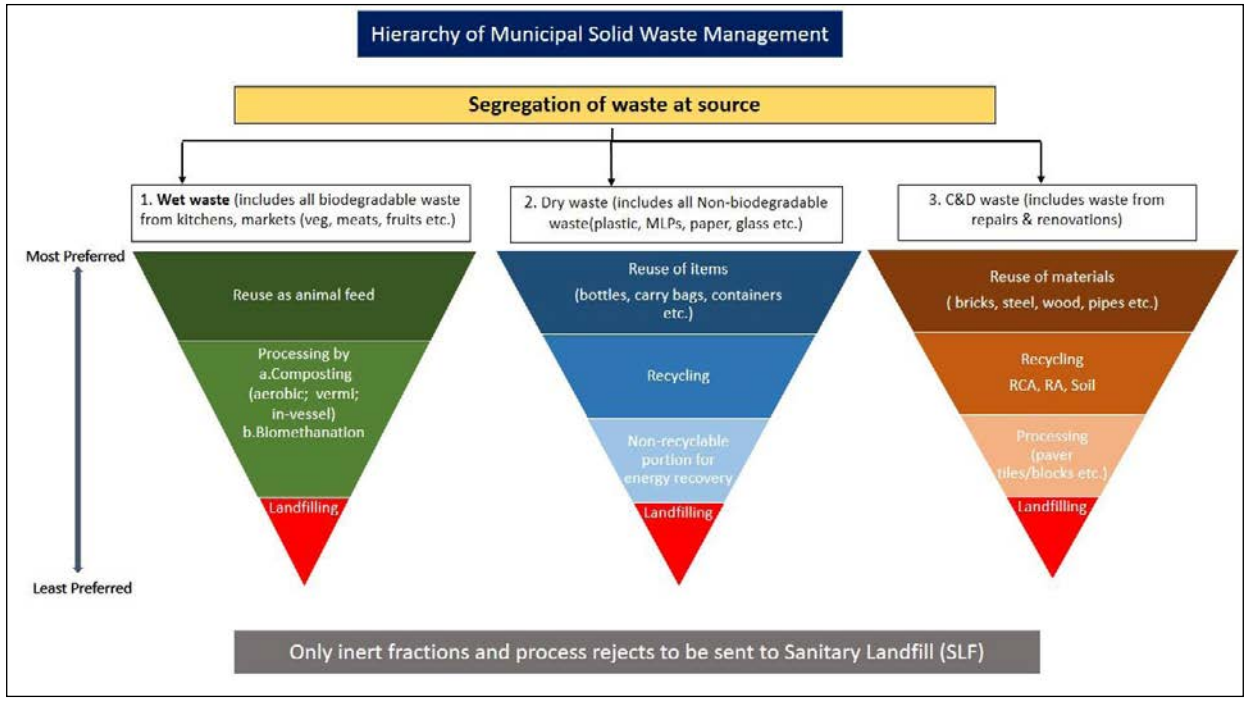
S. No.	Components	Description
1.	**Source Segregation**	Source Segregation of waste at the place of its generation in following categories is fundamental to MSWM: • Biodegradable wastes (wet waste - food waste, fruits & vegetables and parts thereof, meats, etc.), • Non-biodegradable wastes (dry waste - plastics, paper, cardboard, rags, glass, metal, wood and inert waste, etc.) • Sanitary waste and disposables thereof • Domestic hazardous wastes (such as aerosol cans, paint material, discarded medical supplies etc.) • Construction & Demolition waste • Generators of E-waste (including fluorescent and mercury containing bulbs & lamps) shall not mix e-waste with any other waste but deposit the same at e-waste collection centre
2.	**Door to Door Collection**	Collection of solid waste from the door step of households, apartments, housing societies, shops, commercial establishments, offices, institutional or any other non-residential premises, including collection of such waste from entry gate or a designated location on the ground floor in a housing society, multi storied building or apartments, large residential, commercial or institutional complex or premises;
3.	**Separate transportation**	Transportation of the segregated waste collected from source premises in specially designed, partitioned and covered transport vehicles, to the respective processing facilities.
4.	**Waste Processing**	Processing of different fractions of MSW i.e. dry, wet, C&D and plastic as per Solid Waste Management Rules 2016. Processing is to be done differently for different categories of waste.

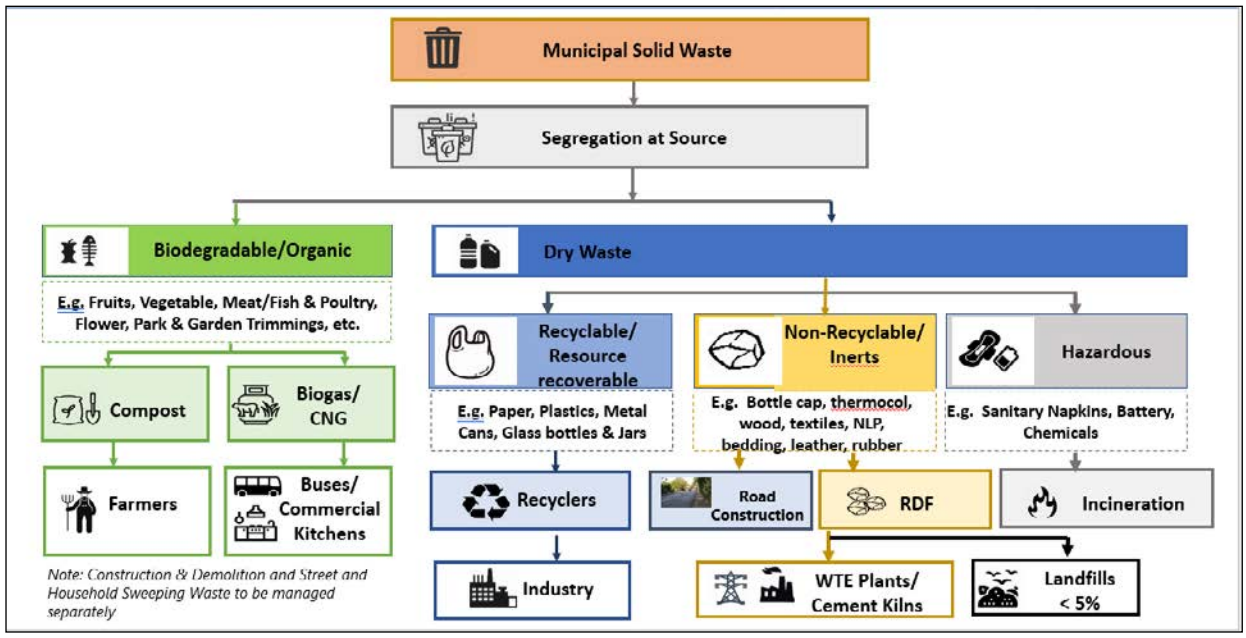
S. No.	Components	Description
4(i).	**Wet Waste**	1. Home / Family sized Decentralized Composting Community /larger Decentralized (Less than 5 TPD) composting facilities 2. Centralized composting facilities (More than 5 TPD) 3. Bio-methanation - most suited for segregated wet waste like food waste from hotels/restaurants, and waste from dairy, vegetable market, meat/fish markets, mela waste etc.
4(ii).	**Dry Waste**	1. Material Recovery Facility (MRF) is a facility where non-compostable solid waste can be temporarily stored and processed by authorized agencies for further segregation, sorting and recovery of recyclables/non-recyclables/inert such as segregation of plastic, glass, metal, paper, clothes etc. The recyclable fraction like plastics and metals are to be sent to authorized recyclers. 2. The non-recyclable/ combustible waste is to be sent to Waste to Energy plant/ Cement Kilns as Refuse Derived Fuel (RDF). i. Incinerators: Sanitary napkins and Diapers are to be separated, specially marked and sent to a bio-medical waste/ waste to electricity plant for incineration. ii. Waste to Electricity plants: The combustible fraction of waste out of MRF/ Processing Facilities which is non-recyclable and has calorific value of 1,500 Kcal per kg and above can be used in waste to electricity plants.
4(iii).	**Sanitary Landfill**	Only the inert waste (mostly from street sweeping) and process rejects (in no case should this exceed 20% of total waste) which are not suitable for any of the above dry and wet waste treatment processes can be sent to sanitary landfills. It is recommended that SLFs are set up as separate business entities levying tipping/ gate fee as per the quantity and quality of waste received at the facility. Free use of SLF / LF may not be allowed, to increase the processing & recycling efficiency by the ULBs and its contractors.

S. No.	Components	Description
4(iv).	**C&D Waste**	Construction & Demolition (C&D) waste is generated whenever construction/ demolition activity takes place such as building roads, bridges, highways, flyovers, subway and redevelopment of old structures. It consists mostly of inert, non-biodegradable material such as concrete, soil, steel, wood & plastics, bricks & mortar etc. C&D waste is sorted into different streams and sent to C&D waste processing plant.
5.	**Bulk Waste Generators**	All Bulk waste generators have to manage their own wet waste and also make own arrangements for dry waste management.
6.	**User Fee**	Suitable User Fee and relevant penalty provision needs to be notified by all ULBs as per Rule 15 (ze) (zf) of SWM Rules 2016 on the lines of advisory circulated by MoHUA.

6.1.2 Hierarchy and Process Flow of Municipal Solid Waste Management:

The basic principles involved in scientific solid waste management are given below which is called the Hierarchy of Integrated Solid Waste Management (ISWM).





Process Flow of Municipal Solid Waste Management

6.2 **General Principles for Designing of Waste Processing Facilities:**

6.2.1 The composition of Municipal Solid Waste in India is as follows:

- Organic / compostable fraction: 40 – 60%;
- Recyclable/ Resource Recoverable fraction: 20 – 30%;
- Non-Recyclable/ Combustible (RDF): 10 – 20%';
- Construction & Demolition (C&D) waste & unusable combustible: 5 – 15%.

6.2.2 **City Solid Waste Action Plan (CSWAP):**

The vision of SBM 2.0 for scientific MSWM is that cities will ensure segregation of waste at source, process waste in segregated fractions, recover resources and recycle to the maximum extent and minimize landfilling to 20% or less (including reject material coming out of processing). Cities must be seen to be clean 360°, duly remediating the legacy dumpsites. Further, Cities with non-conforming air quality need to replace the common manual street sweeping with air quality friendly mechanical sweeping and process the C&D wastes as well.

6.2.2.1 As a first step in fulfilling the vision, ULBs will prepare the CSWAP duly identifying the projected waste generation, segregation as wet and dry

waste, the available processing capacity and the gap thereof. The CSWAP should also capture the gaps in dumpsite remediation, mechanical sweeping and C&D waste processing facilities. Funds will be available for addressing the assessed gaps.

6.2.2.2 Cluster of ULBs can also be considered for creation of common infrastructure, keeping in mind the techno-commercial viability. For ULBs with population of more than 3 lakh (including ULB clusters), it is recommended that the wet waste will be processed using Bio-methanation, to produce biogas/bio-CNG for higher economic returns.

6.2.3 CSWAP will identify sanitary landfills (SLFs) which shall be set up preferably on cluster model. In order to ensure economies of scale and operational efficiency, State/ UTs may encourage creation of common infrastructure to cater to a group of small ULBs and their surrounding rural areas (in convergence with SBM-Grameen), including shared O&M of the infrastructure. In this SLF matter, the "one-district-one-operator" approach may also be considered.

6.3 The templates of CSWAP for various funding components of SWM is at Annex 2. The targeted outcomes of scientific MSWM will also be brought out in the CSWAP such as:

- timelines for implementation of required infrastructure
- timelines for achieving stages of Star Rating under GFC protocol. A minimum 3 Star Rating will be achieved before the end of mission.

6.4 As achieving the mandatory GFC 3 Star Rating is linked to the creation of required infrastructure identified in the CSWAP, Cities and States /UTs need to examine strategic implementation plans. Bottlenecks such as land and environmental clearances need to be taken up in parallel with administrative and financial approvals so that the grounding of project works is not delayed. States/ UTs may develop a matrix of implementation issues for all their ULBs and select ULBs for their annual Action Plans which will mature to immediate implementation.

6.5 SBM 2.0 interventions in MSWM envision discrete project categories such as (i) MSW processing plants (ii) Legacy Dumpsites Remediation (iii) C&D Waste Processing plants (iv) Mechanical Sweepers and (v) SLFs which can be implemented simultaneously as independent projects, and also have vastly different implementation characteristics and different sets of vendors/contractors. Cities and States/ UTs need to link such different implementation

factors into their Annual Action Plans. Considering these factors, the State / UT SBM Urban Mission Directorates are advised to prepare immediately ULB-wise CSWAPs and the corresponding implementation schedules.

6.6 Cities and States/ UTs can also develop implementation strategies responsive to the annual Swachh Survekshan to improve their rankings therein.

6.6.1 CSWAPs prepared duly incorporating the planned phasing of different modules will be the input for State/ UT Annual Action Plan and will be part of the proposal taken to SHPC for approval. State SBM Urban Mission Directorate will combine all CSWAPs and furnish the State Action Plan for achieving the mandatory 3 Star Rating of all ULBs in the State, spread across the 5 years of Mission. The State/ UT Annual Action Plans covering all ULBs will be approved in the first three years of mission, leaving a cushion of two years for implementation of outputs and achieving the mandated outcomes.

6.6.2 CSWAPs will also identify sanitary landfills (SLFs) which shall be set up preferably on cluster model. In order to ensure economies of scale and operational efficiency, State/ UTs may encourage creation of common infrastructure to cater to a group of small ULBs and their surrounding rural areas (in convergence with SBM-Grameen), including shared O&M of the infrastructure. In this matter, the "one-district-one-operator" approach may also be considered. Relevant CSWAPs will be part of the proposal taken to SLTC for approval. State SBM Mission Directorate will combine all CSWAPs and furnish the timeline for achieving the mandatory 3 Star Rating of all ULBs in the State, spread across the 5 years of Mission.

6.6.3 ULBs are to prepare DPRs for Solid Waste Management in consultation with State Governments, in compliance with MoHUA checklist (**Annex 6**). Smaller cities can be formed into clusters to become viable entities for economies of scale and to attract private investment. State Governments may handhold ULBs in preparing DPRs for SWM by engaging agencies/ institutions for this purpose. The DPRs should be ideally bankable, having a viable financial model. DPRs should be aligned with the guiding principles, SWM Rules 2016, CPHEEO Manuals and MoHUA Advisories.

6.6.4 Co-processing - Cement plant / RDF: For RDF produced from non-recyclable fraction of dry waste, the first priority should be given to using it in nearby

cement plants or other similar industries (as alternative fuel).

6.6.5 It is stressed that waste to electricity projects are financially and operationally viable only with assured input of minimum 150 – 200 tonnes per day (TPD) of non-recyclable, high-calorific value segregated dry waste (RDF). Ideally, only ULBs with population of 10 lakhs and above (individually or in cluster) may opt for waste to electricity projects. While approving Waste to Electricity projects, ULBs are advised to ensure adequate quantity of waste/ RDF of specified calorific value. In this respect, ULBs may refer to the waste processing flowchart given under para 6.1.2 for recommended processing options for various waste fractions.

6.7 State Government can engage qualified institutes/ organizations for the technical and economic appraisal for project DPRs recommended by ULBs.

6.8 **Governance and Administrative provisions:**

i. While considering projects under SWM, it will be ensured that there is no duplication in terms of funding under any other scheme or programme.

ii. States/ UTs shall be free to choose the technology for SWM projects. MoHUA would be technology-agnostic as far as project funding is concerned, subject to overall allocation for State/ UT.

iii. MoHUA shall, from time to time, bring to the notice of the States/UTs, through Advisories and Manuals, and other consultative mechanisms, various technology options available in the field.

iv. States/ UTs and their ULBs are recommended to use the GeM (government e-market place) portal for procuring waste management equipment.

v. The State Governments are recommended to put in place a single-window clearance system for SWM projects for ease of setting-up of facilities in timely manner and encourage private sector participation.

6.9 **Funding mechanism for the SWM projects** (as mentioned in section 4.5.4)**:**

The GoI contribution for setting up MRFs, transfer stations, waste processing plants (including C& D waste processing plants), procurement of mechanized sweeping equipment and bio-mining of legacy dumpsites shall be as follows:

- 90% for ULBs in NE/ Himalayan States
- 100% for ULBs in UTs without legislature

- 80% for ULBs in UTs with legislature
- 25% for other 10 lakh plus ULBs
- 33% for other ULBs with 1 lakh to 10 lakh population (both included)
- 50% for other ULBs with less than 1 lakh population

6.9.1 Components that can be funded include the following (as given in section 4.5.4):

i. In all statutory towns:

- Setting up of waste processing facilities such as MRFs, transfer stations, composting plants, bio methanation plants, RDF processing facilities (for ULBs with 5 lakh population and above), plastic waste processing facilities, waste to electricity, sanitary landfill, etc.
- Remediation and land recovery of legacy dumpsites

ii. In 154 ULBs (NCAP cities +> 5 lakh population ULBs as per list given in **Annex 1**)

- Procuring mechanized sweeping equipment.
- Setting up processing facilities for effective management of Construction and Demolition (C&D) waste.

6.9.2 The **1st instalment of 40%** of allotted Central share from MoHUA will be released to the State, provided the entry conditions specified in Section 4.2, and following additional conditions are satisfied:

- SLTC approved CSWAP for respective modules (viz. C&D, Mech. Sweeping,

  Legacy dumpsites, MRF+waste processing) and action plans for respective component submitted;
- Receipt of SLTC approved proposals for a city along with O&M arrangements for at least 5 years, and its funding arrangements;
- Land identified & earmarked for setting up SWM facility/ facilities.

6.9.3 The **2nd instalment of 40%** of allotted Central share from MoHUA will be released to the State, provided the following conditions are satisfied:

- UC submitted for 75% expenditure of Central and State share of first instalment;
- Physical progress of at least 25% should have been completed in each of the sub components (such as processing plants, MRFs, SLFs, legacy dumpsite remediation, etc.)

- Receipt of documentary evidence of completion of construction of SWM facilities and their functionality with funds received under SBM-U earlier.

6.9.4 The **3rd instalment of 20%** of allotted Central share from MoHUA will be released to the State, provided the following conditions are satisfied:

- UC submitted for 75% expenditure of Central and State share of second instalment
- City is at least 1-star certified as per Star Rating Protocol for Garbage Free Cities, and is segregating at least 60% of its municipal solid waste at source;
- Physical progress of at least 60% should have been completed in each of the sub components (such as processing plants, MRFs, SLFs, legacy dumpsite remediation, etc.)

6.10 **Outcomes (in all statutory towns):**

i. 100% Door to Door collection;

ii. 100% source segregation of MSW;

iii. 100% waste processing (in separate fractions of Wet , Dry, C&D waste);

iv. Safe, quantified and scientific disposal of inert waste and processing rejects to Scientific Landfills;

v. Legacy waste in dumpsites is remediated;

vi. C&D Waste management in all 154 non-attainment cities under Nation Clean Air Program (NCAP) and remaining cities >5 lakh population is achieved;

vii. All cities achieve at least 3-Star Garbage Free rating.

USED WATER MANAGEMENT

Sets out the overall approach to be taken by ULBs to put in place systems and processes to ensure that no untreated waste/used water is discharged into water bodies, along with reuse of treated used water.

7.1 Used water management

In the current scenario in India, only 40% of urban population have access to sewerage system, while the remaining 60% is dependent on unregulated on-site sanitation systems.

In the first phase of SBM (U), there were no funds earmarked for waste water management for towns. Based on learnings from the seven years, used water management for towns less than 1 lakh population has been newly added as a component under Swachh Bharat Mission-Urban 2.0 and Govt of India's AMRUT 2.0 Mission has funds earmarked for used water treatment including Faecal Sludge management, for cities with more than 1 lakh population.

Some basic definitions & terms used under this chapter are as given below for ready reference.

7.2 Components of Used Water Management Systems

The table below gives a tabular depiction of various components of domestic used water management systems:

S. No.	Components	Description
1.	**Sewage (Used Water)**	Used Water comprises of the following two components: **Grey Water** from kitchens, bathrooms, wash basins etc. **Black Water** from toilets & urinals. These may sometimes be mixed with other municipal flows such as surface water and storm water.
2.	**Generation of Domestic Used Water**	***Generation of Domestic Used water:*** GOI/States/UTs endeavor to provide 135 Litres per capita per day (LPCD) of potable water through various Missions/ programmes. Of this, 80% (108 LPCD) is expected to be generated as used water.
3.	**Management of Used Water**	**Management of Used Water** includes collection, conveyance, treatment & recycling/ disposal of all the above stated flows.

S. No.	Components	Description
4.	**Collection**	Grey water from kitchens, bathrooms, wash basins etc. and black water from toilets shall be collected and let into the nearby sewer (i.e off-site sanitation system) or into the onsite sanitation systems (septic tanks with soak pits)
5.	**Conveyance**	
5.1.	**Off-site System**	Offsite System consists of sewage conveyance and treatment at STP
5.1.1	**Interception & Diversion drains**	This is a system of intercepting & collecting sewage from municipal drains (where sewer network is absent) and to divert it to STP for treatment.
5.1.2	**Sewer network**	Sewer network consists of continuous pipes laid underground, mostly along roads, to collect sewage from households and other establishments. Central portion of city area often characterized by high population density is designated as Core Sanitation Zone (CSZ) which is suitable/ viable for laying of sewer network. The outskirts of a city often characterized by sparse population density is designated as fringe areas. These areas are often based on on-site sanitation system, as laying of sewer network is often unviable.
5.2.	**On-site System**	Onsite treatment system (OTS) is a privately owned and maintained sewage disposal system (other than municipal body) that treats used water and produces partially treated water. However, some packaged onsite sewage treatment systems are also available.
5.2.1	**Septage (from septic tanks with soak-pits)**	In on-site systems, the fecal sludge and black water is accumulated in septic tank and soak pit, situated within the premises. Periodically, specialized collection vehicles will be used for desludging the septic tanks and transporting the same for treatment.
6.	**Treatment**	Sewage is treated in STP and faecal sludge can be treated either at STP or STP-cum-FSTP or standalone FSTP. Further, the treatment may be centralized or decentralized treatment.
6.1.	**STP**	**Sewage Treatment Plants (STP)** are used for treatment of used water coming out from Domestic, Commercial, institutional establishments etc.

S. No.	Components	Description
6.2.	**Faecal Septage Treatment Plants (FSTPs)**	**Faecal Septage Treatment Plants (FSTPs)** are used for treatment of faecal septage being periodically removed from septic tanks of domestic, commercial, institutional establishments etc. to maintain their efficiency.
6.3.	**STP-cum-FSTP**	Septage can be economically treated at STPs with certain minor modifications saving CAPEX, OPEX & land requirement.
7.	**Recycle/ Disposal**	The treated used water may be used by ULB either for self-consumption, or sold, for the following purposes: 1. Non-potable purposes like flushing toilets, gardening etc. 2. Agricultural purposes 3. Horticulture purposes 4. Industrial purposes 5. Municipal purposes like dust mitigation, road washing, construction activity, etc. 6. Water body rejuvenation It is targeted to recycle and reuse at least 20% of treated used water for above mentioned purposes.
8.	**User Fees**	Suitable user fees matching the cost of sewage management to be levied ensuring long term sustainability and assured service delivery. Levied user charges should be sufficient to recover fully/ partial O&M cost for running the facility uninterruptedly. Along with user charges, suitable penalty provisions to be notified in ULB bylaws.

7.3 Used water as new component under SBM-U 2.0

SBM-U 2.0 provides funds to address the issue of used water management including the safe containment, transportation and disposal of faecal sludge and septage from toilets, for cities with population of less than 1 lakh. It will help to holistically manage approximately 13,000 MLD of sewage generated from the notified Class II - VI towns of the country, as shown in Table 7.1:

Class of Cities based on Population		No. of Cities*	Total Population @ 2011 Census [in crore]	STP capacity reqd (in MLD) (after adjusting for 23% decadal growth of population)	Average capacity (in MLD)
Class II	**50,000-99,999**	535	3.65	4,498	5.5
Class III	**20,000-49,999**	1,439	4.46	5,494	3.5
Class IV	**10,000-19,999**	1,233	1.2	2,826	.70
Class V	**5,000-9,999**	541	.43		
Class VI	**<5,000**	153	.05		
Total		**3,901**	**10.42**	**12,818 (approx. 13,000)**	

***- For purpose of estimation, Census 2011 figures are considered with suitable population projections. However, all Statutory towns will get funding support from SBM (U).**

7.4 Objectives

Inclusion of used water management component under SBM-U 2.0 will help to achieve following two objectives:

i. all used water is safely collected, treated and reused to feasible extent and no untreated used water is discharged into water bodies or the open environment;

ii. all faecal matter and septage is properly collected, treated and by-products reused.

7.5 Focus Areas under used water management

To achieve the objective of treating used water before discharge into water body/ overland, the following will be the major areas of focus under SBM 2.0, and will be eligible for Central share of funding:

i. setting up of Sewage Treatment Plants (STPs)/ STP-cum-FSTP;

ii. laying Interception and Diversion (I&D) structures including provision of pumping stations and pumping main/gravity main upto STP;

iii. procuring adequate numbers of septic tank desludging equipments;

iv. deploying Digital (IT enabled) tools for real time monitoring of efficiency parameters during the operational phase of STPs and allied equipments.

7.6 Project components eligible for funding

7.6.1 Used Water Project Components eligible for central funding

The project components to be funded by GOI is given below.

1. **Sewage Treatment Plant:** State/ULB will be free to adopt any proven technology, as brought out in the CPHEEO Manual/MoHUA Advisories from time to time. However, for smaller ULBs, nature-based technologies in suitable combinations may be adopted. Relevant components for integration of septage treatment at STP such as desludging ramp, screens, solid/ liquid separation chamber, pumping etc, will be admissible components for Central funding as part of STP.

2. **Interception and diversion drains/ outfall sewer/ trunk main sewer**: Interception and diversion drain component is eligible for funding for conveying municipal dry weather flow upto STP/ STP cum FSTP through an outfall sewer/ trunk sewer from existing/ upcoming sewer network leading to the Sewage treatment facility.

3. **Sewer & Septic tank cleaning machines**

Desludging/ cleaning equipments will be eligible for funding provided that SLTC confirms that (a) the Private Sanitation Service Operators (PSSOs) are unlikely to be available to undertake this task at the particular ULB and (b) the State/ ULB will be engaging operators on contract to run them.

7.6.2 Used Water project components to be fully funded by States/ULBs

1. **Sewer Network**- The entire cost of sewer network being set up in the towns to be borne by the State/ UT & ULB including those of tied 15thFinance Commission(FC) Grants. The arrangements in terms of funds and timelines need to be delineated and explained to SLTC while sanctioning of projects and also communicated to the National Mission Directorate, at the time of claiming central share of funds for STPs/ STP cum FSTP and I&D infrastructure in any town. It is expected that each ULB will use 15th FC tied Grants/ SFC Grants and their own resources to suitably convey sewage from the households through sewer networks to ensure robust and environmentally conscious sanitation approach. As an interim arrangement due to fund constraints or any other reasons existing and improved municipal pucca drains could be used as means of conveyance. Use of tied 15th FC grants towards development of sewage conveyance network would be monitored by Ministry in accordance with 15th FC guidelines.

Further, to promote planned urbanization with requisite basic services, it is advised that in new green field developments in and around towns, provision of sewerage network along with decentralized sewage treatment facilities should be ensured. This will avoid construction of individual septic tanks and soak pits.

2. **Strengthening of Municipal Drains**

As an interim arrangement, till sewers are laid in town, strengthening of drainage networks is to be taken up and intercepted into existing/ upcoming sewer network, wherever feasible, or brought to I &D point from where, sewage/ sullage can be conveyed to STP/ FSTP cum STP.

As in the case of sewer network, the arrangements being contemplated in terms of funds including tied 15th FC Grants and timelines need to be delineated and explained to SLTC, while sanctioning of projects, and also communicated to the National Mission Directorate, at the time of submission of funds request towards STPs and I&D infrastructure. As explained above, in this case also funds mobilized out of 15th FC tied Grants/ SFC Grants and State/ULB's own resources would be monitored in adherence to 15th FC guidelines.

7.7 **Mission Governance at State level**

7.7.1 **Sanctioning of Proposals and Mission Monitoring**

While administering, approving and monitoring various related proposals of Used water management, SLTC to ensure the following and place before SHPC for approval:

i) **Annual progress plan for achieving Mission targets in respect of ODF++ and Water+.**

ii) **Sanctioning of** City Sanitation Action plans (CSAP) part 2, including year-wise overall action plan for its approval.

iii) **Seamless project implementation:** All Used water management projects are planned in an integrated manner, where Interception & Diversion of drains, STP and/ or STP- cum-FSTP construction and at least 5-years O&M of the constructed infrastructure are the responsibility of the same vendor/ operator and to be awarded in a single package.

iv) Ensuring that projects are planned in a manner that the envisioned Mission objectives of "no untreated used water discharged into water bodies" are met in totality.

v) For robust O & M of assets created, the "one-district-one-operator" approach may also be explored, if other wise found suitable to State/UT.

vi) **Cluster/ clubbing of ULBs:**

In order to ensure economies of scale and operational efficiency, State/ UTs may encourage creation of common infrastructure to cater to a group of small nearby ULBs and their surrounding rural areas (in convergence with SBM-Grameen), including shared O&M of the infrastructure, where found feasible.

vii) **Recycle & Reuse:** The projects must provide for recycle and reuse of treated used water. The recycle and reuse projects should be formulated in such a way so as to be financially sustainable.

viii) **Land availability:** SLTC will ensure timely land availability to take up implementation of projects particularly STPs.

ix) **Use of IT enabled Tools/ Computer software**: States / ULBs are encouraged to use IT-enabled tools/ computer software for design of various project components, its cost estimation & overall DPR preparation, to the extent feasible.

x) Policy and leveraging funds from various sources, private sector, capacity building etc.

xi) Constitution of State level Technical Committee(SLTC) under Principal Secretary (UD) for technical appraisal and sanctioning of projects submitted after detailed examination by engaged Technical Agency/Institutes.

xii) The DPRs submitted by ULBs to state Mission directorate will be required to be systematically scrutinized by technical institutes/ agencies, engaged for the purpose, from techno-economic angle and submitted to SLTC for technical sanction before submitting the same to SHPC for Financial & Administrative Sanction as outlined in Chapter 3.

7.8 Mission Implementation Strategy

7.8.1 City Sanitation Action Plan (CSAP) – Part 2

As a first step, ULB will be required to prepare the CSAP Part 2. The CSAP Part 2 is expected to contain information on sewage management, specifically details of existing sewer networks, STPs, STP cum FSTPs, FSTPs and details of main municipal drains, etc, along with gap analysis in respective infrastructure and proposed projects along with block cost estimate, as per standard template provided at **Annex 3B**.

Gap Analysis: CSAP Part 2 must contain a gap analysis in sewage management and prospective projects to be taken up under SBM-U 2.0 along with its prioritization. The tentative block cost estimate for components like STP, sewer networks, pumping stations and I&D drains etc. are to be prepared with suitable zoning.

7.8.2 Broad DPR preparation approach

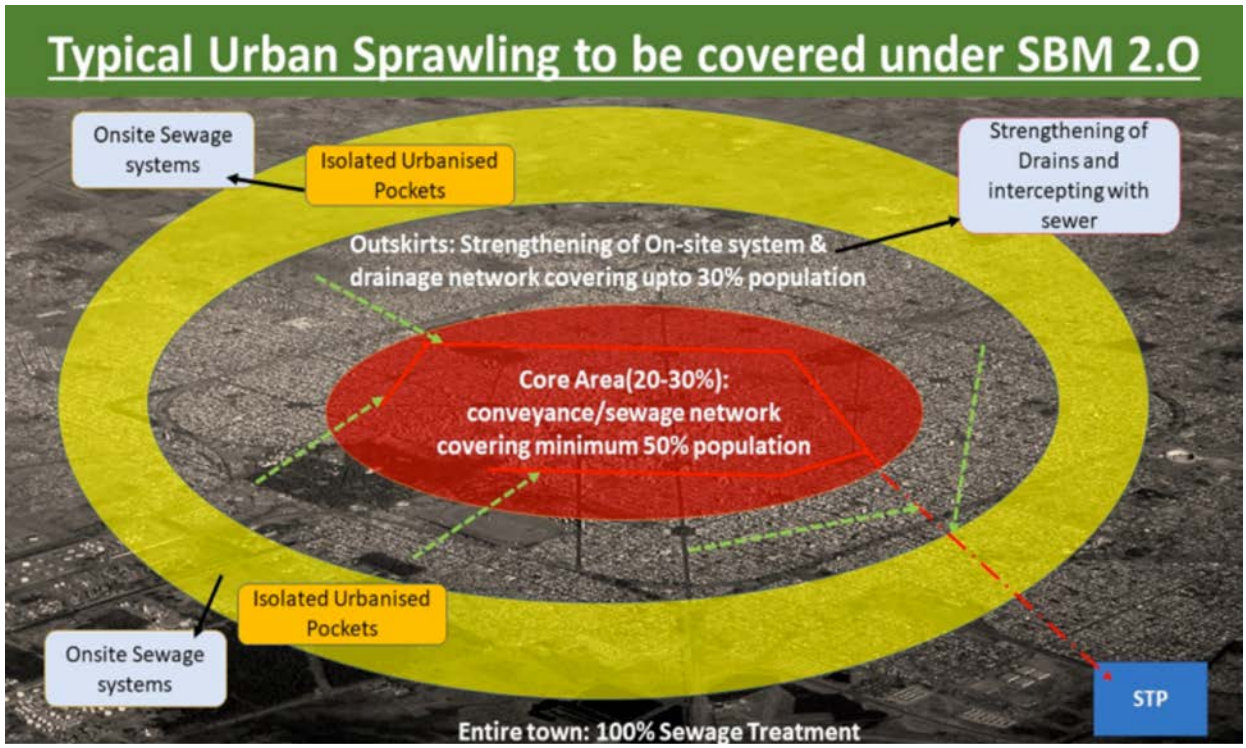
Broad DPR preparation approach is outlined below for two possible field scenarios:

A) Sound foundation for sanitation in ULBs using sewer network based robust used water management approach followed by Sewage treatment facility.

B) Where, States/ULBs, instead decides to adopt, municipal pucca drains based used water conveyance system, as interim arrangement, followed by I&D and Used Water and Septage treatment facility.

7.8.3 DPR Preparation approach adopting sewer network & STP

State/ ULB will be required to prepare DPR as identified in CSAP, following the CPHEEO Manual on Sewerage & Sewage Treatment Systems, 2013/ Advisories published by Ministry from time to time. For guidance on



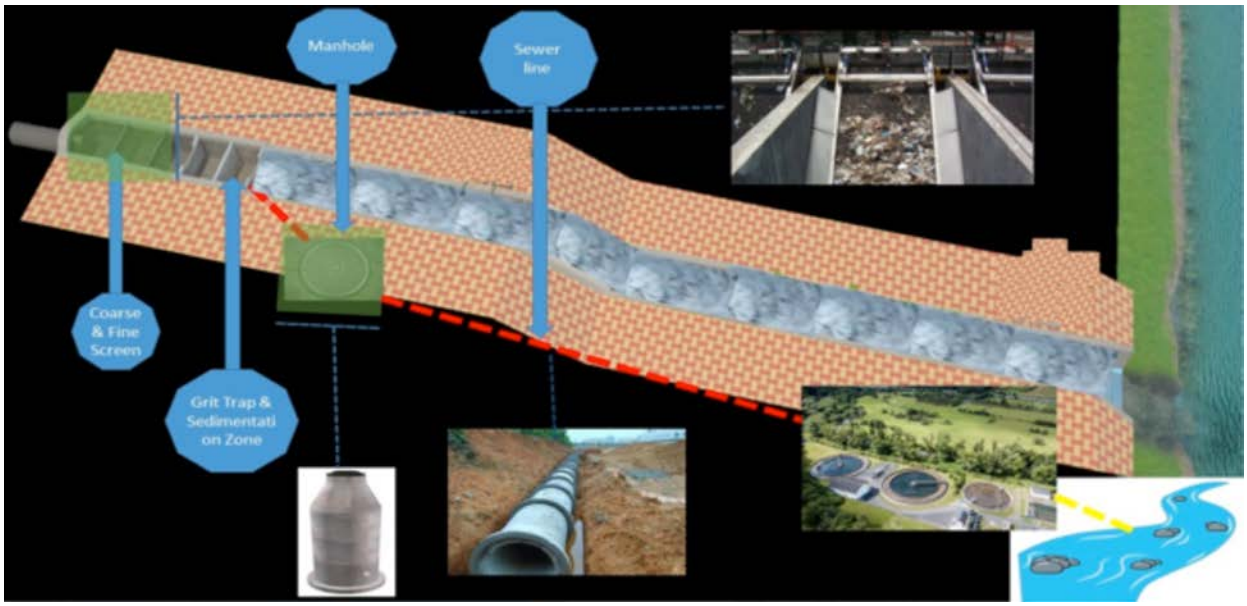
the type of Infrastructure [sewerage, drainage, I&D and STP etc.] to be considered while preparing DPRs for various class of towns, the schematic layout may be considered:

1. **Sewer Network in Core Sanitation Zone**: ULBs to identify its **"Core Sanitation Zone (CSZ)"**, defined as a zone which has at least 50% of the town's current population settled over an area comprising about 20-30% of the town's spread (please refer diagram given above). The CSZ will be provided with a sewer network to connect it directly to the STP.

The cost of the CSZ sewer network will be borne entirely by the State/ ULB from 15th FC Grants/ SFC Grants/ their own funds etc. States/ UTs are expected to encourage the ULBs to identify any suitable area in the city to provide with a sewer network. City can expand network coverage based on necessity and availability of resources over the time.

For upcoming new green field developments in and around towns, the provision of sewerage network along with decentralized sewage treatment facilities should be factored in planning.

2. **Intercepting used water from open drains to Sewer network:**
State is also required to **strengthen existing open drains** carrying sullage and connect the same to the sewer network, wherever feasible, after providing suitable I&D structures like coarse screen, grit chamber, fine screen and settling basin etc. before intercepting into sewer network.



3. **Approach for Fringe Areas**

• For inhabitants residing in fringe areas outside the CSZ, the town authorities may work out economically judicious solutions, opting between continuing with onsite disposal systems (septic tanks with soak pits) and providing localized community level sewage treatment plants for grey/ black water where feasible or conveying it to STP depending on economics. The septage from these households will continue to be safely hauled to a designated STP under professional arrangements.

• It is advised that the fringe areas may try to strengthen their onsite disposal arrangements by providing for soak pits where they are missing and forcing the septic tank effluent into the ground, adhering to design norms.

4. **Provision for adequate Used Water Treatment Facility in each ULB:**

It may be noted that each ULB needs to plan for adequate used water (grey water + black water) treatment facility with provision to treat septage as well. Creating adequate used water treatment facility is an important component and aligned with mission objective to ensure that used water is discharged to water body or over land only after proper treatment ensuring compliance to environmental discharge standards. This is necessary to comply with Legal and Regulatory requirements under Hon'ble NGT O.A no. 673/2018 and Honb'le Supreme court WP(C) 375.2012. as well as WATER (Prevention and Control of Pollution) Act 1974.

Accordingly, all towns will need to prepare a DPR containing the provision of minimum one STP (for 70% of current population).

5. **STP Technology:**

As regards selection of Used water treatment technology, it will be open to ULB/State Government to select **any proven technology** as brought out in the CPHEEO Manual/ Advisories from time to time. In case States come across any other technology not listed in CPHEEO Manual/Advisories, the same should be referred to CPHEEO for evaluation and inclusion in the Advisories. State Governments are encouraged to select nature-based sewage treatment technologies (alone or in combination of two to attend desired treated effluent quality), where feasible, to economise Capex & Opex.

In this context, it may be mentioned that global experiences have established STPs to be the most effective method for treating used water (grey water and black water). Hence, States/ UTs may take informed decisions regarding technology to be used for treating their used water so that the Mission's objective of "no untreated used water polluting water bodies" is realized.

7.8.4 **Municipal pucca drains based used water conveyance system, followed by I&D and Used Water Treatment Facility**

i. Urban Drains of various sizes comprising tertiary, secondary and primary tributaries (main drains) discharge sewage into natural water bodies. During dry weather (when it is not raining), almost the entire flow in urban drains consists of

a. raw sewage from toilets not connected to a sanitary disposal system,
b. partially treated effluent from existing septic tanks, and
c. other onsite management systems where soak pits are not provided or are blocked.

ii. As an interim arrangement, till sewers are laid or in the periphery outside core area of town where providing sewerage system is uneconomical, strengthening of drainage networks can be taken up by ULBs and intercepted in the sewer network wherever feasible, so as to efficiently convey sewage/ sullage to STP in the town.

iii. **Sullage Diversion (I&D) Plan leading to Used Water Treatment Facility**

All tertiary and secondary drains will be provided with bar screens to trap floating debris, as per the following norms:

- Drain upto 1 metre width cross section – at every 1000 metre
- Drain above 1 metre width cross section- as per the local engineer's assessment.
- On primary drain, before outfall into a water body, there should be at least two bar screens within 2 km before discharge point into the water body.
- Proper periodic (daily) cleaning mechanism for drains to avoid overflowing in case of choking, especially by safai karmacharis.

iv. **Repair & Maintenance of drains:** ULBs will also need to repair all surface drains to maintain continuity so that the discharge is not dissipated through a breach or overflow.

The dry weather discharge flowing in the drains needs to be intercepted by ULB at suitable locations so that at least 50% of the current sewage generation in the town is collected and conveyed to the Used Water Treatment Facility. This criterion is a mandatory condition for sanctioning Used Water Treatment Facility for any ULB. Pumping arrangements are permitted, if absolutely necessary. However, gravity sewers are preferred.

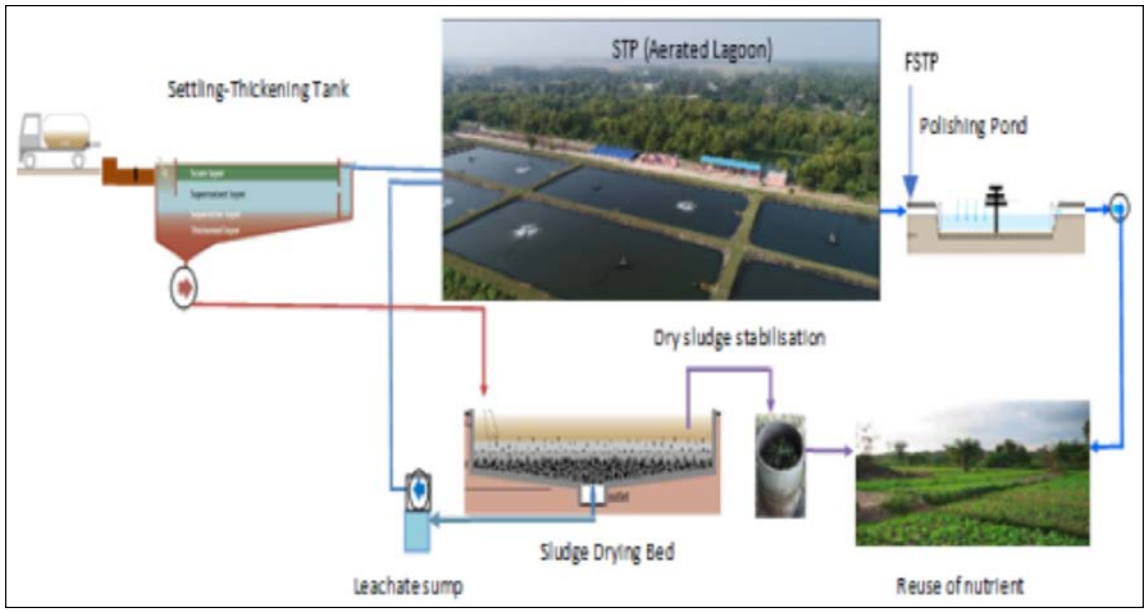
7.8.5 Faecal sludge treatment approach

In the towns/ those parts of town not covered with sewer network, ULBs need to have in place adequate mechanism for **faecal sludge treatment**. The approach to treat the faecal sludge may follow the hierarchy/ order of priority given below:

- **Town with existing STP**: Wherever STP is available, faecal sludge is to be co-treated with sewage in STP by constructing septage unloading facility coupled with Solid liquid separator by way of retrofitting. Liquid so separated would be pumped at inlet of STP and settled sludge can be put to sludge drying bed. If septage has low solid content (< 3 %), it can be even directly injected at inlet of STP after ensuring suitable ratio of dilution as detailed out in "On-site and Off- site sewage management systems" advisory brought out by MoHUA. It is explained in figures a and b above.

- **Town without STP**: In ULBs where no Used Water Treatment Facility is available, ULBs will need to ensure that Used water generated in its jurisdiction is properly collected, conveyed and

STP-cum-FSTP to treat sewage and faecal sludge in the same facility



Process Diagram of STP-cum-FSTP in the same facility

treated to environmental discharge standards before its discharge into water body/ over land. While planning for new Used Water Treatment Facility, faecal sludge management may be factored in such a manner that it is co-treated in the facility itself as mentioned above. This will result in reduced Capex & Opex and would also save precious land, thereby, promoting sustainability and improved service delivery. In newly notified smaller ULBs, where there is no STP and no FSTP, it is advised to plan and implement used water treatment facility with facility to co-treat fecal sludge. Further, till STP facility is created, fecal sludge can be transported to nearby STP having facility to co-treat fecal sludge to economise Capex & Opex.

• **Town with FSTP but without STP:** In towns having standalone FSTPs, although it provides facility to treat faecal sludge from septic tanks, desludged once in 3 years, it is not capable of treating Greywater from kitchens, bathrooms and washings etc, which is in huge quantity compared to septage and generated on daily basis. It also contains major share of pollution load generated from households/ commercial establishments etc. In a majority of cases, septic tanks do not have soak pits and black water from septic tank finds its way to municipal drains subsequently, polluting water bodies. This comes out on continuous basis from septic tanks and there is no treatment available for it, under faecal septage treatment facility. In

such ULBs, State will need to draw up a plan to collect grey water as well as black water from septic tanks and suitably collect and treat to meet environmental discharge standards before release into a water body or over land.

It also need to be ensured by States/ ULB that untreated used water (grey water and / or black water) is not discharged or allowed to percolate into ground water which has potential to pollute ground water and cause environmental degradation.

Where the existing FSTPs are available, the same can be utilized to treat septage from peri-urban area/ rural areas. However, since it is not designed to treat used water generated in the ULB area, separate used water collection and treatment infrastructure need to be created by each ULB to safely treat used water to the environmental discharge standards before its release in compliance with Honb'le NGT O.A. no. 673 of 2018.

7.9 **Recycle & Reuse**

The treated used water may be used by ULB either for self-consumption, or sold, for the following purposes:

1. Non-potable purposes like flushing toilets, gardening etc.
2. Agricultural purposes
3. Horticulture purposes
4. Industrial purposes
5. Municipal purposes like dust mitigation, road washing, construction activity, etc.

Efforts may be made to utilize as much used water as feasible, but not less tha 20%. Circularity in used water has may advantages over conventional sytem of treating and discharging into water body or over land.

7.10 **Fund release:**

7.10.1 **Funding Pattern**

Central share for above mentioned components will be disbursed as per following cost sharing pattern:

- 90% for ULBs in NE/Himalayan States,
- 100% for UTs without legislature,
- 80% for UTs with legislature,
- 50% for ULBs with less than 1 lakh population

This will follow suitable ULB wise cost capping as mentioned in Annex- 10

7.10.2 **Outcome-based fund release** (as mentioned in section 4.5.4)

The Central government fund for used water management will be released in three (3) instalments with each instalment to be released based on achievement of specific milestones / outcomes as mentioned below:

7.10.2.1 The **1st instalment of 40%** of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the entry conditions specified in Section 4.2, and following additional conditions are satisfied:

i. Responsible Sanitation Authority (RSA) notified across the State/ UT at District level/ in big municipal corporations;

ii. Submission of City Sanitation Action plans (CSAP) part 2 (approved by SHPC)for sewage management along with gap analysis;

iii. Receipt of SLTC approved proposals for a city along with at least 5 years' O&M contract post commissioning, and its funding arrangements;

iv. Annual progress plan of State/UT of ODF++ and Water+ cities;

v. Action plan for revamping all non-functional existing STPs/FSTPs in ULBs having less than 1 lakh population (if any- as recorded in the City MIS).

vi. ULB has provided for encumbrance free land for setting up STP/ STP-cum- FSTP.

7.10.2.2 The **2nd instalment of 40%** of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the following conditions are satisfied:

i. Functional Sanitation Response Units (SRU) set up;

ii. UC submitted for 75% of first instalment of Central and State shares;

iii. Portion of O&M being recovered through user charges;

iv. City is certified ODF+ at least once;

v. State will certify along with geo-tagged photos and other documentary evidence that:

vi. Work has commenced for the drainage system development/ installation/ revamping duly completed (with geo-tagged photos and other documentary evidence);

vii. The Interception & Diversion drain & related conveyance system has reached 20% physical progress;

viii The STP/FSTP (in case of co-treatment) sub-project has achieved at least 10% physical progress on ground.

ix. Existing STP/FSTPs are made functional to treat used water, at least to the level as per their original design.

x. Work awarded for non-functional STPs/ FSTPs requiring major repairs/ rehabilitation.

7.10.2.3 The **3rd instalment of 20%** of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the following conditions are satisfied:

i. UC submitted for 75% of second instalment of Central and State shares;

ii. The Interception & Diversion drain & related conveyance work has been completed to the extent of at least 80% of physical process;

iii. The STP sub-project work has been completed to the extent of atleast 60%;

iv. Non-functional STPs/FSTPs made functional.

It may be noted that proposals should be in compliance with checklist provided in **Annex 6**.

7.11 Expected Outcomes

The following outcomes are envisaged under SBM-U 2.0 for used water management:

i. All statutory towns with < 1 lakh population will become ODF++ certified.

ii. 50% of all statutory towns with < 1 lakh population will become Water+ certified.

States/UTs would be required to develop road map to achieve and sustain above outcomes and progress would be monitored periodically.

हम सबका एकही नारा,
साफ सुथरा हो देश हमारा।
एक कदम स्वच्छता की ओर
स्वच्छ भारत

गीला कचरा
पका व अनपका भोजन
फल सब्जी के छिलके
वनस्पति अपशिष्ट
सेनेटरी नैपकिन
बच्चों के डायपर
सब्जी तथा मछली
मटन के अपशिष्ट
सूखा कचरा
कागज
प्लास्टिक
गत्ता, गत्ते का बोर्ड
पैकिंग सामग्री
टीन, काँच, धातु
रबर, लकड़ी
टेट्रा पैक
कपड़े आदि

IEC & BEHAVIOR CHANGE

Sets out the overall approach to be adopted to ensure awareness creation along with large scale citizen outreach to intensify 'Jan Andolan' and institutionalize swachh behavior and action , for achievement of "Garbage Free" cities, and sustaining the gains of urban sanitation

8.1 The IEC & Behaviour Change initiatives under SBM 2.0 will be based on the learning that the achievements of SBM-U in the last 7 years largely rest on people's participation, made possible through systematic communication at multiple levels. The Jan Andolan created under SBM-Urban was triggered by the Hon'ble Prime Minister and managed to engage with nearly 20 crore urban citizens. With the momentum created by the SBM, citizens have realised that sanitation impacts their lives in so many ways that it needs to be everybody's agenda. The scale of impact that behavioral choices around sanitation have on people's lives and society at large makes the issue of sanitation both personal and social. Under SBM-U 2.0, this aspect will assume far greater criticality, and will need to become the soul of the Mission. Accordingly, IEC and BCC under SBM-U 2.0 will require a more intensified and focused approach to ensure participation and active engagement from each and every citizen and every stakeholder. In fact, people's participation will be foundational to achieving the Mission's vision of Garbage Free cities. The IEC and BCC strategy would thus have to be innovatively reformatted to cater to the Mission's vision of Garbage Free cities in accordance with the objectives under SBM-U 2.0.

8.2 **IEC and BCC strategy:**

8.2.1 MoHUA will disseminate a National Level Communication Strategy to be implemented at Central, State and ULB levels. This will be done in close consultation with States, other stakeholders, domain experts and after taking into account relevant studies of the past and present. Additionally, States and ULBs would also be advised to design their own communication strategy.

8.2.2 MoHUA will hold periodic consultations among States for mutual learning and exchange of best IEC practices.

8.2.3 Detailed studies will need to be taken up by States/ UTs to identify triggers for behavior change among communities, which would form the basis of their IEC and BCC strategy and initiatives to be undertaken.

8.2.4 ULBs would need to engage citizen volunteer (depending on the size of the ward), who will be the designated interpersonal

communicator(s) to engage with each household in the ward on regular basis. The role of these volunteers would be critical in bringing about and sustaining behaviour change at the ground level with respect to key sanitation and waste management practices. The volunteers could be engaged through community structures already working in the ward such as NULM, NUHM, ASHA, Anganwadis, Self-Help Groups (SHGs), Non-Governmental Organizations (NGOs), youth/ women's groups, Community-Based Organisations (CBOs), RWAs, and other similar bodies, or from among general citizens (e.g. teachers, senior citizens, retired personnel, etc) who have influence in the community/ ward.

8.2.5 The role of the citizen volunteer would be to sensitise households on how their role would be critical to make their cities Garbage Free, trigger among them a sense of intolerance to garbage, alert them to the benefits of a clean surrounding and specify the behaviors they can adopt to contribute to that vision.

8.2.6 For achieving Garbage Free outcomes, households and citizens would need to be sensitized about:

i. segregating their household waste into two bins;

ii. taking ownership to maintain cleanliness of their immediate neighbourhoods;

iii. educating others about the importance of cleanliness;

iv. harmful effects of single use plastic and triggered to reduce their usage;

8.2.7 For sanitation and used water management, households and citizens would need to be sensitized about:

i. the harmful effects of grey and black water from kitchens and toilets not being safely contained, transported and managed

ii. maintaining community toilets in a functional manner,

iii. providing feedback after using public toilets

iv. calling for periodic desludging of their septic tanks

8.2.8 ULBs should facilitate formal creation and registration of all citizen residential areas into RWAs/ CBOs/ Slum Development Associations or equivalent, to strengthen ULB's last mile connect with every household.

8.2.9 ULBs should set up City Sanitation Committees with participation of selected citizen representatives for periodically reviewing and monitoring the efficient functioning of assets created.

8.3 States and ULBs may make use of existing IEC material designed at the national level, in addition to developing their own creative content, depending on the local and cultural context.

8.4 States will make sure that at least three comprehensive multi-media campaigns are created and placed in public domain: 1. in favour of garbage free city 2. Usage and maintenance of toilets, especially public and community toilets 3. Safe disposal of used water.

8.5 States will locate opportunities to converge SBMU campaigns with other highly visible major campaigns for gaining collateral impact

8.6 States and ULBs will coordinate with locally resourceful organizations/ enterprises so that they partake in SBM-U 2.0 messaging in a significant manner and add to the overall communication.

8.7 **Fund Sharing (as mentioned in Section 4.5.4)**

8.7.1 The Centre: State fund sharing for this component will be as given below:

- 90:10 for ULBs in NE/Himalayan States;
- 100% for UTs without legislature;
- 80:20 for UTs with legislature;
- 60:40 for other States/ UTs

8.7.2 A total of 5% of the total allocation for project components of the overall budget will be earmarked for this component. Of this earmarked amount, 80% of the Central share will be released to States/ UTs/ ULBs to design and undertake IEC/ BCC interventions. Out of this released amount, half the amount must be allocated to ULBs by respective State/ UT. The remaining 20% per cent will be earmarked for the National Mission Directorate to draw up a national campaign and develop standard campaign tools for effective awareness and communication.

8.7.3 The **1st instalment** of 40% of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the entry conditions specified in Section 4.2, and following additional conditions are satisfied:

- SLTC approved IEC action plan for State submitted (as per **Annex 7**).

8.7.4 The **2nd instalment** of 60% of allotted Central share from MoHUA will be released to the State/ UT for a ULB provided the following conditions are satisfied:

- UC submitted for 75% expenditure of Central and State share;
- 50% Progress against action plan;
- City certified ODF+;
- City certified at least 1-star with 60% source segregation.

8.7.5 Expenditure on national Newspaper and TV is not an admissible item under this component for the State Government or for the ULBs.

8.7.6 Under no circumstance shall the IEC fund be utilized for purchase of vehicles, construction and maintenance of buildings, creation of posts and payment of salary of municipal staff, and purchase of furniture and fixtures.

8.7.7 While approving IEC proposals, SHPC should ensure that at least 80% of the funds requested are for ground -level behavior change initiatives through inter-personal

communication, rather than for merely messaging and awareness activities.

8.7.8 In light of the experience of the past, it is advised that ULBs will need to report expenditure on IEC to the State Mission every month and States in turn will provide information on monthly expenditure in IEC to SBMU Mission at MoHUA through the designated portal. For further release of funds to States, at least 75 % of utilization of funds earmarked for IEC would be considered essential.

8.8 Outcomes

It is expected that outcomes of the IEC and BCC initiatives would lead to:

i. all households segregating their household waste into two bins and ensuring its due disposal
ii. all citizens sensitized about non-acceptability of garbage in any form in their vicinity and acting for its due disposal
iii. all citizens sensitized about harmful effects of usage of single use plastic and triggered to reduce their usage
iv. all citizens sensitized about necessity for getting septic tanks periodically desludged and acting accordingly

CAPACITY BUILDING, SKILL DEVELOPMENT & KNOWLEDGE MANAGEMENT

Sets out the overall approach to be adopted by ULBs for building the capacities and skills of all stakeholders, preeminently of the ULBs, in order to ensure effective ground level implementation, for achieving the vision of "Garbage Free" cities and towns, and for meeting all other objectives of SBM-U 2.0.

9.1 Urban Local Bodies (ULBs) are mandated by the Constitution of India, under Twelfth Schedule, to carry out functions related to water supply and sanitation. The first phase of the Swachh Bharat Mission was successful in meeting its aims and objectives to make India an ODF country, but also brought to light qualitative and quantitative shortfalls in the capacities of the key personnel engaged in the implementation of the Mission. With the launch of SBM-U 2.0, it has become imperative to develop a cadre of professionals at the ULB level and also at the State level to work towards the specific objectives of the Mission, and sustain the gains made in last seven years. Identifying the need to make the Mission truly people-centric and stakeholder-owned, SBM-U 2.0 will focus on comprehensive capacity building across the pyramid of stakeholders engaged in program implementation, and most importantly at the ULB level. This would include components for which funding is available within the mission, and other related areas where funding is available through convergence with other schemes, including leveraging of AMRUT 2.0 and other relevant Mission/ Programme funds such as SBM-Grameen, Namami Gange, Ministry of Social Justice and Empowerment, etc.

9.2 In line with these goals, there is a requirement for a focused approach to capacity building and stakeholder development. Thus, MoHUA will conceptualize a National Capacity Building and Skill Development Strategy to be implemented at the Central, State/UT and ULB levels. States/UTs and ULBs will be required to identify relevant administrative and technical officials (both senior level officials and field-level functionaries, including sanitation workers and *SafaiMitras*) for training and draw up a quarterly training calendar for them. It will be the responsibility of the State Mission Director to ensure that the identified officials undergo adequate capacity building to ensure the success of SBM-U 2.0 at the State and ULB level. Another key component of the National Strategy Document would be a robust mechanism of assessments and certifications for the capacity building and skill development training imparted, which would also include independent evaluations.

9.3 Capacity Building and Skill Development

The capacity building and skill development initiatives under SBM-U 2.0 will focus on the selected key stakeholders in the sanitation and waste management value chain, who will be trained in the following key priority areas, with support from the professional organizations that will be partnered at the Central and State/UT level as per the procedures laid down in the National Capacity Building and Skill Development Strategy document under SBM-U 2.0.

9.3.1 State Government and Parastatal Officials

- Focus on institutionalizing holistic leadership development and change management by facilitating customized capacity building and training through workshops, online training and short-term technical courses.

9.3.2 Administrative Officials of ULBs:

- Focus on developing implementation capacity and change management functionalities by creating targeted capacity building training, e-learning courses and online workshops.

- Comprehensive approach to human resource development with a sensitization towards the social, economic and technological environment for effective implementation and service delivery under the Mission.

9.3.3 PHE and Technical Officials of the ULBs

- Technical officials and staffs will be provided hands on technical training, access to e-learning courses, workshops, field visits and knowledge exchange exposure visits to enhance their capacity to effectively implement objectives of SBM-U 2.0. Courses will be focused on the latest technologies, which are sustainable, environmentally friendly, and context appropriate.

- In addition to trainings developed towards enhancing the technical knowledge and skill sets, the PHE and technical officials will also be imparted trainings to sensitize them with the citizen centric and social aspects of the Mission, with the intent of inculcating a holistic human centered approach to all interventions under the Mission.

9.3.4 SafaiMitras and Sanitation Workers:

- Focus on the skill development of SafaiMitras and sanitation workers, and the promotion of entrepreneurship across the value chain in the sanitation sector, in partnership with Ministry of Skill Development & Entrepreneurship, NSDC and respective Sector Skill Councils.

- Conducting a skill gap study to develop an understanding of the human resource requirement in the sector, demand and supply scenario of skilled people, skilling gaps in the existing workforce and recognition of skills of the informal workers.

- Training and orientation of Master Trainers for conducting the trainings on relevant subject areas in sanitation.

- Institutionalizing a robust framework for undertaking Recognition of Prior Learning (RPL) based assessments and providing certifications, in consonance with the NSQF, to the SafaiMitras and sanitation workers to recognize the existing skill sets and to ensure that a high quality of training is imparted for further progression.

- A special emphasis will be laid on imparting training to the sanitation workers to build their technical knowledge and skill sets for operating advanced equipment and safety gears.

9.3.5. **NGOs, Educational and Skilling Institutes and other organizations**

- Focus on engaging diverse sets of organizations such as NCC, NSS, NYK, Skill Institutes along with schools and colleges to impart targeted Capacity Building training. The training will be centered upon enabling these organizations to become ambassadors of the Mission and to contribute towards the implementation of initiatives under the focus areas of SBM (U)- 2.0, with a special emphasis on those components, which are to be executed in a campaign mode, such as Garbage Free Cities, maintenance of community/public toilets, safe disposal of wastewater and reduction of plastics, amongst others.

9.4 Center(s) of Excellence (CoE) focusing on capacity building, research, and innovation in key thematic areas of sanitation and waste management, will be established at the national level in partnership with eminent knowledge institutions. The mandate of the CoE will be to provide leadership & technical training, policy guidance, develop best practices, and other relevant activities on sanitation and waste management issues, in line with the aims and objectives of the Mission.

9.5 Chair Professor position(s) will be established at select academic institution(s) of national repute in the field of sanitation and waste management, with funding support from the Centre.

9.6 For building the capacities of technical officials at Central, State/UT and ULB level, (in-service engineers, other technical officials) regular master level training programs and short-term courses under PHE training will be implemented at the national level by MoHUA.

9.7 Government, Non-Government, educational and professional Institutions of repute and with prominent experience in the field of Capacity Building, particularly in sanitation and waste management will be empaneled as '**Swachhta Knowledge Partners**' (SKPs), to support the design and delivery of training modules and workshops on capacity building and skill development, to ensure effective implementation of the Mission. The Swachhta Knowledge Partners will be selected

and onboarded as per the procedures laid down in the National Capacity Building and Skill Development strategy document.

9.8 MoHUA will establish strategic collaborations under the Mission with key development sector organizations, having prominent sectoral expertise, knowledge and implementation experience across thematic areas. The development sector partner organizations will play a pivotal role in providing technical assistance at the Central level and handholding support to States/UTs and ULBs in implementing capacity building and skill development interventions under the Mission.

9.9 To promote affordable and scalable modern technologies suitable to different geographical conditions, a national level technical committee will be set up at MoHUA under the Mission exclusively for promoting research & development, innovations and entrepreneurship in the field of sanitation and waste management.

9.10 A part of Central funds will be used to pilot innovative projects/ start-ups in sanitation and SWM sectors, in partnership with States/ UTs, reputed institutes of national importance, etc.

9.11 States/UTs will also be encouraged to set up incubators to provide support to entrepreneurship, innovation and private sector participation.

9.12 Swachhata Technology Challenges, hackathons, etc. will be conceptualized and implemented in collaboration with the key private sector organizations, towards encouraging startups and social business ventures to develop innovative digital solutions and business models in the sanitation and waste management sector. The Challenges will encompass diverse thematic areas and endeavor to achieve the dual objective of identifying and leveraging key enabling technologies while also encouraging and recognizing local entrepreneurs and technology solutions at the national level.

9.13 **Knowledge Management**

9.13.1 A comprehensive Knowledge Management Framework will be institutionalized to augment the capacity building initiatives under the Mission. As a part of this, the relevant knowledge materials such as training modules literature, videos, plans and reports developed by the ULBs during the implementation of various initiatives across focus areas of the Mission, will be consolidated and uploaded onto the SBM-U e-Learning portal for ease of use and access by all stakeholders. Further, the training and the technical material developed for trainings will be made available via the SBM-U e-Learning platform.

9.13.2 States/ UTs will be encouraged to set up technical cells within premier academic/ technical institutions to facilitate Research & Development.

9.13.3 As part of the training needs analysis, it is suggested that ULBs ascertain the gaps and deficiencies in the available training material and aim to fill those gaps by suitably revising the existing material or developing new modules if required, before conducting the trainings for relevant stakeholders.

- Materials used for training in workshops, capacity building courses and other technical courses shall be uploaded on SBM-U e-learning portal for ease of use and access.

- The States / UTs and ULBs shall be free to add their own resource materials to the SBM-U e-learning platform. It is suggested that ULBs revise and update the training material at regular intervals.

9.14 Human Resource Support under SBM (U) 2.0:

9.14.1 In addition to enhancing the capacities of the key officials and sanitation workers, there is a pertinent need for dedicated human resources with specialist knowledge and skills in order to strengthen the implementation of the various components of the Mission. Towards this, dedicated human resource units have been envisaged at the State/UT level, the details on which have been elaborated below.

9.14.2 At the State/UT level, a dedicated Program Management Unit (PMU) will be set up under the Mission to ensure effective implementation of the SBM-U 2.0. Parastatal bodies supporting ULBs in implementation of Mission components may be supported with human resources as per the requirements.

9.14.3 The Program Management Unit at the State/UT level should ideally consist of the following human resources. The State/UT shall have the flexibility of expanding the PMU with additional specialists based on their specific requirements.

State Level PMU (With more than 100 ULBs)	State Level PMU (With less than 100 ULBs)
1. SWM expert - 1 2. Waste-Water expert - 1 3. Procurement Specialist - 1 4. Capacity Building Specialist - 1 5. IEC Specialist - 1 6. M & E Specialist - 1 7. IT Specialist – 1 8. Documentation Specialist – 1 9. Additional specialist – 1 (As per requirement)	1. SWM expert- 1 2. Waste-Water expert - 1 3. Procurement Specialist - 1 4. Capacity Building Specialist - 1 5. IEC Specialist - 1 6. IT and M & E Specialist - 1 7. Additional specialist – 1 (As per requirement)

9.14.4 A specialized program will be conceptualized and implemented for engaging students from academic and technical institutions as young professionals and interns for supporting interventions under SBM U 2.0 at the National as well as the State/UT level. The selected young professionals and interns will be deputed to select projects across focus areas under the Mission, for a stipulated time, and will play a pivotal role in augmenting the internal human resources of the departments while also strategically integrating the youth with SBM-U 2.0.

9.14.5 The ULBs will be provided with the flexibility to hire Young Professionals and interns to augment their internal human resources for key project implementation activities under the Mission. Additionally, State may provide human resource support from their own share of funding for implementation of key mission components under SBM (U) 2.0.

9.15 Funding Mechanism

9.15.1 The Centre: State fund share for this component will be as given below:

- 90%:10% for ULBs in NE/ Himalayan States,
- 100% for UTs without legislature
- 80%: 20% for UTs with legislature,
- 60%: 40% for other States/ UTs.

9.15.2 A total of 3% of the total allocation for project components will be earmarked for the component of Capacity Building, Skill Development and Knowledge Management. Out of the Central share for this component, 67% will be earmarked for States/ ULBs to conduct capacity building and skill development initiatives. The remaining 33% will be earmarked for MoHUA. It may be noted that Administrative and Office expenditure in a year should be kept as a proportion of actual expenditure / output rather than as a percentage of indicative outlay.

9.15.3 The disbursal of the Central Assistance will be as follows- **1st instalment of 40%** of allotted Central share from MOHUA will be released to the State/ UT for a ULB provided the entry conditions specified in Section 4.2, and following additional conditions are satisfied:

- SHPC approved CB action plan for State submitted (as per **Annex 8**).

9.15.4 The **2nd instalment of 60%** of allotted Central share from MOHUA will be released to the State/ UT for a ULB provided the following conditions are satisfied:

- 40% of identified State Officials/ Parastatal Officials/ ULB Officials trained (in some format of training);
- 40% of Sanitation workers identified for skill development completed training;
- All informal sector workers (including those in sewer and septic tank cleaning) identified and integrated by ULB;
- City certified ODF+;
- City certified at least 1-star with 60% source segregation;

9.15.5 Under no circumstance shall this fund be utilized for purchase of vehicles, construction and maintenance of buildings, creation of permanent/regular posts and payment of salary, and purchase of furniture and fixtures, etc.

9.15.6 States/ UTs/ ULBs may take assistance of PSUs and Corporates through CSR for implementing capacity building programs

9.15.7 States/ UTs and ULBs, if they so wish, may use the CB funds to upgrade/ strengthen their existing institutes / entities to provide capacity building support to the State/ ULB.

9.15.8 States shall propose extensive capacity building activities, including training of administrative and technical staffs, conducting skill gap analysis, skill development training programs for sanitation workers to be implemented in a Mission- mode manner, which will enable the progressive achievement of objectives of SBM-U 2.0 in a time-bound manner. These will be specified in the comprehensive annual action plan prepared by each State/UT and approved by SHPC. At least 50% of this fund, in each annual plan, as approved by SHPC must go to the ULBs for activities at the ULB level.

9.15.9 The SLTC will approve State training plan comprising the following:

- Training Need Analysis (TNA) for Capacity Building and Skill Gap Analysis for Skill Development;
- Training Modules and Tools;
- Institutions to impart training, and cost of training;
- Mandatory Inclusion of areas identified by CPHEEO;
- Training Calendar;
- Evaluation of training.

9.16 Expected Outcome

It is expected that outcomes of the Capacity Building, Skill Development and KM initiatives would lead to improvement in capacities, knowledge, skills, leadership development and change management competencies of ULB officials and Sanitation workforce connected with implementation of Mission, through Workshops, Seminars, Trainings, etc.

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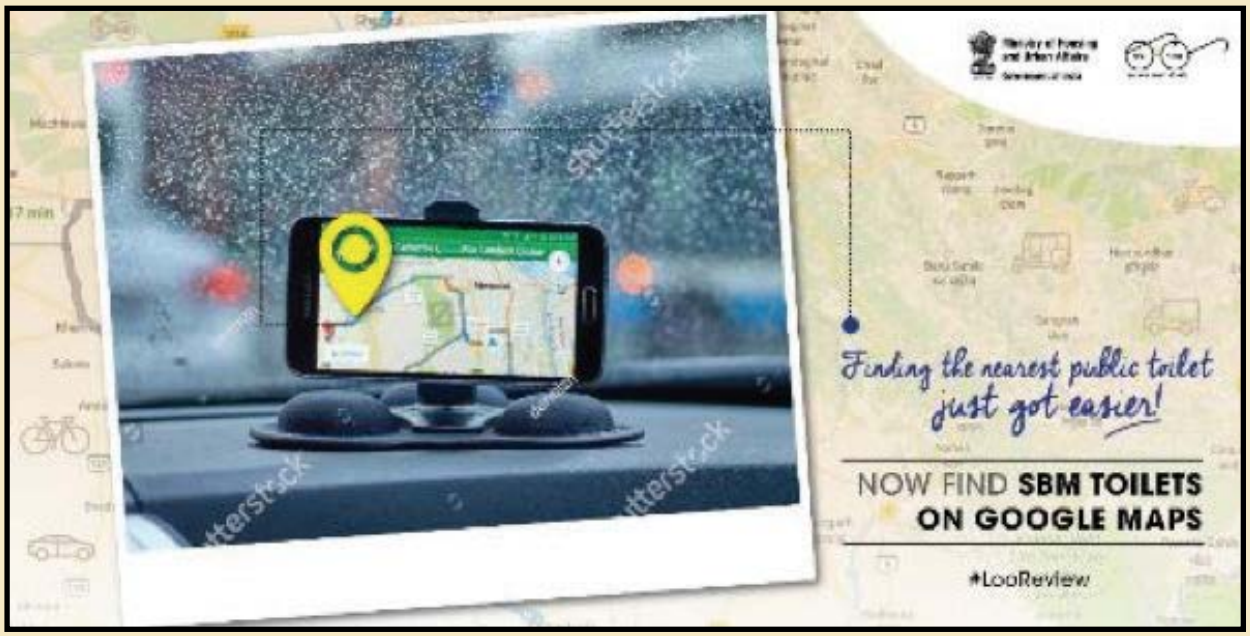
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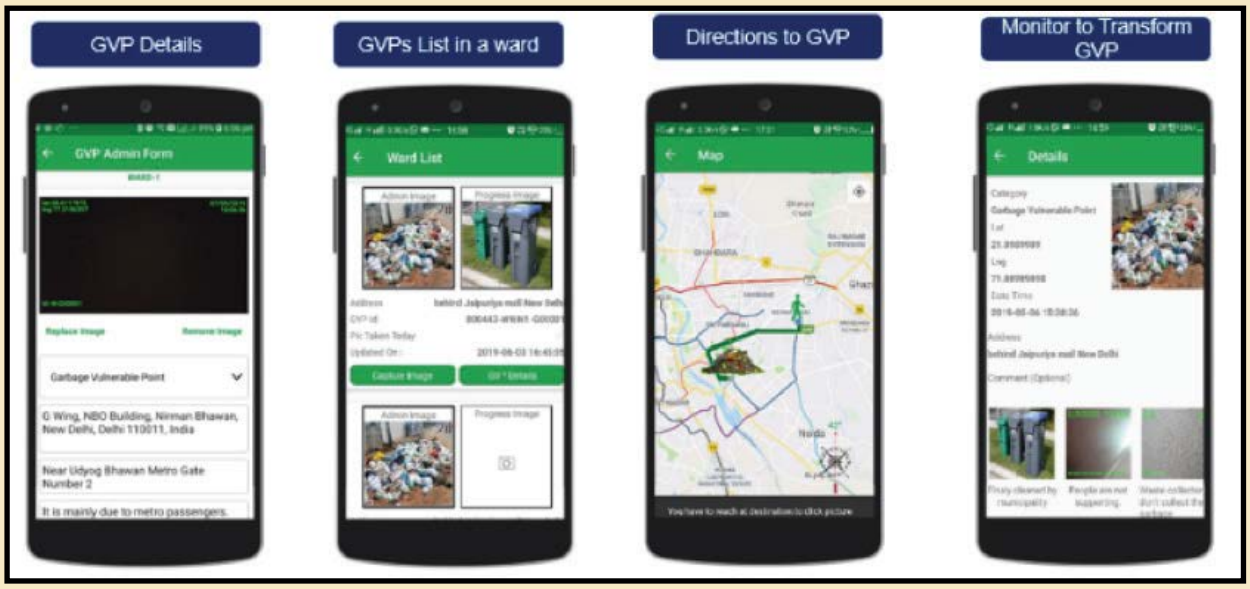
GVP Details
GVPs List in a ward
Directions to GVP
Monitor to Transform GVP
GVP Admin Form
Ward List
Map
Details

IT ENABLED GOVERNANCE

Enumerates the various digital enablements developed for maximising citizen outreach, along with facilitating a transparent and an objective monitoring and evaluation of Mission progress, to ensure a smooth and seamless user experience by all stakeholders, and making the Mission paperless, towards ensuring standardization of outcomes across all ULBs.

10.1 Digital interventions will support different stages of SBM-U implementation in a paperless manner, across all components, starting from conceptualization, implementation, and real-time online monitoring of functional assets to be created under different components of the Mission, such as STP, MRF etc, and other key indicators of progress for the Mission. The ICT and GIS enabled tools and systems will also be leveraged in the evaluation of the interventions.

10.2 MoHUA has developed various workflow based, web enabled IT-enabled applications and mobile applications in order to ensure a transparent and robust citizen-centric engagement, Mission governance, Mission implementation, along with facilitating collaborations amongst key stakeholders & capacity building.

10.3 The various IT-enabled applications that will be mandatorily deployed for all implementation components of the Mission, including the monitoring of the progress of the Mission, are briefly described:

10.3.1 **SBM-U Integrated platform**: MoHUA has developed a comprehensive platform that provides an integrated experience for States/ UTs and ULBs and enabled fact-based decision-making at various levels of governance. The portal allows ULBs to create city profiles (ward, area, workforce, vehicles, BWGs, Non BWGs, vendor details, etc.), upload details of city infrastructure and assets (e.g. processing plants, landfills, dumpsites, water bodies, storm water drains, STP/FSTP etc.) and report their sanitation and waste management progress on a monthly/periodic basis through a single sign-on approach. The platform standardizes information across States/ULBs and ensures a single source of truth and data consistency across levels.

10.3.2 **Swachhata App:** This is a Mobile based application that enables citizens to register sanitation related complaints and enables the ULBs to address the citizen's grievances efficiently and effectively. The app plays a pivotal role in scaling demand and ensuring transparency and accountability in sanitation

service delivery. In its updated version, the App will, in addition to taking feedback, also engage with citizens for validating the information regarding the city's progress on improving sanitation outcomes, in a time-bound manner. The App is available on both Google Play & IOS platforms.

10.3.3 **SBM Toilets on Google Maps and CT/ PT feedback system** - To improve access to, and thereby their usage, of community and public toilets, MoHUA has partnered with Google to map all CT/ PTs on Google maps, as SBM Toilet. In its updated version, citizens can also provide feedback and rate these public toilets which, in turn, will lead to better cleanliness and maintenance of these facilities.

10.3.4 **Geo spatial enabled Project Proposal Creation and Tracking System:** This application has been designed to enable States/ ULBs to upload their SHPC-approved project proposals (along with the documentation as per the checklist circulated by the National Mission Directorate) for the release of Central share by MoHUA, dissemination of funds by States/ UTs (i.e. Central share + State share) to respective ULBs, and subsequently, digitally tracking the project's progress and functionality. MoHUA, States/ UTs and ULBs would be able to receive and transmit documents in electronic mode with a facility of system-generated alert messages (SMS & e-mail), for greater transparency. The GIS-based monitoring & controlling of the project would support Mission governance, through periodic online uploading of photographs of progress on project site, along with its geo coordinates.

10.3.5 **Annual GFC Rating, Swachh Survekshan & ODF Assessments through an integrated module:** An integrated system is being designed to capture online data for assessment, digital tools to conduct self-assessment, uploading of documents required for desktop assessment. The Assessor App for use by third party agency is also an integral part of the platform. This integration will help in minimizing the assessment duration and also optimize the documents requirement, especially where similar documents are required across multiple protocols and assessments.

10.3.6 **GIS Mapping of SBM-U assets and infrastructure:** MoHUA has developed web and mobile applications that will enable all ULBs to draw their city boundaries, ward boundaries, assets (CT/ PT, processing plants, STP, FSTP, etc.) boundaries, map existing geo spatial data and collect geo-location of all facility points in existence. This GIS application provides a wide range of capabilities such as data visualization, analysis, understanding and insight into city or ULBs' activities, both current and planned.

10.3.7 **Dashboard and Analytics platform:** This is a stakeholder requirement-based analytical dashboard for monitoring the progress of SBM-U 2.0, with inbuilt data standardization and validation mechanism that ensures informed decision making. The dashboards at ULB, State and National level will provide a unified experience with accumulated data points. It is planned to be supported by

AI-driven components such as Chatbot and predictive analytics.

10.3.8 **E-Learning Platform:** The current pandemic has demonstrated the importance of digital medium to ensure that the process of learning continues uninterrupted. The E-learning platform takes care of the training needs of the frontline workers, ULBs, mission officials, agencies and citizens, at a time and place of their convenience. Moreover, the e-learning platform has a modular, incremental approach with training/ learning modules customized to different audiences and levels.

10.3.9 **14420 Helpline** – In a bid to reduce incidences of unsafe manual entry into sewers and septic tanks, and promote their cleaning through mechanized means, MoHUA, through Department of Telecommunications (DoT), has been given a short code "14420" as the National Helpline number across all telecom service providers, for registering citizens' complaints on this issue.

10.4 **Other digital initiatives:** A list of additional IT-enabled modules under development or planned for the future as per of digital roadmap of the Mission is summarised below:

10.4.1 **Swachh Nagar and IoT based asset monitoring:** to provide ease of monitoring waste management lifecycle at ULB, State and Central levels. It is envisioned that the solution would generate large amounts of data to accelerate the progress in solid and liquid waste management in the mission.

10.4.2 **Document Management System** - System is used to receive, track, manage and store documents exchanged at various levels and encourage paperless communication.

10.4.3 **IEC activities tracking system** - Facilitating ULBs to track and trace the planned IEC activities for citizen outreach.

10.5 **Evaluation Mechanisms**

The aforementioned digital solutions will also play a pivotal role in enabling the holistic evaluation of the outcomes and outputs under SBM (U) 2.0.

10.5.1 The National Mission Director would conduct periodic reviews in the form of monthly reviews (through VC) with each State and select ULBs (as required). Further, periodic visits would also be conducted by officials of MoHUA / NMD, etc. to monitor on-ground progress, understand challenges and identify good practices adopted by States/ULBs.

10.5.2 The National Mission Directorate will engage appropriate third-party independent agencies for conducting certifications/ assessments of cities as per the ODF+/ODF++/ Water+ protocols and the Garbage Free Star Rating system. Background data for the same shall be taken from the Mission MIS, and any additional requirements would be communicated to States/cities from time to time.

10.5.3 The National Mission Directorate will undertake an annual ranking exercise - Swachh Survekshan. The survey has a comprehensive list of *Swachhata* parameters with a robust methodology to competitively rank the cities on initiatives undertaken and progress made, towards enhancing the cleanliness and improving the sanitation service delivery chain, both in terms of quality of safely managed services and access to such services. The methodology of the survey will be revised on an annual basis and would be released to States/ UTs/ ULBs prior to on-field assessments.

10.5.4 States / UTs would need to submit an output-outcome plan (as per format given in **Annexure 5**), and thereafter submit quarterly progress on the same format.

10.5.5 Other tools such as impact studies, third party evaluations may also be instituted by National Mission Directorate.

10.5.6 After 18 months, a comprehensive evaluation of the Mission's progress will be undertaken to effect mid-term correction and align the Mission to achieve its objectives.

10.6 States/ UTs need to ensure that the information provided by ULBs is correct by periodic review of the information provided by their ULBs and signing off on the data submitted, to signal their approval/ confirmation of the ULB data. It may be noted that MoHUA will only be accepting those ULBs' data for further action that has been confirmed/validated by the respective State/UT.

10.7 States/ ULBs are also encouraged to periodically conceptualize and launch suitable ICT platform to create awareness among citizens to provide feedback on mission outcomes through communication channels like social media, IVR, mobile app, email, WhatsApp, website, etc. The innovative solutions, if found feasible and successful, can be suitably replicated, and scaled up.

10.8 The various IT enabled applications will be eligible activities for funding under the capacity building head of the Mission.

10.9 Digital components pertaining to monitoring of efficiency/ operational outcomes of SBM-U project components (Sanitation, Wastewater Management & SWM) will be funded under the respective component heads.

ANNEXES

ANNEX 1: LIST OF ULBs ELIGIBLE FOR C&D WASTE PROCESSING AND MECHANISED SWEEPING FUNDING

(As referred in Chapters 2 and 7)

S. No.	State Name	ULB Name	Status of City	Population
1	Andhra Pradesh	GVMC Visakhapatnam	NAC	>20 Lakhs
2	Andhra Pradesh	Vijayawada	NAC	10-20 Lakhs
3	Andhra Pradesh	Guntur	NAC	5-10 lakhs
4	Andhra Pradesh	Nellore	NAC	5-10 lakhs
5	Andhra Pradesh	Kurnool	NAC	5-10 lakhs
6	Andhra Pradesh	Rajahmundry	NAC	3-5 Lakhs
7	Andhra Pradesh	Anantapur	NAC	3-5 Lakhs
8	Andhra Pradesh	Ongole	NAC	3-5 Lakhs
9	Andhra Pradesh	Vizianagaram	NAC	3-5 Lakhs
10	Andhra Pradesh	Eluru	NAC	1-3 Lakhs
11	Andhra Pradesh	Kadapa	NAC	1-3 Lakhs
12	Andhra Pradesh	Chittoor	NAC	1-3 Lakhs
13	Andhra Pradesh	Srikakulam	NAC	1-3 Lakhs
14	Assam	Guwahati	NAC	10-20 Lakhs
15	Assam	Silchar	NAC	1-3 Lakhs
16	Assam	Nagaon	NAC	1-3 Lakhs
17	Assam	Sibsagar	NAC	<1 Lakh
18	Assam	Nalbari	NAC	<1 Lakh
19	Bihar	Patna	NAC	>20 Lakhs
20	Bihar	Gaya	NAC	5-10 lakhs
21	Bihar	Muzaffarpur	NAC	3-5 Lakhs
22	Chandigarh	Chandigarh	NAC	10-20 Lakhs
23	Chhattisgarh	Raipur	NAC	10-20 Lakhs
24	Chhattisgarh	Bhilai Nagar	NAC	5-10 lakhs
25	Chhattisgarh	Korba	NAC	3-5 Lakhs
26	Delhi	South Delhi (Sdmc)	NAC	>20 Lakhs
27	Delhi	North Delhi (N-Dmc)	NAC	>20 Lakhs
28	Delhi	East Delhi (Edmc)	NAC	>20 Lakhs
29	Gujarat	Ahmedabad	NAC	>20 Lakhs
30	Gujarat	Surat	NAC	>20 Lakhs
31	Gujarat	Vadodara	NAC	>20 Lakhs
32	Gujarat	Rajkot	NAC	10-20 Lakhs

S. No.	State Name	ULB Name	Status of City	Population
33	Gujarat	Bhavnagar	Non-NAC	5-10 lakhs
34	Haryana	Faridabad	NAC	10-20 Lakhs
35	Haryana	Gurgaon	NAC	10-20 Lakhs
36	Himachal Pradesh	Baddi	NAC	<1 Lakh
37	Himachal Pradesh	PaontaSahib	NAC	<1 Lakh
38	Himachal Pradesh	Sunder Nagar	NAC	<1 Lakh
39	Himachal Pradesh	Nalagarh	NAC	<1 Lakh
40	Himachal Pradesh	Parwanoo	NAC	<1 Lakh
41	Himachal Pradesh	Damtal	NAC	<1 Lakh
42	Himachal Pradesh	Kala Amb	NAC	<1 Lakh
43	Jammu And Kash-mir	Srinagar	NAC	10-20 Lakhs
44	Jammu And Kash-mir	Jammu	NAC	5-10 lakhs
45	Jharkhand	Dhanbad	NAC	10-20 Lakhs
46	Jharkhand	Ranchi	NAC	10-20 Lakhs
47	Jharkhand	Jamshedpur	NAC	5-10 lakhs
48	Karnataka	Bruhat Bengaluru Mahanagara Palike	NAC	>20 Lakhs
49	Karnataka	Hubli-Dharwad	NAC	10-20 Lakhs
50	Karnataka	Mysore	Non-NAC	10-20 Lakhs
51	Karnataka	Gulbarga	NAC	5-10 lakhs
52	Karnataka	Devanagere	NAC	5-10 lakhs
53	Kerala	Thiruvananthapuram	Non-NAC	10-20 Lakhs
54	Kerala	Kozhikode	Non-NAC	5-10 lakhs
55	Kerala	Kochi	Non-NAC	5-10 lakhs
56	Madhya Pradesh	Indore	NAC	>20 Lakhs
57	Madhya Pradesh	Bhopal	NAC	>20 Lakhs
58	Madhya Pradesh	Jabalpur	NAC	10-20 Lakhs
59	Madhya Pradesh	Gwalior	NAC	10-20 Lakhs
60	Madhya Pradesh	Ujjain	NAC	5-10 lakhs
61	Madhya Pradesh	Dewas	NAC	3-5 Lakhs
62	Madhya Pradesh	Sagar	NAC	3-5 Lakhs
63	Maharashtra	Greater Mumbai	NAC	>20 Lakhs
64	Maharashtra	Pune	NAC	>20 Lakhs
65	Maharashtra	Nagpur	NAC	>20 Lakhs
66	Maharashtra	Thane	NAC	>20 Lakhs

S. No.	State Name	ULB Name	Status of City	Population
67	Maharashtra	Pimpri Chinchwad	Non-NAC	>20 Lakhs
68	Maharashtra	Nashik	NAC	10-20 Lakhs
69	Maharashtra	Kalyan Dombivali	Non-NAC	10-20 Lakhs
70	Maharashtra	Vasai Virar	NAC	10-20 Lakhs
71	Maharashtra	Aurangabad	NAC	10-20 Lakhs
72	Maharashtra	Navi Mumbai	NAC	10-20 Lakhs
73	Maharashtra	Solapur	NAC	10-20 Lakhs
74	Maharashtra	Mira-Bhayandar	Non-NAC	10-20 Lakhs
75	Maharashtra	Bhiwandi Nizampur	Non-NAC	5-10 lakhs
76	Maharashtra	Amravati	NAC	5-10 lakhs
77	Maharashtra	Nanded Waghala	Non-NAC	5-10 lakhs
78	Maharashtra	Kolhapur	NAC	5-10 lakhs
79	Maharashtra	Ulhasnagar	NAC	5-10 lakhs
80	Maharashtra	Sangli	NAC	5-10 lakhs
81	Maharashtra	Jalgaon	NAC	5-10 lakhs
82	Maharashtra	Akola	NAC	5-10 lakhs
83	Maharashtra	Latur	NAC	3-5 Lakhs
84	Maharashtra	Chandrapur	NAC	3-5 Lakhs
85	Maharashtra	Jalna	NAC	3-5 Lakhs
86	Maharashtra	Badlapur	NAC	1-3 Lakhs
87	Meghalaya	Byrnihat	NAC	<1 Lakh
88	Nagaland	Dimapur	NAC	1-3 Lakhs
89	Nagaland	Kohima	NAC	1-3 Lakhs
90	Odisha	Bhubaneswar	NAC	10-20 Lakhs
91	Odisha	Cuttack	NAC	5-10 lakhs
92	Odisha	Rourkela	NAC	3-5 Lakhs
93	Odisha	Balasore	NAC	1-3 Lakhs
94	Odisha	Kalinga Nagar/Byasanagar	NAC	<1 Lakh
95	Odisha	Angul	NAC	<1 Lakh
96	Odisha	Talcher	NAC	<1 Lakh
97	Punjab	Ludhiana	NAC	>20 Lakhs
98	Punjab	Amritsar	NAC	10-20 Lakhs
99	Punjab	Jalandhar	NAC	10-20 Lakhs
100	Punjab	Patiala	NAC	5-10 lakhs
101	Punjab	Pathankot/DeraBaba	NAC	1-3 Lakhs
102	Punjab	Khanna	NAC	1-3 Lakhs

S. No.	State Name	ULB Name	Status of City	Population
103	Punjab	Gobindgarh	NAC	1-3 Lakhs
104	Punjab	NayaNangal	NAC	<1 Lakh
105	Punjab	DeraBassi	NAC	<1 Lakh
106	Rajasthan	Jaipur	NAC	>20 Lakhs
107	Rajasthan	Jodhpur	NAC	10-20 Lakhs
108	Rajasthan	Kota	NAC	10-20 Lakhs
109	Rajasthan	Bikaner	Non-NAC	5-10 lakhs
110	Rajasthan	Ajmer	Non-NAC	5-10 lakhs
111	Rajasthan	Udaipur	NAC	5-10 lakhs
112	Rajasthan	Alwar	NAC	3-5 Lakhs
113	Tamil Nadu	Chennai	NAC	>20 Lakhs
114	Tamil Nadu	Coimbatore	Non-NAC	>20 Lakhs
115	Tamil Nadu	Madurai	NAC	10-20 Lakhs
116	Tamil Nadu	Tiruchirappalli	NAC	10-20 Lakhs
117	Tamil Nadu	Salem	Non-NAC	10-20 Lakhs
118	Tamil Nadu	Thoothukudi	NAC	3-5 Lakhs
119	Telangana	Greater Hyderabad	NAC	>20 Lakhs
120	Telangana	Warangal	Non-NAC	10-20 Lakhs
121	Telangana	Nalgonda	NAC	1-3 Lakhs
122	Telangana	Patencheru	NAC	1-3 Lakhs
123	Telangana	Sangareddy	NAC	<1 Lakh
124	Uttar Pradesh	Lucknow	NAC	>20 Lakhs
125	Uttar Pradesh	Kanpur	NAC	>20 Lakhs
126	Uttar Pradesh	Ghaziabad	NAC	>20 Lakhs
127	Uttar Pradesh	Agra	NAC	>20 Lakhs
128	Uttar Pradesh	Meerut	NAC	10-20 Lakhs
129	Uttar Pradesh	Varanasi	NAC	10-20 Lakhs
130	Uttar Pradesh	Allahabad	NAC	10-20 Lakhs
131	Uttar Pradesh	Bareilly	NAC	10-20 Lakhs
132	Uttar Pradesh	Moradabad	NAC	10-20 Lakhs
133	Uttar Pradesh	Aligarh	Non-NAC	10-20 Lakhs
134	Uttar Pradesh	Saharanpur	Non-NAC	5-10 lakhs
135	Uttar Pradesh	Gorakhpur	NAC	5-10 lakhs
136	Uttar Pradesh	Noida	NAC	5-10 lakhs
137	Uttar Pradesh	Firozabad	NAC	5-10 lakhs
138	Uttar Pradesh	Loni (Npp)	Non-NAC	5-10 lakhs
139	Uttar Pradesh	Jhansi	NAC	5-10 lakhs
140	Uttar Pradesh	Raebareli	NAC	1-3 Lakhs

S. No.	State Name	ULB Name	Status of City	Population
141	Uttar Pradesh	Khurja	NAC	1-3 Lakhs
142	Uttar Pradesh	Gajraula	NAC	<1 Lakh
143	Uttar Pradesh	Anpara	NAC	<1 Lakh
144	Uttarakhand	Dehradun	NAC	5-10 lakhs
145	Uttarakhand	Kashipur	NAC	1-3 Lakhs
146	Uttarakhand	Rishikesh	NAC	<1 Lakh
147	West Bengal	Kolkata (M Corp.)	NAC	>20 Lakhs
148	West Bengal	Haora (M Corp)	NAC	10-20 Lakhs
149	West Bengal	Durgapur	NAC	5-10 lakhs
150	West Bengal	Asansol	NAC	5-10 lakhs
151	West Bengal	Raniganj	NAC	5-10 lakhs
152	West Bengal	Siliguri	Non-NAC	5-10 lakhs
153	West Bengal	Haldia	NAC	1-3 Lakhs
154	West Bengal	Barrackpore	NAC	<1 Lakh

NAC: Non attainment city under NCAP

Non-NAC: not NAC, but included under "5 lakh and above" category

ANNEX 2: CITY SOLID WASTE ACTION PLAN (CSWAP)

(As referred in Chapter 2 and 6)

ULB's City Profile: (demographic and waste generation details)

1.	Name of the ULB:
2.	Name of the District, State/ UT:
3.	No. of Municipal Zones in ULB:
4.	No. of wards in the ULB:
5.	Population & Households in the ULB as per 2011 Census:

Population (P_0)	Households(HH_0)

6.	Population & Households in the ULB as per current scenario:

Population (P_1)	Households(HH_1)

7.	Projected Population & Households in the ULB @2025

Population (P_2)	Households(HH_2)

8.

Institutional & Governance framework				
			Yes / No	If no, action to be taken to notify & timeline
a	Regulatory Framework	Whether Municipal SWM Bylaws notified? (conforming to SWM Rules 2016)(furnish details)		
		State SWM Strategy & Plan (available / not available)		
b	Institutional Arrangement	Roles and Responsibilities for dealing with MSWM services.		
c	Governance Reforms -	Implementation of e-governance in ULBs (available / not available)		
d	ICT based Governance	ICT based monitoring of MSWM operations, services and complaint redressal (furnish details)		

9.	MSWM Service Level Benchmarks

	Indicator	Benchmark	Before implementation of project(s)	After implementation of project(s)
1.	Household level coverage of SWM services	100%		
2.	Efficiency of collection of municipal solid waste	100%		
3.	Extent of segregation of municipal solid waste	100%		
4.	Extent of municipal solid waste recovered	80%		
5.	Extent of scientific disposal of municipal solid waste	100%		
6.	Efficiency in redressal of customer complaints	80%		
7.	Extent of cost recovery in SWM services	100%		
8.	Efficiency in collection of SWM-related user charges	90%		
--	Notified User Fee for MSWM services (provide details)			

Current MSW Management:

1.	Current MSW total generation in TPD **(A)**: _____ TPD= Tonnes per day	Per Capita generation in gms: _____ ($Ax10^6 / P_1$)
2.	Total waste collected (TPD): _____	
3.	No. of wards & % of wards practicing source segregation: No of wards | % of wards _____ | _____	
4.	No. of wards & % of wards practicing 100% door to door waste collection: No of wards | % of wards _____ | _____	
5.	Total quantity transported in TPD to: Processing Plants | SLF _____ | _____	

6.	Secondary collection points/Transfer Stations (TS) (only if TS is/ are existing, otherwise not applicable)

Waste stream	Number of TS	Capacity of TS (in TPD)
Wet waste		
Dry Waste		

7.	On basis of Waste Characterization, quantity of segregated waste generated (in TPD), of given waste streams

MSW Waste Stream	Quantity in TPD	% of MSW
Wet waste		
Dry Waste		
Sanitary Waste		
Domestic Hazardous Waste		
Other wastes (Drain Silt &Inert		
C&D Waste	Qty in TPD	% of MSW
Total C&D Waste generated		(expressed as % of A at row 1 above)

8.	Total quantity of MSW currently processed **(B)** in TPD:
9.	Total design capacity* available of all types of processing plants in TPD: *All existing, under construction, approved and defunct plants (defunct plants that have not been written off) Note: This capacity will be equal to or greater than **(B)**
10.	Operation & Maintenance and Recovery of SWM fees Issues Prepare statement of previous 5 years O&M costs incurred in ULB for O&M and the collections of SWM use fees and analyses for sustainability of O&M

Assessment of requirement of processing plants/facilities:

A	Projected waste generation@2025 in TPD:

Per capita generation for calculating waste generation:
ULBs > 10 lakh population@550 gms/capita:
ULBs 1 lakh -10 lakh (both included) population@450gm/capita:
ULBs <1 lakh population@300gm/capita:

B	Projected Waste generation streams for year 2025:

Waste stream	Fraction in MSW (indicative–can be changed as per actuals in ULB)	Projected waste generation in TPD	% of MSW
Wet Waste	55%		
Dry Waste	35%		
Domestic Hazardous waste	Minor		
Other Waste(Drain Silt & Inert)	10%		
To SLF (not more than)	20%		

Other components of MSW Management

C	**Sanitary Landfill (SLF)** (Filling CELL for 5 years only)

Waste sent to SLF restricted to 20% of total Municipal	
SLF capacity for 5 years duly adding extra volume for daily cover, top cover etc. (as per Manual on MSWM) Tonnes/cum/day	

D **Estimated cost for proposed components as per GAP analysis**

Waste Management Component	Total proposed requirement (gap projected @2025)	Estimated cost/ tonne (per machine for MRSs)	Proposed estimated cost
Wet waste processing			
Dry waste processing			
C&D waste processing			
Dumpsite Remediation			
Sanitary Landfill			
Transfer Station			
Mechanical Road Sweepers (MRSs)			

Financing Planning of Fund Required for Addressing the GAPs (Rs. in Crore)

	Waste management Item	Total Proposed Cost	ACA under SBM-U 2.0	State Govt. Fund	ULB fund	Other Fund (PPP, others)
1.	For wet waste processing					
2.	For Dry waste processing					
3.	For C&D waste processing					
4.	For Dumpsite Remediation					
5.	For Sanitary Landfill					
6.	For Transfer Station					
7.	For Mechanical Road Sweepers					
	Grand Total					

Items not required/applicable in the particular ULB may be deleted

Module 1: MSW Processing GAP analysis & Action Plan

M1.1 GAP Assessment for 100% Processing of MSW at ULB level

Processing Facility proposals	Existing Plants Capacity (TPD)*	Status of Current Capacity- Deficit/ Surplus	GAP Projected @2025 (TPD)
Mixed Waste Processing Facility (continue to be used for either Wet OR Dry Waste) – Data taken for assessing capacities			No new mixed waste plant will be allowed
Composting Plants (for WET waste)			
Bio-methanation Plants (for WET waste)			
Material Recovery Facilities MRF- (for DRY waste)			
Standalone RDF Plants (for DRY waste downstream of MRFs)(not part of composting plants)			
Waste to Electricity (RDF based – only for ULBs > 10 lakh)			
Others (describe the nature of plants, feed stock should be source segregated waste)			

*(Operational/Under Constn. / in Tender Process, Non-Functional good condition)

*Explanation for calculating the **GAP**.*

Many ULBs have installed composting plants receiving mass waste, without segregation at source, but carry out segregation within the process. Such plants shall continue to be utilized for either wet or dry waste, for full design capacity with segregation at source. It will result in proposing plants for other waste stream only.
Additional process may be added down the line to process RDF if not already being done in such plants.

After the GAP analysis, actions need to be taken for preparation of DPRs; Identifying & earmarking land; documents for tenders etc.

M1.2 ULB level Action Plan for achieving 100% scientific MSW Processing

Processing Facility proposals	Proposed Plant Capacity (TPD)	Estimated Cost	Plant Commissioning Date
Composting Plants (for WET waste)			
Bio-methanation Plants (for WET waste)			
Material Recovery Facilities MRF- (for DRY waste)			
Standalone RDF Plants (for DRY waste downstream of MRFs)(not part of composting plants)			
Waste to Electricity (RDF based – only for ULBs > 10 lakh)			
Others (describe the nature of plants -feed stock should be source segregated waste)			
TOTAL			
Other Proposals part of MSW			
Construction of SLF			
Construction of TS, if required (ULBs >5lakh and haulage of fully loaded vehicles is > 15Km			
TOTALs			

M1.3 ULB commitment timelines for Certification under Garbage-free Cities Star Rating

S.No.	GFC Star Rating Certification	Committed Date
1.	1-Star GFC Rating Certification	
2.	3-Star GFC Rating Certification	(mandatory before 31.3.2026)
3.	5-Star GFC Rating Certification	These Certifications are beyond the mandatory requirement under SBM 2.0. ULBs are encouraged to get these certifications.
4.	7-Star GFC Rating Certification	

M1.4 State/ UT – Consolidated Financial Action Plan for MSW Processing: Financials in Rs. Crore

	FY 2021-22	FY 2022-23	FY 2023-24	TOTAL (equal to SBM 2.O SWM allocation, Processing part only)
Action Plan Amount				
No. of ULBs covered*				All ULBs in the State/ UT covered in APs by 2023-24
** Detailed ULB-wise, plant-wise Action Plan statement is to be furnished Action Plan approvals to be obtained by 31.3.2024 for all ULBs*				

M1.5 State / UT – Consolidated Certification- cum-Implementation Action Plan (only First time GFC Certifications to be considered)

Certification	Before SBM 2.O	FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26
No. of ULBs rated 1-Star				All ULBs to be 1-Star rated by 31.3.2023		
No. of ULBs rated 3-Star*						
No. of ULBs with 100% waste processing						
* All ULBs to become 3-Star GFC Rated before 31.3.2026						

Module 2: Legacy Waste Dumpsites Remediation Action Plan

M2.1 ULB's Dumpsite Remediation Plan (applicable only if ULB has an existing dumpsite(s))

Total quantity of existing legacy waste in tonnes	
Land occupied by the dumpsite, Acres	
Proposed method for remediation*	
Action plan for recoverable material	
Indicative Uses/ Utilization of Segregated Material	
Land to be recovered, Acres (extent of land from which waste is completely removed)	
End uses of remediated dumpsite area	
Estimated Cost for Remediation	
Most likely date for complete remediation (not beyond 31.3.2023 for ULBs < 10 lakhs and 31.3.2024 for ULBs > 10 lakhs)	

** to be compliant with extant NGT and Court orders*

M2.2 State/ UT– Consolidated Financial Action Plan for Dumpsite Remediation:

Financials in Rs. Crore

	FY 2021-22	FY 2022-23	**TOTAL** (equal to SBM 2.O allocation for dumpsite remediation for the State / UT)
Action Plan Amount			
No. of ULBs covered*			All ULBs in the State/ UT
Action Plan approvals to be obtained by 31.3.2022 for all ULBs <10 Lakh and by 31.3.2023 for all ULBs >10 lakh * *Detailed ULB-wise, dumpsite-wise Action Plan statement is to be furnished*			

M2.3 State/ UT – Consolidated Dumpsite Remediation Implementation Action Plan

Remediation	Before SBM 2.O	By 31.7.2022	By 31.3 2023	By 31.3.2024	TOTAL
No. of ULBs completing remediation					All ULBs in the State/ UT to complete remediation by 31.3.2024

Module 3: C&D Waste Processing Action Plan (only for 154 non-complying (NCAP cities) and 5-lakh size ULBs)

M3.1 ULBs Gap Assessment for Processing of Construction and Demolition Waste

(Applicable for ULBs > 5 lakh population and/or 154 Non-attainment cities)

Estimated C&D Waste generated @ 50gm/capita of total Municipal Solid Waste in TPD	
Add 25% extra for bulk C & D waste generators, depositing with ULB	
Add 20% over and above	
Total C&D waste currently generated in TPD	
Existing capacity of C&D waste processing plant available in TPD	
Proposed capacity in TPD for 2025	

M3.2 State/ UT – Consolidated Financial Action Plan for C&D Waste Processing: Financials in Rs. Crore

C&D Waste Processing	FY 2021-22	**TOTAL** (equal to SBM 2.O allocation for C&D Waste Plants)
Action Plan Amount		Approvals to be obtained by 31.3.2022 for all the ULBs concerned in one go, thus prioritizing control of air pollution
Detailed Statement of ULB-wise C&D waste processing plant proposals are to be furnished		

M3.3 State/ UT– Consolidated C&D Waste Processing Plants Implementation Action Plan

Setting up C&D Waste Processing Plants	**Before/ Outside SBM 2.O**	**By 31.7.2022**	**By 31.3.2023**	**TOTAL**
No. of ULBs				All ULBs > 5lakh + NCAP ULBs in the State/ UT to complete the plants by 31.3.2023

Module 4: Mechanical Road Sweepers Action Plan (only for 154 non-complying (NCAP) and 5-lakh size ULBs)

M4.1 Mechanical Road Sweepers (Applicable only for ULBs > 5 lakh population and/or 154 Non-attainment cities) - Assessment for a ULB:

Length of road to be swept daily(Only those roads which are 4-lane or more lanes)	
Detailed calculation of mechanical sweeping required in **Lane-KMs**	
Proposed no. of Machines required to sweep the length	
No. of Machines currently operating /existing	
Current requirement of machines (nos)	

M4.2 State/ UT – Consolidated Financial Action Plan for Mechanical Road Sweepers: Financials in Rs. Crore

	FY 2021-22	**TOTAL** (equal to SBM 2.O allocation for Mechanical Road Sweepers)
Action Plan Amount		Approvals to be obtained by 31.3.2022 for all the ULBs concerned in one go, thus prioritizing control of air pollution
Detailed Statement of ULB-wise Mechanical Road Sweepers proposals are to be furnished		

M4.3 State Government / UT Administration – Consolidated Mechanical Road Sweepers Implementation Action Plan

Equipping ULBs with Mech. Road Sweepers	**Before/Outside SBM 2.O**	**By 31.7.2022**	**By 31.3.2023**	**TOTAL**
No. of ULBs				All ULBs > 5lakh + NCAP ULBs in the State/ UT to complete procurement of MRSs by 31.3.2023

STATE/ UT ANNUAL ROADMAP

I. State/ UT Annual Action Plans (Financial)

(Aggregate of action plans mentioned at M1.4, M2.2, M3.2 and M4.2 above)

	FY 2021-22	FY 2022-23	FY 2023-24	TOTAL
Sub-Action Plans:				
MSW Processing				
Dumpsite Remediation				
C&D Waste Processing				
Mechanical Road Sweepers				
Cumulative Action Plan TOTAL				(equal to SBM 2.O allocation)
No. of ULBs covered				All ULBs in the State/ UT are to be covered in Action Plans by FY 2023-24 leaving adequate time for implementation

II. Roadmap for Deliverables:

MSWM compliances	Before SBM 2.O	By 31.3.2022	By 31.3.2023	By 31.3.2024	By 31.3.2025	By 31.3.2026
No. of ULBs with -						
100% MSW processing						(All ULBs)
100% Dumpsite Remediation				(all ULBs concerned)	----------	----------
100% C&D Waste processing			(all ULBs concerned)	----------	----------	----------
Mechanical Road Sweeping			(all ULBs concerned)	----------	----------	----------
* *All ULBs to become 3-Star GFC Rated before 31.3.2026*						

III. Roadmap for Garbage Free City (GFC) Star Rating Certifications:

Certification	Before SBM 2.O	By 31.3.2022	By 31.3.2023	By 31.3.2024	By 31.3.2025	By 31.3.2026
No. of ULBs with GFC 3-Star Certification (mandatory under SBM 2.0) or higher certification						(All ULBs)

ANNEX 3A: CITY SANITATION ACTION PLAN (CSAP): FOR TOILETS

(As referred in Chapters 2 and 7)

To be filled in by all ULBs

S. No	Description	Particulars	Detailed description	Remarks
A	**GENERAL INFORMATION**			
1	**Location and Physical aspects**			
1.a	Location	Name of the City, District, State		
1.b	Physical Aspects	Municipal Area in sq. km and Class of Town		
		Number of Wards		
		Geographical description -Hilly area, river, Environmental sensitive area etc.		
1.c	Maps	Map depicting administrative boundaries, roads and railways, water bodies, Important land-marks etc. (if not available, to be prepared)		
		Topo-Sheet *(ref: Survey of India, Scale - 1:50000)*(if not readily available, get it)		
2	**Demography and Growth pattern**			
2.a	Population	Census data - Latest census data and previous census data (population projection for 2025, 2040 and 2055)		
		Slum population • Population • Households • Density		
		Non slum population • Population • Households • Density		
		Floating population • Population per day (if available from tourism department)		
		Decadal Population growth rate (in %)		
3	**Land Use information and Development**			
3.a	Land Use pattern	Land use classification in the city– [Area under residential, commercial, Institutional, open areas, slums (available / not available)]		
		Details of Population and projected growth		
3.b	Maps	Map depicting the existing land use - residential, commercial, Institutional, slums, green cover, open land etc. (available / not available)		

B	**TECHNICAL INFROMATION: Information regarding Sanitation infrastructure facilities**			
4	**Access to Toilet** *(Ward-wise information to be made available)*			
4.a	Individual Toilet	• Number of Sanitary toilets • Number of insanitary toilets (single pit, twin pit, insanitary, dry, pour flush) • septic tank without soak away		
	Community toilet	• Number of households dependent • Number and Location of toilet blocks • Number of seats per block • Functional status • Septic tank without soak away		
	Public toilet and urinals	• Number and Location of toilet & urinal blocks • Number of seats per block • Functional status • Septic tank without soak pit		
	Open defecation	• Location of OD spots		
4.b	Operation and maintenance	Notified rates of User charges (Rs) • For community toilets • For public toilets		
		Responsible agency for O&M [By in-house arrangement or outsourced]		
		Complaint redressal system		
4.c	Service Level Benchmark (100%)	Access to toilet (% coverage)		
4.d	Maps	Map depicting the Location of public and community toilets (if not available, the same to be depicted)		
C	**INSTITUTIONAL AND GOVERNANCE**			
5	**Institutional framework**			
5.a	Regulatory Framework	Whether Municipal Sanitation Bye Laws notify tariff for sanitation services. (details)		
		State Sanitation Strategy (available / not available)		
5.b	Institutional Arrangement	Roles and Responsibilities for dealing with sanitation services.		
5.c	Governance and Reforms -	Implementation of e-governance in ULBs (available / not available)		

D	**CAPACITY ENHANCEMENT:**			
6	**Capacity Management**			
6.a	Human Resource Development	Details of the personnel engaged in sanitation services along with roles and responsibilities.		
		Outsourcing of staff and services (available / not available)		
E	**GAP ANALYSIS:**			
7.a		Analyze the projected requirement of sanitation infrastructure/facilities in 2025,		
7.b		Identify the available infrastructure in good condition		
7.c		Analyze the gap in various areas and suitably club as part of a project/DPR • IHHL/CT/PT/Urinals		

Funding requirement				
Total fund required	**Central share**	**State share**	**ULB share**	**Others (pl specify)**

ANNEX 3B: CITY SANITATION ACTION PLAN (CSAP): FOR USED WATER MANAGEMENT

(As referred in Chapters 2 and 7)

(To be filled in only for Cities below 1 Lakh Population, as referred in Chapters 2 and 6)

S.No.	Description	Particulars	Detailed description	Remarks
A	**GENERAL INFORMATION**			
1	**Location and Physical aspects**			
1.a	Location	Name of the City, District, State		
1.b	Physical Aspects	Municipal Area in sq. km and Class of Town		
		Number of Wards		
		Geographical description -Hilly area, river, Environmental sensitive area etc.		
1.c	Maps	Map depicting administrative boundaries, roads and railways, water bodies, Important landmarks etc. (if not available, to be prepared)		
		Topo-Sheet *(ref: Survey of India, Scale - 1:50000)* (if not readily available, get it)		
2	**Demography and Growth pattern**			
2.a	Population	Census data - Latest census data and previous census data (population projection for 2025, 2040 and 2055)		
		Slum population • Population • Households • Density		
		Non slum population • Population • Households • Density		
		Floating population • Population per day (if available from tourism department)		
		Decadal Population growth rate (in %)		
3	**Land Use information and Development**			

3.a	Land Use pattern	Land use classification in the city– [Area under residential, commercial, Institutional, open areas, slums (available / not available)]		
		Details of Population and projected growth		
3.b	Maps	Map depicting the existing land use - residential, commercial, Institutional, slums, green cover, open land etc. (available / not available)		
B	**TECHNICAL INFROMATION: Information regarding Used water infrastructure facilities**			
4	**Details of existing sewage infrastructure**			
4.a		Brief description of existing sewage infrastructure in the town: (i) TPs (ii) FSTPs (iii) Existing sewers (iv) Drains (v) Number of cesspool tankers (govt./private) (vi) Funding Agencies & amount		
5	**Sewage Management**			
5.a	Sewage Generation	• Estimated sewage generation (in MLD for 2025. 2040, 2055)		
5.b	Collection and Conveyance	**NETWORK COVERAGE** • Present population covered with sewerage network • Present population uncovered with sewerage network		
		SEPTAGE • Status of scheduled desludging (by ULB/ Licensed operator)		
		Drainage • Number of drains with length & material of construction etc. (width more than 75 cm) carrying sewage into the surface water body or open land • Status of drains with or above 75 cm width (covered/uncovered) • Number of outfall locations along with estimated quantity of sewage (dry weather) being discharged into surface water body or open land		
		Outfall location • Mention the location of outfall points (river/ Natural drain/surface water body/ open land)		

5.c	Treatment (Septage, Used water)	**Used water treatment (including cotreatment)** – Are the used water treatment facility available (yes/no) If 'yes' • Treatment technology and Capacity (MLD) • Current capacity utilization–under/over (MLD) • Quantity of used water treated (MLD) • Quantity of septage co-treated (KLD) • Reuse (treated used water, sludge, biogas) Information along with respective quantity		
		Septage treatment Are the septage treatment facility available (yes/No) – If 'yes' • Quantity of septage to be treated (KLD) • Treatment technology and Capacity (KLD) • Current utilization - under/over (KLD) • Reuse (treated used water, sludge, biogas) Information along with respective quantity		
5.d	Operation and Maintenance	For existing septage collection, conveyance and treatment facility • Responsible agency • User charges for desludging, conveyance and disposal per household (Rs) • O&M cost for the treatment facility (Rs) • Cost recovery (%)		
		For existing used water collection, conveyance and treatment facility • Responsible agency • Household sanitation tariff – Monthly (Rs) • Conservancy tax as part of property tax • O&M cost for the conveyance and treatment facility (Rs) • Cost recovery (%)		

<table>
<tr><td>5.e</td><td>Service Level Benchmark - Present</td><td>
<table>
<tr><td>Indicators</td><td>Benchmark</td><td>Before implemen-tation of project</td><td>After the implemen-tation of project</td></tr>
<tr><td>Coverage of Sewerage Network</td><td>100%</td><td></td><td></td></tr>
<tr><td>Collection efficiency of Sewerage Network</td><td>100%</td><td></td><td></td></tr>
<tr><td>Adequacy of Sewage Treatment Capacity</td><td>100%</td><td></td><td></td></tr>
<tr><td>Quality of sewage treatment</td><td>100%</td><td></td><td></td></tr>
<tr><td>Extent of Reuse and Recycling of Sewage</td><td>20%</td><td></td><td></td></tr>
<tr><td>Extent of cost recovery in sewage/ used water management</td><td>100%</td><td></td><td></td></tr>
<tr><td>Efficiency in redressal of customer complaints</td><td>80%</td><td></td><td></td></tr>
<tr><td>Efficiency in Collection of sewage / used water Charges</td><td>90%</td><td></td><td></td></tr>
<tr><td>Access to toilets</td><td>100%</td><td></td><td></td></tr>
<tr><td>Scheduled desludging</td><td>100%</td><td></td><td></td></tr>
<tr><td>Notified tariff for desludging</td><td></td><td></td><td></td></tr>
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</td><td></td><td></td></tr>
<tr><td>5.f</td><td>Maps</td><td colspan="2">Map depicting the coverage of existing sewer network coverage and onsite system</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Access to toilets</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Scheduled desludging</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Notified tariff for desludging</td><td></td><td></td></tr>
<tr><td>C</td><td colspan="5">INSTITUTIONAL AND GOVERNANCE</td></tr>
<tr><td>6</td><td colspan="5">Institutional framework</td></tr>
</table>

6.a	Regulatory Framework	Whether Municipal Sanitation Bye Laws notify tariff for sanitation/sewage services (details)		
		State Sanitation Strategy (available / not available)		
6.b	Institutional Arrangement	Roles and Responsibilities for dealing with sanitation/ sewage services.		
6.c	Governance and Reforms -	Implementation of e-governance in ULBs (available / not available)		
D	**CAPACITY ENHANCEMENT:**			
7	**Capacity Management**			
7.a	Human Resource Development	Details of the personnel engaged in sanitation services along with roles and responsibilities.		
		Outsourcing of staff and services (available / not available)		
E	**GAP ANALYSIS:**			
8.a		Analyze the projected requirement of used water infrastructure/facilities in 2025,		
8.b		Identify the available infrastructure in good condition		
8.c		Analyze the gap in various areas and suitably club as part of a project/DPR • Sewer network • Septage conveyance • STP cum FSTP • Recycle and reuse potential		
F	**CONCLUSION**	On above lines identify various DPRs/ plan for projects related to • I&D and STP cum FSTP • Sewer network • Storm water drainage system • Recycle and reuse projects • Gap in human resources for execution and O&M etc.		

Funding requirement				
Total fund required	**Central share**	**State share**	**ULB share**	**Others (pl specify)**

Roadmap for achieving Mission outcomes

Target/Year	2021-22	2022-23	2023-24	2024-25	2025-26	Remarks
Cities ODF++						
Cities Water+						

ANNEX 4: STATEWISE ALLOCATION OF FUNDS

(As referred in Chapter 4)

For toilet construction and SWM components, the allocation of funds has been done on the basis of weighted average of urban population of State/ UT to total urban population of statutory towns, and area of State to total area of country. For Used water management, the allocation of funds has been done on the basis of total population of < 1 lakh ULBs in State / UT to total population of < 1 lakh ULBs in the country. All population figures are based on Census 2011 figures.

S. No.	Name of State/ UT	Central share allocation (₹ in crores) for:					
		Toilet construction		Used water Manage-ment	Solid Waste Manage-ment	IEC	CB
		Floating fund	State allocation				
1.	ANDAMAN AND NICOBAR ISLANDS		0.5	0.0	5.5	1.7	0.9
2.	ANDHRA PRADESH		47.1	694.1	458.1	142.4	71.6
3.	ARUNACHAL PRADESH		1.0	79.3	33.2	10.3	5.2
4.	ASSAM		14.2	315.7	118.3	36.8	18.5
5.	BIHAR		37.9	666.5	341.1	106.0	53.3
6.	CHANDIGARH		3.3	0.0	28.5	8.9	4.5
7.	CHHATTISGARH		19.1	414.6	200.1	62.2	31.3
8.	DADRA AND NAGAR HAVELI & DAMAN and DIU		1.1	23.1	4.8	1.5	0.7
9.	DELHI		52.8	0.0	436.1	135.6	68.1
10.	GOA		2.9	56.9	12.3	3.8	1.9
11.	GUJARAT		83.0	806.9	701.4	218.0	109.6
12.	HARYANA		28.5	284.4	226.9	70.5	35.4
13.	HIMACHAL PRADESH		2.2	101.0	36.5	11.3	5.7
14.	JAMMU & KASHMIR		10.3	226.4	131.7	40.9	20.6
15.	JHARKHAND		25.6	236.8	174.9	54.4	27.3
16.	KARNATAKA		76.1	1,128.6	709.3	220.5	110.8
17.	KERALA		51.4	521.7	205.8	64.0	32.2
18.	LADAKH		0.7	34.1	19.0	5.9	3.0
19.	MADHYA PRADESH		64.7	1,229.5	617.5	192.0	96.5

20.	MAHARASHTRA	IHHL/CT/ PT/Urinals	163.8	1,484.8	1,438.1	447.1	224.7
21.	MANIPUR		2.5	58.7	23.9	7.4	3.7
22.	MEGHALAYA		1.9	40.8	16.8	5.2	2.6
23.	MIZORAM		1.8	48.1	22.2	6.9	3.5
24.	NAGALAND		1.8	60.3	19.0	5.9	3.0
25.	ODISHA		22.6	491.0	209.8	65.2	32.8
26.	PUDUCHERRY		2.7	25.5	20.4	6.3	3.2
27.	PUNJAB		33.5	589.0	294.2	91.5	46.0
28.	RAJASTHAN		54.9	916.1	541.8	168.4	84.6
29.	SIKKIM		0.5	9.8	6.2	1.9	1.0
30.	TAMIL NADU		112.5	1,999.7	807.4	251.0	126.1
31.	TELANGANA		43.9	463.1	381.9	118.7	59.7
32.	TRIPURA		3.1	48.4	23.0	7.2	3.6
33.	UTTAR PRADESH		143.4	2,117.2	1,235.9	384.2	193.1
34.	UTTARAKHAND		9.8	203.0	89.0	27.7	13.9
35.	WEST BENGAL		93.8	507.9	577.7	179.6	90.3
	RETAINED AT MOHUA			-		790.2	782.4
	TOTAL	**405**	**1,215**	**15,883**	**10,168**	**3,951**	**2,371**

ANNEX 5: OUTPUT-OUTCOME INDICATORS

(As referred in Chapter 10)

Outputs (2021-26)					Outcomes (2021-26)				
Output	**Indicator(s)**	**Target**	**Year-wise Target**		**Out-come**	**Indica-tor (s)**	**Target**	**Year-wise Target**	
1. Sustainable Sanitation									
1.1 Construction of Community Toilets/ Public Toilets (2,70,000 seats)	Total number of CT/PT constructed	Number of CT/PT con-structed	Y1:		ODF+ Status (All cities declared ODF+)	Total number of Cities/ towns declared ODF+	Number of Cities/ towns declared ODF+ in the country	Y1:	
			Y2:					Y2:	
			Y3:						
			Y4:						
			Y5:						
1.2 Construction of Urinals (50,000 nos.)	Total number of Urinals Constructed	Number of Urinals Con-structed	Y1:					Y3:	
			Y2:						
			Y3:						
			Y4:					Y4:	
			Y5:						
1.3 Construction of IHHL (50,000 nos.)	Total number of IHHL constructed	Number of IHHL Con-structed	Y1:					Y5:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						
2. Solid Waste Management									
2.1 Upgradation of system of Segregation, collection and transportation (All Cities)	Total number of cities with upgraded segregation, collection and transpor-tation system	Number of cities with upgraded segregation, collection and trans-portation system / **number of wards covered by 100% source segregation**	Y1:		Garbage Free Rat-ings for the Cities (All cities)	Total number of Cities/ Towns Declared at least 3 star rated	Number of Cities/ Towns Declared at least 3 star rated	Y1:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						
2.2 Construction of Material Recycling Facilities (MRFs) (All Cities)	Total number of Cities with MRFs installed	Number of Cities with MRFs installed	Y1:					Y2:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						

2.3 Processing of Waste (dry and wet waste) (All Cities)	Scientific Processing of Waste generated in all the cities	Number of cities with 100% scientific processing of waste **/ quantity (tonnes per day) of generated waste being scientifically processed**	Y1:						
			Y2:						
			Y3:						
			Y4:						
			Y5:						
2.4 Processing of Construction and Demolition Waste (Non-Attainment Cities and other cities with population of 5 lakh and above)	Scientific Processing of C&D waste in Non-Attainment Cities	Number of Non-Attainment Cities with Scientific Processing of C&D Waste / **quantity (Tonnes per day) of C&D waste processing for which plants commissioned**	Y1:					Y3:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						
2.5 Biomining and Capping of Dumpsites (>10 Lakh Population Cities)	(a) Biomining of waste from dumpsites of all cities.	Number of Cities with biomining of waste / **Quantum (in lakh tonnes) of waste remediated in dumpsites**	Y1:					Y4:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						
	(b)Biomining and Capping of dumpsites in Cities with 10 lakh & above population	Number of Cities with 10 lakh & above population with Capping of Dumpsites **/ Quantum (in lakh tonnes) of waste remediated in dumpsites**	Y1:						
			Y2:						
			Y3:						
			Y4:						
			Y5:						
2.6 Mechanized Road Sweeping (Non-Attainment Cities and other cities with population of 5 lakh and above)	Mechanized road sweeping in Non-Attainment cities	Number of Non-Attainment cities with Mechanized road sweeping.	Y1:					Y5:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						

1. Used water Management (only for cities with population of below 1 lakh)									
3.1 Installation of Sewage Treatment Plants (STPs/ FSTPs)	Installation of STPs/FSTPs in cities with less than 1 lakh population.	Number of cities with less than 1 lakh population having installed STPs/FSTPs	Y1:		ODF++ Status All Class II cities and below and Water+ Status (in 50% of Class-II and below cities)	Total number of Cities ODF++ Water+	Number of Cities ODF++ Wate		
			Y2:						
			Y3:						
			Y4:						
			Y5:						
3.2 Procurement and O&M of Septic Tank Cleaning Vehicles	Provision of Scheduled cleaning of septic tanks in all the cities of less than 1 lakh population	Number of cities of less than 1 lakh popula-tion with provision of scheduled cleaning of septic tanks	Y1:					Y1: ODF+ + Y1: Water+ +	
			Y2:					Y2: ODF+ + Y2: Water+ +	
			Y3:						
			Y4:						
			Y5:						
3.3 Improve-ment of Sewerage and Septage Man-agement in cities with less than 1 lakh Population	Total Sewerage Treatment plants (STPs) capacity add-ed/installed	Total STPs capacity to be achieved in five years	Y1					Y3: ODF+ + Y3: Water+ +	
			Y2						
			Y3						
			Y4						
			Y5						
	Total FSSM Capacity add-ed/installed	Total FSTPs capacity to be achieved in five years	Y1					Y4: ODF+ + Y4: Water+ +	
			Y2						
			Y3					Y5: ODF+ + Y5: Water+ +	
			Y4						
			Y5						

4. IEC and Capacity Building	Campaigns on Radio, TV, Social Media, and e-learning training workshops	Cover 100% population in Urban Area	Y1:		Awareness generation and behavioural change vis-à-vis importance of hygiene and sanitation in public health. The outcome is not quantifiable, however, effective communication and awareness would lead to greater public participation and citizen involvement in creating garbage free and Open Defecation Free cities, and ultimately, make Swachh Bharat Mission into a 'jan andolan'. 100% population sensitized about the Mission	Number of citizens participated in Star Rating for GFC, Swachh Manch, Swachhata App Downloads	Cover approx. 30% people connected with GTL, Swachhata App, Helpline, Swachh Manch.	Y1:	
			Y2:					Y2:	
			Y3:					Y3:	
			Y4:					Y4:	
			Y5:					Y5:	

	Number of Workshops conducted such as Regional/ National level Workshops, Star Rating Garbage free protocol, NIUA workshops on Sanitation and SWM, etc.	Number of ULBs covered with Capacity Building (All cities)	Y1:		Improvement in skills, knowledge and capacities, leadership development and change management competencies developed of ULB officials connected with implementation of Mission, through Workshops, Seminars, Trainings, etc.	Number of ULB officials trained	Cover all ULB officials	Y1:	
			Y2:					Y2:	
			Y3:					Y3:	
			Y4:					Y4:	
			Y5:					Y5:	
			Y2:						
			Y3:						
			Y4:						
			Y5:						

ANNEX 6: CHECKLIST FOR PROPOSAL PREPARATION

(As referred in Chapter 6,7)

Check List for Scrutiny for Solid Waste Management Projects seeking funding from Swachh Bharat Mission (Urban) 2.0

1.	Name of the Project:
2.	Name of the ULB, District, State/UT:
3.	No. of wards of the ULB:
4.	Present Status of SWM:

a.	MSW generation in TPD:	
b.	Per capita waste generation:	
c.	% of wards practising source segregation:	
d.	% of wards practising door to door collection:	
e.	Quantity of MSW being processed in TPD:	
f.	% of waste being processed:	
g.	% of waste dumped /landfilled	

5. Waste Quantification with the waste streams of the current year records

Waste streams	Current year (TPD)	% of MSW
Wet Waste		
Dry Waste		
Sanitary Waste		
Domestic Hazardous Waste		
Other Waste(Drain Silt & Inert)		

6. Details of existing/on-going/proposed scheme in the project area (Please enter brief details project wise)

7. Details of existing design capacity of processing facilities (including under construction, tendered, non-functional)

Waste Processing Unit	Exiting Design Capacity
Composting Plants	
Bio-methanation Plants	
Material Recovery facility	
Material Recovery facility with RDF	
Waste to Electricity	

8. Population Details

2011 Census	Current Year 2021	Projected 2025

9. Implementing Agency:

10.	Operating Agency:
11.	City Sanitation Plan (CSP) status: Approved/Not approved
12.	Recycling agencies whether/ which have in partnership with ULBs etc. (brief details to be mentioned)
13.	Status of Solid Waste Management Service Level Benchmarks

S. No.	Indicator	Unit	Baseline before project	Reliability of measurement	After project	Reliability of measurement
1	Household level coverage of SWM services	%				
2	Efficiency of collection of municipal solid waste	%				
3	Extent of segregation of municipal solid waste	%				
4	Extent of municipal solid waste recovered	%				
5	Extent of scientific disposal of solid waste	%				
6	Efficiency in redressal of customer complaints	%				
7	Cost recovery of SWM services	%				
8	Efficiency in collection of charges	%				

For Integrated Solid Waste Management

14.	Per capita waste generation :
	ULBs > 10 lakh population@550 gm/capita:
	ULBs 1 lakh -10 lakh (both included) population@450gm/capita:
	ULBs <1 lakh population@300gm/capita:
15.	Projected Quantity of Waste Generation for 2025 in TPD as per waste/capita: TOTAL:

16. Projected Waste generation streams for year 2025:

Waste stream	Fraction	Proposed waste generation in TPD	% of MSW
Wet Waste	55%		
Dry Waste	35%		
Domestic Hazardous waste	Minor		
Other Waste(Drain Silt & Inert)	10%		
To SLF	20%		

17. Details of Proposed Components

a. Proposed capacity of processing facilities for Integrated Municipal Solid Waste Management (as applicable):

Waste Processing Unit	Exiting Design Capacity (inclusive of the under construction/ tendered/non-functional /approved units)	Required Capacity
Composting Plants		
Bio-methanation Plants		
Material Recovery facility with RDF		
Waste to Electricity		

b. Transfer Stations (applicable only for ULBs with >5 lakh population)

Existing capacity in (TPD)		Proposed Capacity in (TPD)	
Wet Waste	Dry Waste	Wet Waste	Dry Waste

c. Sanitary Landfill (SLF)

Proposed quantity of waste sent to SLF (restricted to 20% of total MSW) in TPD	
Proposed capacity of SLF (Tonnes/Cum/day)	
Proposed design Year of SLF -5 years tenure	

d. Dumpsite Remediation(applicable only if Dumpsite is existing)

Total quantity of existing legacy waste	
Details of Proposed method for remediation	
Cost of per tonne of waste remediation proposed	
End uses of remediated dumpsite area	
Indicative Uses/ Utilization of Segregated Material	

e. Construction and Demolition Waste Management (applicable only for ULBs >5 lakh and NCAP cities)

C&D waste generation in TPD (restricted to 50gm/capita of total MSW generated)	
C&D waste generation (Bulk waste generators) (@ 25% of the total C&D waste generation)+20% extra in TPD	
Total Processing Capacity proposed in (TPD)	

f. Mechanical Road Sweepers (applicable only for ULBs >5 lakh and NCAP cities) * Rate of mechanical sweeping **80 Km-Lane per Shift**

Proposed length of Road to be swept/day (only 4 or more lane roads)	
Detailed calculation of mechanical sweeping required in **Lane-KMs** (please attach)	
Proposed no. of Machines required to sweep the length	
No. of Machines currently operating /existing	
Current requirement of machines (nos)	

*All mechanical sweepers are to be procured from GEM portal or centralized State agency.

18. Estimated Cost-Abstract:

Estimated cost (Cost to be furnished for the proposed components)	Per tonne cost as per Estimate

19. Outcomes of the project:

	Door to door collection service (% of wards)	Source segregation (% of wards)	Processing of waste(% of total MSW generated)
Proposed			

20. Operation & Maintenance cost and revenue generation details (O & M Framework – existing & proposed)

	User charges (in Rs. Per MT)	
	Existing	Proposed
Residential		
Commercial		
Institutions		
Industries		

	Existing (average of last 5 years)	Proposed
Annual O & M cost (Rs. in lakhs)*		
Annual Revenue generation (Rs. in lakhs)		

*Detailed proposed Annual O&M cost to be attached

21. Land Acquisition:

(a) Whether entire land required for all components of the project in possession of the Implementing Agency:

(b) If not, time required for acquiring land:

(c) Whether Right of Way required from other Government Agencies such as Railways, Defence and State Departments.

(d) Whether Resettlement and Rehabilitation involved? If yes, whether R&R project/plan approved and funds allocated?

22. Whether the required Statutory clearances (to be identified) have been obtained – yes/no

Certificate (to be furnished by ULB/ State officials):

Certified that the facts and figures mentioned have been duly verified and found to be correct

Signatures of responsible officers	(Officer 1/ULB)	(Officer 2/ULB)	(Officer 3/State)

Check List for Preparation of Sewerage and Faecal Sludge & Septage Management (FSM) DPR seeking funding under Swachh Bharat Mission (Urban) 2.0

<table>
<tr><th>S.No.</th><th>Description</th><th>Remarks</th></tr>
<tr><td>1.</td><td>Introduction</td><td></td></tr>
<tr><td>i.</td><td>Background (Description of SBM 2.0, State and City)</td><td></td></tr>
<tr><td>ii.</td><td>Location and connectivity of City</td><td></td></tr>
<tr><td>iii.</td><td>Temperature, Rainfall and climate details of the city</td><td></td></tr>
<tr><td>iv.</td><td>Topography and natural resources</td><td></td></tr>
<tr><td>v.</td><td>Soil strata</td><td></td></tr>
<tr><td>vi.</td><td>Depth of water level</td><td></td></tr>
<tr><td>vii.</td><td>Socio economic conditions:
<table>
<tr><th>S.no.</th><th>Census Year</th><th>Population</th><th>Decadal growth rate</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>viii.</td><td>Objectives of the project (describe the goals of SBM 2.0 which are targeted through proposed project)</td><td></td></tr>
<tr><td>ix.</td><td>Structure of the report indicating contents/chapters</td><td></td></tr>
<tr><td>2.</td><td>Existing Infrastructure of the town</td><td></td></tr>
<tr><td>i.</td><td>Status of water supply in the town (describe the coverage, supply hours, quality, supply rate etc.)</td><td></td></tr>
<tr><td>ii.</td><td>Status of sewerage system of city (describe the existing sewerage zones, existing infra-structure etc.)</td><td></td></tr>
<tr><td>iii.</td><td>Status of existing drainage system of the city (describe the number and capacity of the drains, outfall location etc.)</td><td></td></tr>
<tr><td>iv.</td><td>City road network</td><td></td></tr>
<tr><td>v.</td><td>Details of important surface water bodies, rivers natural drains etc. (intended recipient of sewage)</td><td></td></tr>
<tr><td>3.</td><td>Population Projection and sewage generation</td><td></td></tr>
<tr><td>i.</td><td>Population projection (for base-2025, Intermediate-2040,and ultimate-2055 year)</td><td></td></tr>
<tr><td>ii.</td><td>Ward wise population projections</td><td></td></tr>
<tr><td>iii.</td><td>Water demand</td><td></td></tr>
<tr><td>iv.</td><td>Sewage generation</td><td></td></tr>
<tr><td>4.</td><td>Gap Analysis and prioritization</td><td></td></tr>
<tr><td>i.</td><td>Necessity of the project</td><td></td></tr>
<tr><td>ii.</td><td>Population covered under this project</td><td></td></tr>
<tr><td>iii.</td><td>Water demand and sewage generation of the project area</td><td></td></tr>
</table>

<table>
<tr><td>iv.</td><td>Key map of project area within ULB map</td><td></td></tr>
<tr><td>5.</td><td>Proposed project components</td><td></td></tr>
<tr><td>i.</td><td>Sewerage System and its components (DPR should contain the following)
• Zoning under the project area
• Proposed sewerage network (summary of pipes including length, material, dia etc.)
• STP – design, capacity, technology, design year, input and output parameters, please mention if implementation in modules is considered) 36
• Details of Sewage pumping station, if any
• Length of trunk sewer
• Provision of reuse and recycle of treated used water
• Life cycle cost assessment of treatment plant</td><td></td></tr>
<tr><td>ii.</td><td>Faecal sludge and septage management components
• Population covered under FSM component
• STP cum FSTP – design scheme, capacity, technology, design year, input and output parameters, please mention if implementation in modules is considered)
• Provision of reuse and recycle of treated used water
• Number of cesspool tankers proposed along with desludging schedule</td><td></td></tr>
<tr><td>iii.</td><td>Interception & diversion works and Strengthening of drainage system
• Proposed length of drains (having width more than 75 cm) identified for strengthening and improvement
• Methodology for identification
• Number and capacity of the drains identified to be tapped
• Details of pumping arrangement, if any
• Details of outfall locations which are covered under this project
• Details treatment facility if proposed separately</td><td></td></tr>
<tr><td>6.</td><td>Operation and Maintenance</td><td></td></tr>
<tr><td>i.</td><td>General</td><td></td></tr>
<tr><td>ii.</td><td>O&M components
• Direct manpower cost
• Direct electricity/energy cost
• Direct chemical cost
• Direct expenses on repairs of STP/FSTP/Pumps/sewer conveyance and others.
• Direct cost on mechanical devices</td><td></td></tr>
<tr><td>iii.</td><td>Operation & Maintenance cost and revenue generation details (O & M Framework – existing & proposed)
<table>
<tr><td></td><td colspan="2">Sewerage Tariff (in Rs.)</td></tr>
<tr><td></td><td>Existing</td><td>Proposed</td></tr>
<tr><td>Residential</td><td></td><td></td></tr>
<tr><td>Commercial</td><td></td><td></td></tr>
<tr><td>Institutions</td><td></td><td></td></tr>
<tr><td>Industries</td><td></td><td></td></tr>
</table>
Please specify whether it is included as conservancy tax within property tax.
<table>
<tr><td></td><td>Existing (average of last 5 years)</td><td>Proposed</td></tr>
<tr><td>Annual O & M cost (Rs. in lakhs)</td><td></td><td></td></tr>
<tr><td>Annual Revenue received (Rs.in lakhs)</td><td></td><td></td></tr>
</table></td><td></td></tr>
</table>

<table>
<tr><td></td><td>Please specify in case of desludging of septic tanks.
<table>
<tr><td></td><td colspan="2">User fee (in Rs.)</td></tr>
<tr><td></td><td>Existing</td><td>Proposed</td></tr>
<tr><td>By ULB</td><td></td><td></td></tr>
<tr><td>By Private operator</td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>iv.</td><td>Service level benchmarking
<table>
<tr><td>Indicators</td><td>Benchmark</td><td>Before implementation of project</td><td>After the implementation of project</td></tr>
<tr><td>Coverage of Sewerage Network</td><td>100%</td><td></td><td></td></tr>
<tr><td>Collection efficiency of Sewerage Network</td><td>100%</td><td></td><td></td></tr>
<tr><td>Adequacy of Sewage Treatment Capacity</td><td>100%</td><td></td><td></td></tr>
<tr><td>Quality of sewage treatment</td><td>100%</td><td></td><td></td></tr>
<tr><td>Extent of Reuse and Recycling of Sewage</td><td>20%</td><td></td><td></td></tr>
<tr><td>Extent of cost recovery in sewage/ used water management</td><td>100%</td><td></td><td></td></tr>
<tr><td>Efficiency in redressal of customer complaints</td><td>80%</td><td></td><td></td></tr>
<tr><td>Efficiency in Collection of sewage / used water Charges</td><td>90%</td><td></td><td></td></tr>
<tr><td>Access to toilets</td><td>100%</td><td></td><td></td></tr>
<tr><td>Scheduled desludging</td><td>100%</td><td></td><td></td></tr>
<tr><td>Notified tariff for desludging</td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>7.</td><td colspan="2">Environmental Assessment of the project</td><td></td></tr>
<tr><td>i.</td><td colspan="2">Environmental compliance requirements</td><td></td></tr>
<tr><td>ii.</td><td colspan="2">Applicable legislations</td><td></td></tr>
<tr><td>iii.</td><td colspan="2">Identified environmental impacts from the project</td><td></td></tr>
<tr><td>iv.</td><td colspan="2">Mitigation and enhancement measures</td><td></td></tr>
<tr><td>v.</td><td colspan="2">Environmental budgetary provision</td><td></td></tr>
<tr><td>vi.</td><td colspan="2">conclusion</td><td></td></tr>
</table>

8.	**Training and Institutional**	
i.	Proposed capacity building works under the project	
ii.	Details of Institutional framework, if proposed	
9.	**Implementation schedule**	
10.	**Statutory permissions/ Clearances**	
11.	**Cost Estimates**	
i.	Cost basis for proposed works (component-wise) (as far as possible State schedule of rate are to be considered)	
ii.	O&M cost	
iii.	Provisional sum	
iv.	Cost for environmental and social management	
v.	Cost for capacity building works	
vi	Per Capita Cost(overall &component-wise)	

ANNEX 7: IEC ACTION PLAN

(As referred in Chapter 8)

1. City Profile

1	Name of the ULB:
2	Name of the District, State/ UT:
3	No. of Municipal Zones in City:
4	No. of wards in the ULB:
5	Population & Households in the ULB as per 2011 Census:
6	Population & Households in the ULB as per current scenario:
7	Projected Population & Households in the ULB @2025

Population	Households

2. Proposed IEC and Behavior Change interventions by the ULB

Proposed IEC initiatives					
Key themes/messages of the Mission amplified through the initiatives		**Details of the activities undertaken (including communication materials developed and communication platforms used)**	**Target audience**	**Expected outcomes/ desired behavior change**	**Timeline**
1	SWM (Source Segregation, Home Composting etc) / Waste Water Reuse etc	Advertisements in local print and electronic media			
2		Running radio jingles on the local FM/community radios			
3		Swaczhhagrahis conducting meetings with the ward members (specify number of meetings)			
4		Swacchata Captains facilitating meetings with key opinion influencers (specify details of influencers engaged)			

5		Workshops for engaging school children (specify the number of locations)			
6		Communication collaterals put up at strategic locations across the ward (specify the number of locations)			
Proposed Initiatives for citizen engagement					
Number of Swacchata leaders and Swacchagrahis identified for formal nomination					
Number of Citizen Sanitation Committees proposed to be set up					

3. Financial overview

S. No	Description of the activity	Tentative expenditure (in ₹)	ACA under SBM-U 2.0	State Govt. Funds	ULB Funds	Other Funds (PPP, others)
1	Development of outdoor collaterals					
2	Advertisements in print, electronic media and FM/ community radios					
3	Monthly work-shops/events with local community members and representatives					
4	Other activities					
Total tentative expenditure (in ₹)						

ANNEX 8: CAPACITY BUILDING ACTION PLAN

(As referred in Chapter 9)

1. City Profile

	Name of the ULB:
	Name of the District, State/ UT:
	No. of Municipal Zones in City:
	No. of wards in the ULB:
	Population & Households in the ULB as per 2011 Census:

Population	Households

	Population & Households in the ULB as per current scenario:

Population	Households

	Projected Population & Households in the ULB @2025

Population	Households

2. Training for Capacity Building of identified Stakeholders

S. No	Identified Stakeholders	Total Number	Areas for Training
1.	Municipal Officials		
	Technical staffs/PHE officials		
	NGOs, Educational and other institutes identified		
	Institutes identified for conducting CB Training		
	Master Trainers Identified for conducting CB Training activities		

Before beginning with trainings, ULBs are to conduct a Training Needs Analysis to identify relevant gaps and design appropriate programs and modules for imparting the training.
ULBs are to attach the following details in the CB Action Plan:

1. Quarterly training calendar carrying a description of activities as well as targeted groups
2. Training plan to also detail method of delivery of training (virtual, in person, e-learning, etc)
3. Monitoring and Evaluation Framework
4. Name and contact details of stakeholders who will attend the training

3. Training for Skill Development of the identified stakeholders

S. No	Identified Stakeholders	Total Number	Areas for Training
	Sanitation workers and SafaiMitras identified for Skill Development trainings		
	Training Institutes identified for conducting Skill Development trainings		
	Master Trainers identified for conducting Skill Development trainings		
Before beginning with trainings, ULBs are to conduct a Skills Gap Analysis to identify relevant gaps and skill needs to design appropriate modules for imparting the training. ULBs are to attach the following details in the CB Action Plan: 1. Quarterly training calendar carrying a description of activities as well as targeted groups 2. Training plan to also detail method of delivery of training (virtual or in person) 3. Monitoring and Evaluation Framework			

4. Financial Overview

S. No.	Activities to be Conducted (Representative List)	Tentative Expenditure (in ₹)	CA under SBM-U 2.0	State Govt. Funds	ULB Funds	Other Funds (PPP, others)
1	Training Needs Analysis					
2	Trainings for Municipal Officials					
3	Trainings for Technical/ PHE Officials					
4	Trainings for NGOs/ CSOs					
5	Skills Gap Analysis					
6	Trainings for sanitation workers and SafaiMitras					
7	Development of Manuals/documentation					
Tentative Total Expenditure (in ₹)						

ANNEX 9: FEATURES OF ASPIRATIONAL TOILETS

(As referred in Chapter 5)

Features of aspirational toilets
All **toilet seats** and **urinals** clean and usable at all times
Wash basin(s) clean and usable at all times
Availability of **water**
Adequate **ventilation** facility (vents, slanted glass slats and/or exhaust fan)
Premises are **well lit** at all times, both **within and outside**, with each seat having its own light point, and all light points functional
Functional **bolting arrangements** on all doors
Untreated faecal sludge/septage and sewage from the toilet is not discharged and/or dumped in drains, open areas or water bodies
Toilet floor is **swept and mopped** at all times
Mirrors, if available, are clean and polished
Available and regularly cleaned (covered) litter bins, with bins available with each toilet seat
Available and operational **soap/soap dispenser**
Usable taps and fittings, with no leakage OR water tank in or outside the structure with water available in it at all times during opening hours
Gender-segregated, distinct entrances for males and females, if both facilities available in single block
Entrance/ accessibility (like ramp, stairs) to toilet block is barrier free, including those for specially abled persons
Premises are visible to passersby, with clear signage, and the area within 3m from each direction of the structure is not encroached by unauthorized construction and vendors
Staff is provided with necessary supplies of consumables, cleaning equipment, protective gear and inventory, and there is no stock out for longer than 24 hours
Roster being maintained for regular cleaning and maintenance and a **caretaker** is on duty at all times during open hours
Public/Community Toilet is visible on Google Maps toilet locator as 'SBM Toilet'
Name and contact details of the following are displayed prominently - Supervisor, Supervisor's agency and area Sanitary Inspector(Contact number will be checked whether it is working or not)

Complaint registration and redressal mechanism (Swachhata App, Swachhata helpline 1969) is in place and is functional, with all complaints, maintenance issues or incidents resolved within 24 hours of registration
Air freshener applied
Walls and floors are clean and stain / graffiti free
Low height toilets/Indian toilets and basins for children
Plants / shrubs in the vicinity of toilet complex are well maintained
Space earmarked for advertisement for revenue generation
Hand dryer / paper napkin available
Ladies' toilets have vending machine for sanitary napkins
Incinerator facility available for disposal of used sanitary napkins for toilet having > 10 seats and also to the toilets adjacent to women college and hostels
Toilet identification number, name of ULB under which jurisdiction toilet is covered, ward number and maintenance authority prominently displayed for each toilet block
SMS based feedback with number displayed on which SMS has to be sent
Bathing facility available

ANNEX 10: BASIS OF COSTING FOR SWM COMPONENTS, CT/ PTs and USED WATER COMPONENTS

(As referred in Chapter 4)

Costing for Solid Waste Management

S.No	Component	Nos/ Population	Unit Cost	Total Cost Rs in Crore	Central Share	State/ULB Share	Private Share
1.	Solid Waste Management (through MRF, transfer stations, processing facilities, remediation of legacy waste dumpsites through Biomining & Scientific Landfilling, etc).	42.86 Crores	Rs 605/ Capita	25930	16336	7675	1919
2.	C&D Waste Processing	17.14 Crores	Rs 35/ Capita (Rs 3.5 Crore/10 Lakh Population)	600	378	111	111
3.	Mechanised Sweeping for combating air pollution	Total of 816 machines	Rs 55 lakh per machine (average)	449	283	166	0
4.	Collection & transportation including modernization of existing system.	42.86 Crores	Rs 300/ capita	12858	0	2572	10286

Cost Estimate of SWM requirements proposed under SBM 2.0 (Aggregated for all ULBs)							
				Qty,TPD	Rate	Unit	Amount
I. MSW Treatment Plants					Rs.Crore		Rs.Crore
a.	Compost Plants			30658.38			
			say	30,700.00	11.50	100 tpd	3,531
b.	BioMethanation Plants			15,063.96			
			say	15,100	18.00	100 tpd	2,718
c.	MRF-cum-RDF Plants			45,152.98			
			say	45,200	8.50	100 tpd	3,842
d.	WtE Plants (RDF based)(Electricity)			9,647.23			
			say	9,700	18.00	100 tpd	1,746
						Subtotal	11,837
II. SLF facilities for all ULBs				40,938.05			
			say	41,000	6.50	100 tpd	2,665
III. Transfer Stations for ULBs> 5lakh population							
	120358.63 TPD	40%		48,143.45			
			say	48,200	4.50	100 tpd	2,169
V. C&D Waste management in all 102 NA cities + remaining 5 lakh cities							
	10409		say	10,000	6.00	100 tpd	600
VI. Dumpsites remediation in all ULBs- 3 Categories							
a	>10 Lakh	754	Lakh MT	754	550.00	Per MT	4147
b	1-10 lakh	519	Lakh MT	519	550.00	Per MT	2855
c	<1 lakh	400	Lakh MT	400	550.00	Per MT	2200
						Subtotal	9,202
						TOTAL	26,472
						Contingencies & rounding off (0.22%)	58
						GRAND TOTAL	26,530

Rupees Twenty- Six thousand Five hundred Thirty Crore only

Costing calculations for CT/PTs:

The following section provides estimate of a 5 seat PT prepared by M/s Sulabh International which has constructed and running thousands of PTs across the country. The estimate was prepared for Bareilly Nagar Nigam in UP in FY 2019-20 following Schedule of Rates for FY 2018-19. Considering even one year cost escalation @6%, per seat cost works out to approx Rs 1.69 lakh. This justifies the cost of Rs 1.5 lakh per seat considered for Mission period 2021-2026.

Cost of 5 seat PT complex (2018-19 rate) = Rs 7,96,515
Cost escalation for one year @ 6% per annum = Rs 8,44,306
Cost per seat of PT/CT = Rs 1.69 lakh
This justifies the cost per seat adopted at Rs 1.5 lakh.

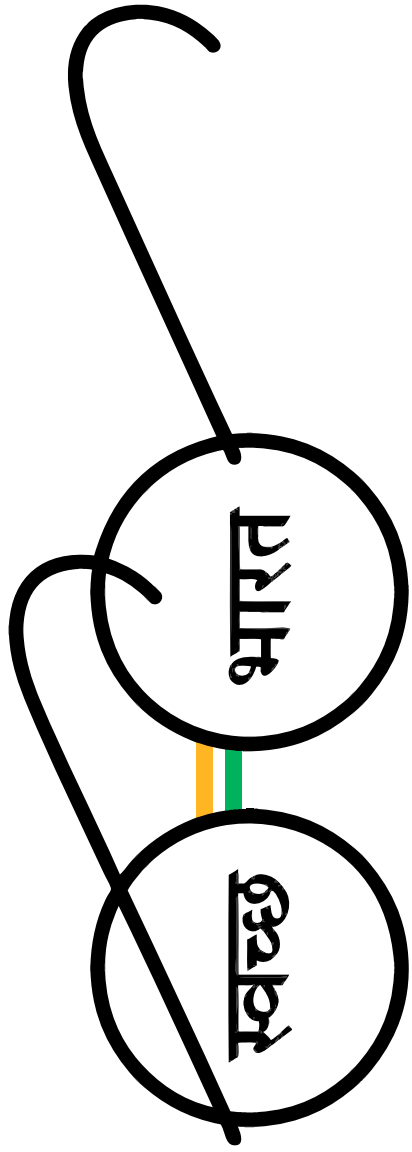
Costing calculations for Used water management

The Central share (as per eligible funding pattern) for STPs and I&D drains, for each notified town in the State/UT, will be governed by the following maximum per capita allocations:

Class of town	Maximum limit of per capita allocation for STP and I&D (including Central share + State/UT/ULB share)
II	₹3,000
III	₹2,000
IV	₹2,000
V	₹2,000
VI	₹2,000
For NE & hilly States	Class II - ₹4,000
Class III and below- ₹3,000	

This will ensure that allocation of funds is uniform across all eligible ULBs. However, depending on needs at ground, States/UTs may sanction higher per pacita funds for some town's projects, within the State/UT's overall funds allocation for used water component (Central + State share), provided that State/UT ensures that all the towns in Class II to VI are also covered with suitable sewage collection and treatment facilities.

In no case should allocated used water funds for all notified towns in the state be utilized in some selected towns while others are left unattended. In such a scenario, Central share allocation would be proportionately restricted commensurate to the number of towns attended.



एक कदम स्वच्छता की ओर

आज इतने दशकों बाद,
स्वच्छता आन्दोलन ने एक बार
फिर देश को नए भारत के सपने के साथ जोड़ने का
काम किया है। और ये हमारी आदतों को बदलने
का भी अभियान बन रहा है और हम ये न भूलें कि
स्वच्छता यह सिर्फ एक कार्यक्रम है, स्वच्छता ये
पीढ़ी दर पीढ़ी संस्कार संक्रमण की एक जिम्मेवारी
है और पीढ़ी दर पीढ़ी स्वच्छता का अभियान चलता
है, तब सम्पूर्ण समाज जीवन में स्वच्छता का
स्वभाव बनता है।

'मन की बात' में प्रधानमंत्री नरेंद्र मोदी, 26 सितम्बर 2021

सत्यमेव जयते

Ministry of Housing and Urban Affairs
Government of India

Clean Air, Clean Water, Clean Land

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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT
ON A
PROPOSED LOAN

IN THE AMOUNT OF US$381 MILLION

AND A PROPOSED GUARANTEE

IN THE AMOUNT OF UP TO US$19 MILLION

TO

INDIA

FOR A

SECOND NATIONAL GANGA RIVER BASIN PROJECT

June 1, 2020

Water Global Practice
South Asia Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective April 2, 2020)

Currency Unit =	Indian Rupee (INR)
INR76.2 =	US$1
US$ 0.0131 =	INR 1

FISCAL YEAR
April 1 – March 31

Regional Vice President:	Hartwig Schafer
Country Director:	Junaid Kamal Ahmad
Regional Director:	John A. Roome
Practice Manager:	Michael Haney, Sebnem Erol Madan (Guarantee)
Task Team Leader(s):	Xavier Chauvot De Beauchene, Upneet Singh, Satheesh Sundararajan (Guarantee)

ABBREVIATIONS AND ACRONYMS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation	KMDA	Kolkata Metropolitan Development Authority
BOD	Biochemical Oxygen Demand	MLD	Million Liters per Day
BUIDCO	Bihar Urban Infrastructure Development Corporation	MoA	Memorandum of Agreement
CAPEX	Capital Expenditure	MoEF&CC	Ministry of Environment, Forest and Climate Change
CERC	Contingent Emergency Response Component	MoJS	Ministry of Jal Shakti
COVID-19	Coronavirus disease 2019	NGRBA	National Ganga River Basin Authority
CPCB	Central Pollution Control Board	NGRBP	National Ganga River Basin Project
CPS	Country Partnership Strategy	NMCG	National Mission for Clean Ganga
CWC	Central Water Commission	NPV	Net Present Value
DBOT	Design Build Operate Transfer	NUSP	National Urban Sanitation Policy
DEA	Department of Economic Affairs	O&M	Operations and Maintenance
DO	Dissolved Oxygen	OPEX	Operational Expenditures
DoWR, RD & GR	Department of Water Resources, River Development and Ganga Rejuvenation	PDO	Project Development Objective
DPR	Detailed Project Report	PPP	Public Private Partnership
EA	Executing Agency	PPSD	Project Procurement Strategy for Development
ESDDR	Environment and Social Due Diligence Report	RPF	Resettlement Policy Framework
ESIA	Environmental and Social Impact Assessment	SAWI	South Asia Water Initiative
ESMF	Environment and Social Management Framework	SMCG	State Mission for Clean Ganga
FY	Financial Year	SNGRBP	Second National Ganga River Basin Project
GAP	Ganga Action Plan	SPV	Special Purpose Vehicle
GDF	Gender Development Framework	STP	Sewage Treatment Plant
GDP	Gross Domestic Product	TA	Technical Assistance
GHG	Green House Gas	ULB	Urban Local Bodies
GKC	Ganga Knowledge Centre	UP	Uttar Pradesh
GoI	Government of India	WRIS	Water Resources Information System
GRM	Grievance Redress Mechanism		
HAM	Hybrid Annuity Model		
I&D	Interception and Diversion		
IBRD	International Bank for Reconstruction and Development		
IDA	International Development Association		
IUFR	Interim Unaudited Financial Report		
JUIDCO	Jharkhand Urban Infrastructure Development Corporation		

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DATASHEET

BASIC INFORMATION

Country(ies)	Project Name	
India	Second National Ganga River Basin Project	
Project ID	**Financing Instrument**	**Environmental Assessment Category**
P169111	Investment Project Financing	A-Full Assessment

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[✓] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Performance-Based Conditions (PBCs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[✓] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternate Procurement Arrangements (APA)	

Expected Approval Date	Expected Closing Date	Expected Guarantee Expiration Date
25-Jun-2020	31-Dec-2026	30-Jun-2038

Bank/IFC Collaboration

No

Proposed Development Objective(s)

The objective of the Project is to reduce point-source pollution from targeted Urban Areas of the Ganga river basin and support the Central Ministry to strengthen the institutional framework for Ganga river basin management.

Components

Component Name	Cost (US$, millions)

Institutional Development	30.00
Infrastructure Development	1,045.00
IBRD Guarantee	19.00
Program Communications and Management	24.00
Contingent Emergency Response Component	0.00

Organizations

Borrower:	India
Implementing Agency:	National Mission for Clean Ganga, Ministry of Jal Shakti

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	1,118.95
Total Financing	1,118.95
of which IBRD/IDA	381.00
Financing Gap	0.00

DETAILS

Private Sector Investors/Shareholders

Equity	Amount	Debt	Amount
Government Contribution	1,099.95		
Government Resources	718.95		
IBRD	381.00		
Total	**1,099.95**		**0.00**

Payment/Security Guarantee

Financed by Commercial Loans/LC and with IBRD Guarantee	19.00
Total	**19.00**

Expected Disbursements (in US$, Millions)

WB Fiscal Year	2020	2021	2022	2023	2024	2025	2026	2027
Annual	0.00	15.00	35.00	50.00	60.00	90.00	90.00	41.00
Cumulative	0.00	15.00	50.00	100.00	160.00	250.00	340.00	381.00

INSTITUTIONAL DATA

Practice Area (Lead)

Water

Contributing Practice Areas

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	Substantial
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Moderate
7. Environment and Social	Substantial
8. Stakeholders	Substantial
9. Other	
10. Overall	Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✓	
Performance Standards for Private Sector Activities OP/BP 4.03		✓
Natural Habitats OP/BP 4.04	✓	
Forests OP/BP 4.36		✓
Pest Management OP 4.09		✓
Physical Cultural Resources OP/BP 4.11	✓	
Indigenous Peoples OP/BP 4.10		✓
Involuntary Resettlement OP/BP 4.12	✓	
Safety of Dams OP/BP 4.37		✓
Projects on International Waterways OP/BP 7.50	✓	
Projects in Disputed Areas OP/BP 7.60		✓

Legal Covenants

Sections and Description

Institutional Arrangements:
The Borrower shall maintain the NMCG and the SMCGs with staff and resources adequate to implement the Project. (LA, Schedule 2, Section I.B.1)

Sections and Description

The Borrower shall, no later than six (6) months after the Effective Date, cause NMCG to recruit, on the basis of terms of reference, qualifications and experience satisfactory to the Bank: a Project Management Consultant, a financial management specialist, a procurement specialist, internal auditors in adequate numbers for the audit of NMCG, each SMCG and each EA participating in the implementation of the Project and for each priority investment under Part 2 of the Project under a HAM PPP approach, a transaction advisor and a Project engineer. (LA, Schedule

2, Section I.B.3)

Sections and Description
The Borrower shall, in carrying out the Project, implement the requirements related to Environmental and Social Safeguards as set forth in Section I.C of the Schedule 2 of the Loan Agreement, which includes compliance with Safeguard Instruments and minimum involuntary resettlement, Bank's agreement prior to modification or waiver of Safeguard Instruments, safeguard obligations reflected in bidding documents and contracts with contractors, supervising entity and supervisors, reporting, selection of priority investments, TA, cultural heritage and grievance redress mechanism. (LA, Schedule 2, Section I.C)

Sections and Description
The Borrower, through NMCG, shall, no later than one (1) month after the Effective Date and no later than January 15 of each year, beginning in 2021, prepare, with inputs from the SMCGs, and furnish to the Bank for review and comment a draft Annual Action Plan and Budget consistent with Section II.B of Schedule 2 of the Loan Agreement, and, no later than two (2) months after the Effective Date and no later than February 15 in each year beginning in 2021, by taking into account the Bank's comments, finalize and furnish to the Bank the Annual Action Plan and Budget, acceptable to the Bank. (LA, Schedule 2, Section II.B)

Conditions

Type	Description
Disbursement	Performance-based priority investments: The Borrower shall, through NMCG, no later than twelve (12) months after the Effective Date update the Namami Gange Program Framework (Project Operations Manual) to define the performance-based eligibility criteria for the selection of priority investments under Part 2.4 of the Project, drawing on the results of the activities performed under Part 1.3 of the Project. (LA, Schedule 2, Section III.B1(b) and Section I.E.1(b)(ii)).
Type	Description
Disbursement	Contingency Emergency Response (CERC): The Borrower shall undertake no activities under the Contingency Emergency Response Component of the Project or withdraw funds funds allocated to Category (3) (Contingency Emergency Response) unless and until the conditions set forth in Section I.D.2 of Schedule 2 of the Loan Agreement have been met in respect of said activities, including eligible crisis or emergency declared and agreed; Environmental and social instruments prepared and disclosed; CERC manual adopted; and implementation arrangements established. (LA, Schedule 2, Section III.B.1(c) and Section I.D.2)

I. STRATEGIC CONTEXT

A. Country Context

1. India's Gross Domestic Product (GDP) growth has slowed in the past three years, and the COVID-19 outbreak is expected to have a significant impact. Growth has moderated from an average of 7.4 percent during FY16-FY19 to an estimated 4.4 percent in FY19/20. The growth deceleration was due mostly to unresolved domestic issues (impaired balance sheets in the banking and corporate sectors), which were compounded by stress in the non-banking segment of the financial sector, and a marked decline in consumption on the back of weak rural income growth. The outbreak of COVID-19 and the public health responses adopted to counter it have significantly altered the growth trajectory of the economy, which is now expected to contract in FY20/21. On the fiscal side, the general government deficit is expected to widen significantly to over 10 percent of GDP in FY20/21, owing to weak activity and revenues as well as high spending needs. However, the current account balance is expected to improve over FY19/20-FY20/21, reflecting mostly a sizeable contraction in imports and a large decline in oil prices. Given this, in spite of recent portfolio capital outflows, India's foreign exchange reserves are expected to remain comfortable (equivalent to over 10 months of imports).

2. Since the 2000s, India has made remarkable progress in reducing absolute poverty. Between FY11/12 and 2015, poverty declined from 21.6 percent to an estimated 13.4 percent at the international poverty line (US$1.90 per person per day in 2011 Purchasing Power Parity (PPP), continuing the earlier trend of rapid poverty reduction. Owing to robust economic growth, more than 90 million people escaped extreme poverty and improved their living standards during this period. Despite this success, poverty remains widespread. In 2015, 176 million Indians were living in extreme poverty, while 659 million—half the population—were below the higher poverty line commonly used for lower middle-income countries (US$3.20 per person per day in 2011). With the recent growth slowdown, the pace of poverty reduction may have moderated.

3. Water security is key to India's economic and human development and public health, especially in the context of infectious disease outbreaks. An estimated 80 percent of the country's surface water is consumed by agriculture and the use of water in agriculture is inefficient. As demand for surface water has outstripped its availability, in recent years India has become the largest global consumer of groundwater, which now meets two-thirds of its irrigation needs and 80 percent of its domestic water needs. In many areas, this has led to unsustainable abstraction of groundwater. Relatively little water is required to meet the country's needs for drinking water and sanitation, but these vital services are often not provided due to the absence of treatment capacity and network infrastructure. About 70 percent of India's urban population and 16 percent of rural households have access to piped water supply; but no city receives continuous water supply. Rainfall is highly variable over space and time; it occurs mainly in intense and unpredictable downpours within a short monsoon season. This variability can lead to floods and droughts which are already major sources of human and economic losses for India. Water quality is a particularly pressing challenge. India ranked 120 among 122 countries on water quality in 2018, with nearly 70 per cent of its water resources contaminated[1]. Nearly 80 percent of sewage generated in urban

[1] NITI Aayog, Government of India. 2018. *Composite Water Management Index*

areas was let out untreated[2], severely impacting public health and the environment. A World Bank study estimated that India loses US$80 billion annually due to environmental degradation, including water pollution, equivalent to 5.7 percent of GDP[3]. The brunt of these losses is borne by children, women and the poor[4].

4. Climate change will exacerbate challenges to India's water security[5]. Temperature in the region is projected to increase by 1 to 3 degrees by 2050[6] which will cause significant changes in rainfall patterns that will impact flows in the Ganga. Studies show that more extreme droughts and floods may occur as a result. Changing rainfall patterns are also expected to increase the nutrient loading in rivers, further impacting water quality[7]. Increased flooding will not only cause direct damage but is also likely to raise water contamination due to a higher volume of untreated wastewater being carried into water bodies, which in turn will increase the risk of exposure for local communities to water-borne pathogens and algal toxins. Increased droughts, heat waves or other water availability shocks will raise the demand for clean and secure water supplies, putting pressure on already exploited freshwater resources. Further, water pollution and lower water flows induced by climate change will negatively impact riverine biodiversity. For example, a study indicates that changes in river flow and depth will adversely affect the distribution and survival of the endangered Gangetic dolphin which depends on echolocation to find its food[8].

B. Sectoral and Institutional Context

5. The need for improving water security is most acute in densely populated river basins like the Ganga. The Ganga basin includes 11 States[9] and covers a quarter of India's landmass. It is home to over 40 percent of India's population (520 million) and two thirds of the country's poor. The Ganga basin is one of the most densely populated areas in the world with an average population density of 520 persons per square kilometer. It provides over one third of India's surface water[10] and includes the country's largest irrigated area. Over 40 percent of India's GDP is generated in the basin. In addition to being a critical economic resource, the Ganga carries immense religious significance in India. The river is worshipped as a living goddess by Hindus who comprise about 80 percent of India's population. Many of Hinduism's most important pilgrimage sites are located along the Ganga. This includes sites of the *Kumbh Mela* festival

[2] Source: Census 2011
[3] World Bank. 2014. Greening India's Growth: Costs, Valuations and Trade-offs.
[4] It is estimated that 1.5 million children under 5 years die each year due to water and sanitation related diseases in India. 200 million person-days of work are lost each year; the time burden is largely borne by women who are often responsible for looking after sick family members. Inadequate sanitation also differentially impacts the poor who are more likely to be unserved by sanitary infrastructure and services.
[5] Khan S *et al*. 2018. Flows and sediment dynamics in the Ganga River under present and future climate scenarios
[6] 1°C to 2°C under the climate-sensitive scenario and 1.5°C to 3°C under the carbon-intensive scenario. Mani M *et al.* 2018.
[7] South Asia's Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards.
[8] Jain CK and Singh S. 2018. Impact of climate change on the hydrological dynamics of River Ganga, India. Journal of Water and Climate Change.
[9] There are five main stem states – Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. The remaining six states are Himachal Pradesh, Delhi, Haryana, Rajasthan, Madhya Pradesh and Chattisgarh.
[10] Bons CA (Ed.). 2018. *Ganga River Basin Planning Assessment Report.* Main volume and Appendices. Deltares with AECOM and FutureWater for the World Bank and the Government of India

during which millions of pilgrims immerse themselves in the Ganga in a ritual that is believed to lead to salvation[11].

6. Despite being revered, the Ganga is at risk. The water quality and flows of the Ganga face several pressures, including: (i) abstraction of around 90 per cent of its water[12], primarily for irrigation, industrial and domestic consumption; (ii) discharge of untreated municipal sewage and industrial effluents; (iii) over-exploitation of groundwater; (iv) dumping of solid waste; and (v) loss of floodplains. These pressures, compounded by growing demands for water, may place parts of the Ganga basin at or below the threshold level of water scarcity by 2025[13]. Water stress in the basin is further aggravated by widespread pollution. The National Mission for Clean Ganga (NMCG) of the Government of India (GoI) estimates that 3 billion liters of wastewater is generated daily primarily from 97 cities with over 50,000 inhabitants located along the main stem of the Ganga. NMCG also indicates that this comprises over 80 percent of the pollution load from point sources in the Ganga and the remainder is from industrial effluent[14]. This situation is likely to worsen as population and economic growth increase pressure on the river and groundwater resources. As a result, water quality of the Ganga has been assessed as unfit for many essential uses (refer Annex 2).

7. Municipal wastewater treatment is the intervention with the greatest potential to improve the Ganga's water quality and may help to reduce transmission of infectious diseases such as COVID-19. A strategic basin planning exercise undertaken by the World Bank in partnership with the GoI in 2018 concluded that while no single intervention can address the multiple pressures on the health of the Ganga, the greatest potential benefits are offered by improved municipal wastewater treatment[15]. This would improve downstream water quality and ecosystem services, as well as reduce water-related illnesses and deaths. Appropriate wastewater treatment may also reduce transmission of pathogens such as COVID-19 as emerging research shows that the virus may remain viable in the environment for days, which could lead to fecal–oral transmission[16]. The presence of COVID-19 in sewage has also been reported in sewage samples of eight cities in the Netherlands[17].

8. Although urban sanitation is a State responsibility, the Central government wields considerable influence in this area. Sanitation is a State responsibility under the Indian Constitution. While Central government has a limited explicit role in urban sanitation in the legislative framework, it wields considerable influence over the planning process by financing wastewater treatment investments and imposing conditions on States and cities for use of funds under centrally funded programs. In 1992, the 74th Constitutional Amendment Act devolved powers and responsibilities for water and sanitation to Urban Local Bodies (ULBs), India's municipal governments. However, ULBs continue to lack functional autonomy and are financially near-completely dependent on the State government. Infrastructure is often developed and maintained by a State department or parastatal (typically an engineering-centric agency

[11] *Kumbh Mela* means Festival of the Sacred Pitcher. An estimated 240 million people participated in the 2019 *Kumbh Mela* at Prayagraj <*https://bit.ly/HindustanTimesKumbhMela*> Accessed April 7, 2020.
[12] Ibid Bons CA (2018)
[13] Hosterman HN *et al* (2009). Water, Climate Change, and Adaptation […] Ganges Basin; *www.nicholas.duke.edu/institute*
[14] NMCG <https://nmcg.nic.in/pollution.aspx> Accessed April 10, 2020. The contribution of cities with less than 50,000 population and non-point sources to the pollution load has not been systematically studied.
[15] Ibid Bons CA, 2018.
[16] Lancet Gastroenterol Hepatol 2020. Published online on March 19, 2020 (*https://www.thelancet.com/action/showPdf?pii=S2468-1253%2820%2930083-2*)
[17] *https://www.medrxiv.org/content/10.1101/2020.03.29.20045880v1*

that builds and sometimes operates infrastructure). Multiple State-level agencies dominate urban service provision and often lack coordination. The various organizations, especially ULBs, are often under-staffed, and lack capacity to plan, implement and manage services. Households primarily finance the construction and maintenance of toilets and on-site containment systems, but the designs of these systems are sub-optimal. There are also several small, informal private players operating in the septage emptying and transport space. Due to the need and push for an increased role for the private sector, greater involvement of large private developers in sewerage and sewage treatment plants (STPs) has started in recent years.

9. The urban sanitation policy landscape in India has evolved since 2008 and has been complemented by national flagship programs. The National Urban Sanitation Policy (NUSP, 2008) accorded priority to safe management of human excreta and a need to look at the full cycle of sanitation. More recently, the National Fecal Sludge and Septage Management Policy (2017) provides guidance for cities dependent on on-site sanitation. These policies are complemented by four main types of national programs/investments: (i) the *Swachh Bharat* (Clean India) Mission Urban (SBMU), launched in 2014, focuses on providing household, community and public toilets to eliminate open defecation; (ii) the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) provides dedicated funding to urban infrastructure and services delivery in India's larger cities[18], especially for water supply, sewerage and septage management, storm-water drainage, etc.; (iii) the Smart Cities Program also potentially provides for resources to be invested in waste management systems; and (iv) urban wastewater collection and treatment activities carried out as part of river cleaning programs, which started with the Ganga Action Plan in the 1980s[19] and which are the focus of the proposed Project.

10. The Ganga Action Plan (GAP), launched in 1985, was the first in a series of national flagship programs to clean the Ganga and focused largely on municipal wastewater treatment. The objective of the GAP was to restore river water quality to 'bathing class' (refer Annex 2). While the Central government financed the construction of STPs under the GAP, their operation and maintenance (O&M) was the responsibility of State governments and ULBs. In practice, ULBs lacked resources to maintain STPs and O&M was under-funded by State governments, resulting in neglect and breakdown of STPs. Hence, this was one of the key reasons for the failure of the GAP. Other reasons included improper planning, insufficient funding, weak monitoring and limited public involvement.

11. In 2009, the GoI created the National Ganga River Basin Authority (NGRBA) with a comprehensive mandate. In 2011, the World Bank approved the ongoing National Ganga River Basin Project (NGRBP)[20] to support the cleaning of the Ganga under the NGRBA with US$1 billion in financing. The National Mission Clean Ganga (NMCG) was set up to implement the NGRBA's mandate and to function as the National Program Management Group for the NGRBP. In its initial years, the NMCG was hamstrung by skeletal staff and a highly centralized governance structure that led to prolonged delays in implementation. The NGRBA also continued to be dogged by the challenges faced by the GAP, notably weak capacity and ownership of ULBs and inadequate counterpart funding from the States (equivalent to 30 percent of the cost of investments with the balance 70 percent being financed by the Central

[18] AMRUT caters to 500 cities whereas Smart Cities Mission targets 100 cities. A budgetary allocation of Rs. 1 Trillion (about US$14 billion) has been made for the two missions.
[19] Wankhade K. 2015. Urban sanitation in India: key shifts in the national policy frame. IIED. Vol 27(2): 555–572.
[20] P119085

government). A 2013 assessment of 51 STPs financed under the GAP and NGRBA in the Ganga basin found capacity utilization of about 60 percent; 27 percent failed to meet effluent discharge standards and 20 percent were not operational. (Refer to Box 1)

12. The launch of the *Namami Gange* Program in 2015 has revitalized the GoI's efforts to clean the Ganga and sets the current context for the proposed Project. The cleaning of the Ganga was an election promise made by the current Prime Minister of India in 2014 and the *Namami Gange* (Homage to Ganga) Program was approved by the GoI in 2015. The NGRBA was dissolved and the management responsibility for the *Namami Gange* Program was transferred from the Ministry of Environment, Forests and Climate Change (MoEF&CC) to the Ministry of Water Resources and River Development (MoWR&RD), partly due to its stronger orientation towards program execution. To signal the priority that GoI accords to the Ganga clean-up, the name of the Ministry was changed to Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD&GR). Following the 2019 general elections, this Ministry was made into a Department of the newly created Ministry of Jal Shakti (MoJS)[21].

13. The *Namami Gange* Program outlines a comprehensive and long-term vision for the Ganga. The GoI's vision is to achieve the 'wholesomeness of the Ganga'. The *Namami Gange* Program recognizes the importance of pollution abatement, but takes a comprehensive approach which comprises four building blocks:

(i) *aviral dhara*[22] *(*continuous flow): the flow of the Ganga is to be continuous and adequate over its entire length and throughout the year;

(ii) *nirmal dhara* (unpolluted flow): the Ganga river is to be free of pollution;

(iii) *geological entity:* protecting the geological foundation of the river basin from anthropogenic damage; and

(iv) *ecological entity:* to restore the ecological balance of the river for endemic flora, fauna and micro-organisms to thrive.

14. The approach of the *Namami Gange* Program has been informed by global experience. Global experience shows that river clean-ups are lengthy and costly, e.g. the clean-up of the Thames in the United Kingdom started in the 1860s and spanned several decades. Learning from global experience, the *Namami Gange* Program has been organized around three phases in recognition that certain aspects of its vision require a long-term horizon whereas others can be addressed sooner. The first phase (three to five years, 2015 onwards) was intended to launch the program with 'quick wins' for immediate, visible impact such as solid waste collection and riverfront development. This was accompanied by a medium-term (up to ten years, 2018 onwards) focus on *nirmal dhara* (unpolluted flow) through municipal and industrial pollution load reduction, afforestation, biodiversity conservation and water quality monitoring improvements. In the long term (over ten years, 2028 onwards), the government plans to ensure *aviral dhara* (continuous flows) through determination of ecological flows, increased water use efficiency and maintenance of the geological and ecological integrity of the river. In view of the scale and complexity of the Ganga, an initial

[21] The MoJS was created by the GoI in 2019 to manage water-related issues in an integrated manner, bringing together the erstwhile Ministry of WR, RD&GR and the Ministry of Drinking Water and Sanitation as departments of the new MoJS.
[22] *Nirmal dhara* and *aviral dhara* are important terms at the center of the national discourse over the Ganga, in particular over the development of hydropower in the upper reaches of the Ganga and its tributaries

budget of Rs 200 billion (US$3 billion) was allocated for the *Namami Gange* Program over five years (2015-20)[23]. By contrast, the GAP spent US$250 million over 23 years.

15. The design of the *Namami Gange* Program learns from the challenges faced by prior public programs to clean the Ganga. The design of the *Namami Gange* Program departs from its predecessors in the following ways:

(i) The implementation arrangements for Program implementation have been strengthened. A four-tier implementation structure – Central, State, District, City – has been put in place by the GoI to manage the Ganga basin (refer Section III A. Institutional and Implementation Arrangements). The national tier, particularly NMCG, which is the implementing agency for the proposed project, has been significantly strengthened since 2015 (refer Box 1) and capacities are developing at sub-national tiers.

(ii) To address the weak capacity of ULBs and under-funding of O&M by State governments, the Central Government increased its funding from 70 percent to 100 percent of capital costs as well as 10 to 15 years of O&M expenses.

(iii) The *Namami Gange* Program introduces a paradigm shift in the wastewater sector, from a construction-oriented approach to an outcome-based one. From 2011 onwards, investments were largely awarded through Design, Build, Operate, Transfer (DBOT) contracts including 10 years of O&M. Under the DBOT, financing of the investment is borne by the government and a private operator is paid based on achievement of contract milestones. To further strengthen the focus on sustaining infrastructure, the Hybrid Annuity Model (HAM) of Public Private Partnership (PPP) was introduced by the NMCG in 2016, with technical support from the World Bank and the International Finance Corporation (IFC). Under the HAM PPP model, the GoI pays a private operator 40 percent of the capital costs to build a STP during the construction period, the remaining 60 percent is paid out in quarterly annuities, on top of O&M annuities, over the 15 years of O&M, with payments of both capital cost and O&M annuities linked to the continued performance of the STP as per agreed parameters. This arrangement provides positive incentives for both government and private operators to invest in the success of the investment and incentivizes proper O&M of the plants for at least

Box 1: Institutional Transformation of NMCG

The NMCG has overcome initial challenges to grow into an effective national program management agency for the Ganga clean-up program. Until 2014, NMCG had fewer than 10 staff. As of March 2020, NMCG, supported by the ongoing NGRBP financed by the World Bank, employs 167 professionals. This remarkable institutional transformation was made possible by a renewed effort following the launch of the *Namami Gange* Program in 2015. In 2016, a Government Authorities Order empowered the NMCG to take all decisions related to the effective 'abatement of pollution, rejuvenation, protection and management of the River Ganga and its tributaries', including sanction of projects up to Rs 10 billion (US$143 million). Further, the NMCG is designated as an Authority under the Environment (Protection) Act, 1986, which gives it regulatory and enforcement powers. In 2019, in acknowledgement of its remarkable transformation into an effective program implementation agency, the NMCG received the Global Water Awards Distinction for Public Water Agency of the Year for its efforts to rejuvenate the Ganga[1].

[1] https://globalwaterawards.com/2019-public-water-agency-of-the-year/

15 years. (Refer Section III. A Technical Analysis for details on PPP HAM; Refer Section II. G for additional details on Lessons Learnt)

16. The implementation experience of the ongoing NGRBP offers valuable lessons for the design of the proposed Project (detailed below in G. Lessons Learned and reflected in the Project Design)**.**

- *The ongoing NGRBP experienced a slow start:* The ongoing NGRBP was approved in May 2011 in the amount of US$1 billion (US$199 million IDA credit and US$801 million IBRD loan) with the twin objectives of building institutional capacity for long-term clean-up and financing investments for reducing pollution load. Concomitant with the slow pick-up of the NGRBA and the weak capacity of the project implementing agencies in the early years, the NGRBP experienced a slow start. The original governance structure was overly complex and became a significant impediment to program implementation. In 2012, a little more than a year after Board approval in May 2011, the ongoing NGRBP fell into problem status, and remained there until October 2019.

- *The NGRBP picked up momentum with the launch of the Namami Gange Program in 2015 and the upswing has accelerated since 2016:* The promulgation of the Government Authorities Order in 2016 empowered the NMCG to assume the role of a national program management agency and greatly accelerated decision-making. In step with this, the ongoing NGRBP made rapid progress in unlocking implementation bottlenecks and committing funds under contracts in support of the Project objective. Building on this momentum, the NGRBP supported NMCG and the States to adopt several innovations, including the HAM PPP approach to attract long-term private financing and to ensure sustainability of investments; network and non-network solutions to achieve universal sanitation coverage at city level; co-treatment of septage at existing STPs; house connections to the sewer in network coverage areas, including for low-income communities; and introduction of a "one-city, one operator"[24] approach, which is a step forward towards unified management of wastewater management at city-level. As of April 2020, the ongoing NGRBP's investments account for approximately 51 percent of the wastewater treatment capacity (construction and rehabilitation of STPs) and 70 percent of the wastewater network being implemented under *Namami Gange* Program on the mainstem of the river Ganga. The adoption of the innovative HAM PPP approach under the *Namami Gange Program* has won several accolades, including the World Bank Sustainable Development Vice President's Award in 2018.

- *The NGRBP was restructured in October 2019 which made it possible to bring the Project out of seven years of problem status:* The NGRBP was restructured to: (i) cancel US$400 million, that is, resizing the project amount to US$600 million; (ii) extend its closing date by two years till December 30, 2021, and (iii) revise the Results Framework. The World Bank also agreed to consider the GoI's request for a new Project to support longer-term initiatives to manage the Ganga river basin in a sustainable manner. A time extension of two years for the NGRBP was agreed with the client to ensure sufficient overlap of the two projects allowing for a seamless carry-forward of selected investments from the NGRBP to the proposed Project. As of February 2020, the total value of World Bank financing is fully committed under the ongoing NGRBP. There is a total of 34 investments under the NGRBP, of which 33 are being implemented and 1 is under bidding. Of the 33 investments under implementation, 11

[24] Under the 'one city, one operator' approach, a single operator is responsible for the entire sewage infrastructure of a city/zone, during construction and O&M phases.

are completed, 8 report physical progress of over 75 percent, 5 report physical progress over 50 percent, 4 report physical progress over 35 percent and five are recently awarded. The Project is 63 percent disbursed as of March 2020 and was on track to fully disburse by its closing date of December 30, 2021, prior to the COVID-19 pandemic. The duration and severity of the impacts of COVID-19 on the NGRBP cannot be assessed at this point.

- *Key lessons learnt:* The key lessons learnt from the ongoing NGRBP are that the project was over-sized relative to client absorptive capacity, the preparation time was unduly short for such a complex undertaking, the responsible Central Ministry at the time (MoEF&CC) was not an appropriate institutional home (as that Ministry has a focus on regulatory affairs and policy, with relatively less emphasis on program implementation), and the mandate outstripped the execution capabilities of the newly created Program Management Groups at national level and State levels (which became the NMCG and SMCG respectively).

17. The proposed SNGRBP builds on and extends the ongoing World Bank engagement with the GoI on cleaning the Ganga. The proposed Project learns from the uneven implementation experience of the ongoing NGRBP to balance ambition with realism. It has an implementation timeline of 6.5 years (June 2020-December 2026). The proposed SNGRBP will continue to finance investments in pollution abatement that will work towards demonstrating sustainable mechanisms for financing O&M, building on the innovative and successful HAM PPP approach. The SNGRBP has an extended scope, covering selected tributaries in addition to the mainstem of the river in five basin States[25]. Its investments focus on treating all wastewater from large point-source pollution cities on selected tributaries and on completing investments started under the ongoing NGRBP which will increase treatment capacity over 50 percent in Kolkata, the capital city of the State of West Bengal and will develop full network coverage and treatment in Patna, the capital city of the State of Bihar, and in three smaller cities in Bihar. The proposed Project will also introduce the first-ever IBRD guarantee for wastewater treatment and the first IBRD Guarantee in the water and sanitation sector in India. The proposed IBRD Guarantee will backstop the payment obligations of the NMCG under three HAM PPP contracts and will help mobilize private investments. The proposed Guarantee will significantly reduce the cost of payment security currently provided by the NMCG. This is complemented by technical assistance to States and ULBs to strengthen and incentivize planning and management of wastewater treatment investments. Hence, the proposed Project directly contributes to the *Namami Gange* Program's medium-term focus on *nirmal dhara* (unpolluted flow, 2018-28).

18. The proposed SNGRBP extends Bank support to India to help it achieve its longer-term goal of a clean and healthy Ganga. The World Bank's experience in Argentina (Matanza-Riachuelo Riachuelo Sustainable Development Project[26]) and Colombia (Rio Bogota Environmental Recuperation and Flood Control Project[27]), among others, confirms the importance of establishing long term engagements in support of countries undertaking river cleanup projects. The efforts to clean the Ganga are expected to extend much beyond 2020 as the *Namami Gange* Program graduates from a medium-term (2018-28) focus on unpolluted flow (*nirmal dhara*) to ensuring continuous flow *(aviral dhara)* over the long term. The proposed Project supports the GoI's holistic approach to river basin management through technical assistance for strengthening the institutional framework for river basin management. It also provides

[25] Refer footnote 9.
[26] P105680
[27] P111479

support for strengthening the capabilities of Central agencies to monitor river flows and water quality and introduction of state-of-the-art tools to support these objectives. Hence, it lays the groundwork to support the subsequent phases of GoI's long-term vision for a clean and healthy Ganga.

C. Relevance to Higher Level Objectives

19. The proposed Project is consistent with the current Country Partnership Strategy (CPS) FY18-22 for India discussed by the Board on September 20, 2018 (Report 126667-IN). The CPS identifies resource efficient growth as one of three focus areas. The proposed Project directly contributes to this focus area by laying the foundation for more efficient use of water in the Ganga basin by addressing wastewater collection and treatment and exploring the potential for wastewater re-use. It also contributes to the objective of livable and sustainable cities through investments in improving urban wastewater management services in urban centers on the main stem and tributaries of the Ganga.

20. The proposed Project also contributes to two levers (the 'hows') identified by the CPF to achieve resource efficient growth: engaging a federal India at different levels and leveraging private finance. The Project will support the operational agencies of the *Namami Gange* Program to address capacity gaps, improve service delivery, strengthen citizen engagement and adopt gender-sensitive human resource policies. It will also engage with State and municipal governments to identify options for strengthening urban governance and institutional arrangements for the delivery of sanitation services. The Project will leverage private financing and operational efficiencies for the construction and maintenance of wastewater collection and treatment infrastructure.

21. The proposed Project is aligned with the World Bank's twin goals of ending extreme poverty and boosting shared prosperity. While India has made remarkable progress in reducing poverty, it remains home to one-third of the global poor. The Ganga basin is home to 520 million persons, including two-thirds of the country's poor. The Project will contribute to efforts to end extreme poverty through improved sanitation access, which is key to improving health, and to boost shared prosperity through improving city-wide sanitation coverage, including in low-income areas, to ensure equitable access.

22. The proposed Project is expected to help in mitigating the impacts of infectious diseases, including the COVID-19 pandemic. By expanding sewage collection and treatment, the proposed SNGRBP will reduce contamination of surface and and groundwater, which is a common cause of outbreaks of water-borne diseases. The Project design includes activities reinforcing the ongoing COVID-19 response of the GoI such as emergency preparedness plans (Sub-component 1.4); tools and protocols to improve the resilience of service delivery and to support service providers in responding to a crisis or shock; communication activities to promote handwashing with soap (Subcomponent 4.1) and a Contingent Emergency Response Component (Component 5). The infrastructure investments financed by the Project will also contribute to the effort to stimulate economic activity and job-creation, with an expected positive impact on the social and economic recovery from the COVID-19 pandemic.

23. The Project aims to address gender gaps related to wastewater management in line with the Country Gender Action Brief (2016-23) and the World Bank Gender Strategy (2016-23). Globally, women are under-represented in water and wastewater sector[28]. The reasons for this include relatively fewer

[28] A global study of 28 countries found that on average, 18 percent of employees in utilities are women. World Bank, 2019, Women in Water Utilities: Breaking Barriers https://www.worldbank.org/en/news/feature/2019/08/27/breaking-barriers

women graduates in Science, Technology, Engineering and Mathematics (STEM) courses, biases in recruitment, issues with retention, and challenges with promotion. In India, women students constitute only 26 percent of enrolled students in engineering courses[29] and their transition to technical roles in traditionally male-dominated sectors such as water and sanitation is low. A gender gap analysis of Project implementing agencies shows that the share of women in leadership and technical roles is low. For example, currently, there are no women in management roles at NMCG and only 12 women in technical roles (engineers and planners) compared with 56 men. As detailed below, the Project will finance an array of measures to improve the presence and prospects of women in the sector, particularly in the institutions and works of the Project.

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

24. The objective of the Project is to reduce point-source pollution from targeted Urban Areas of the Ganga river basin and support the Central Ministry to strengthen the institutional framework for Ganga river basin management.

PDO Level Indicators

25. The achievement of the PDO will be measured through four indicators:

(i) Amount of Biochemical Oxygen Demand (BOD) pollution reduced due to Project interventions;

(ii) Number of sewage treatment plants (STPs) constructed or rehabilitated under the Project which meet the national discharge standards at least 95 percent of the time;

(iii) Adopted recommendations of the study on institutional framework for Ganga river basin management are being implemented;

(iv) A public online system for continuous monitoring of water quality and flow in the Ganga and selected tributaries is functional.

B. Project Components[30]

A detailed Project description is available in Annex 3.

Component 1: Institutional Development (US$30 million, of which IBRD US$19 million)

26. ***Sub-component 1.1 – Strengthening of the institutional framework for Ganga basin management (IBRD US$2 million):*** Providing technical and analytical support for the carrying out of a comprehensive analysis of: (a) the functions and mandates of institutions involved with aspects of Ganga river basin management at central, state and sub-state levels; (b) the relevant laws and regulations; and

[29] All India Council for Technical Education (2015-2016)
[30] Refer Annex 3: Detailed Project Description

(c) possible options for NMCG to operationalize its mandate, all taking into account climate change and gender gaps;

27. ***Sub-component 1.2 – Development and application of tools to monitor and inform decision-making for river basin management (IBRD US$9 million):*** Providing technical and analytical support for: (a) establishing critical tools to improve river basin management and inform decision-making, including a program to develop additional real-time water quality monitoring stations at strategic locations, and a system to monitor water withdrawal/consumption by major users; (b) carrying out a detailed evidence-based, participatory investigation of environmental flow options, for all river reaches across the Ganga basin where substantial flow regime modification has occurred; and (c) strengthening institutional capacity to collate, manage and share data and information on the Ganga basin, including gender disaggregated data, and to implement strategic communications and outreach.

28. ***Sub-component 1.3 – Support to strengthen Project States governments' and ULBs' capacity for wastewater service delivery and river management (IBRD US$7 million):*** (a) Strengthening the capacity of selected States in studying possible options, roles and responsibility sharing between the parastatal EA and participating ULBs for O&M arrangements of wastewater service delivery with the aim of ensuring long-term sustainability of service delivery; (b) designing (i) a roadmap for sustained O&M of sanitation assets and policies; (ii) a State-level sanitation strategy; and (iii) sewer connection strategy for households; and (c) on a demand basis, strengthening ULBs' planning, institutional, technical and financial capacity to manage wastewater and benchmarking ULBs to determine which are eligible for additional support.

29. ***Sub-component 1.4 – Namami Gange Program emergency response preparedness (IBRD US$1 million).*** Providing technical and analytical support for: the development of: (a) emergency preparedness plans and individual investment levels to respond to an emergency related to a health-crisis of natural disaster; and (b) a set of principles and recommendation to increase resilience of investments implemented under the *Namami Gange* Program.

Component 2: Infrastructure Development (US$1,045 million, of which IBRD US$345 million)

30. ***Sub-component 2.1 – Carrying out of Priority Investments selected on the basis of their level of pollution of selected tributaries of the Ganga (IBRD US$150 million).*** NMCG identified three wastewater treatment investments in the State of UP in the cities of Agra, Meerut, and Saharanpur[31], respectively located on the Yamuna, Kali and Hindon tributaries of the Ganga. These investments, which will use the HAM PPP approach, were selected as they are among the largest pollution hotspots on these tributaries.

31. ***Sub-component 2.2 – Carrying out of Priority Investments selected on the basis of their status of implementation and need for further financing to achieve completion of: (a) the design, build, operate and transfer contractual arrangements in Buxar, Begusarai and Munger; and (b) other investments (IBRD US$160 million).*** This sub-component will finance selected investments currently under implementation by the ongoing NGRBP that will be carried forward to the proposed SNGRBP at the closing of NGRBP (December 30, 2021). Five investments will be carried over: three DBOT investments in Bihar: Begusarai, Munger and Buxar[32] and the first two HAM-PPP investments funded under the ongoing NGRBP:

[32] The Project will fund the central share of all investments, which amounts to 100 percent for investments sanctioned since 2017. The DBOT contracts in Begusarai, Munger and Buxar were sanctioned earlier and will remain with a 70:30 cost sharing between Central and State government. The Project will therefore fund the central share of 70 percent for these DBOTs.

Digha-Kankerbargh (HAM and DBOT) in Bihar and Howrah-Bally-Baranagar (HAM) in West Bengal. These investments were selected because, with the exception of the Howrah-Bally-Baranagar HAM-PPP, they will bring the treatment capacity to 100 percent and they will also develop full sewerage network coverage and target 100 percent house sewer connections in each city.

32. ***Sub-component 2.3 – Improving investment resilience to COVID-19-like emergency crises,*** including through the implementation of the recommendation of the emergency preparedness plans developed under Sub-component 1.4 in the Priority Investments carried out under Sub-component 2.2 of the Project, to improve the resilience of service delivery and to support service providers to respond to similar crisis or shock (IBRD US$5 million).

33. ***Sub-component 2.4 – Carrying out of Priority Investments selected on the basis of performance-based incentives for ULBs*** involving measures taken for pollution source prioritization and their performance in strengthening planning, management, and cost recovery of wastewater service delivery to promote holistic approaches at city level (IBRD US$30 million). A framework approach will be used to identify potential additional investments during Project implementation. The NMCG is considering investments to extend sewage networks in cities where initial investments have been made under the ongoing NGRBP and/or will be made under the proposed Project to saturate wastewater collection and promote last mile connectivity in these cities.

Component 3: IBRD Guarantees (IBRD US$19 million)

34. IBRD guarantees in the aggregate amount of up to US$19 million will be structured as contract-based payment guarantees to backstop certain payment obligations of the NMCG under three HAM-PPP contracts being financed under Sub-component 2.1.

Component 4: Program Communication and Management (US$24 million, of which IBRD US$16 million)

35. ***Sub-component 4.1 – Program Communication and Outreach (US$6 million).*** Developing and carrying out mass media and public outreach campaigns targeting different stakeholders to promote the adoption of behaviors related to achieving and sustaining a clean Ganga.

36. ***Sub-component 4.2 – Program Management Support (US$10 million).*** Supporting management and coordination for the *Namami Gange* Program and the Project, including project administration and capacity building on transaction advisory, environmental and social safeguards, financial management, procurement, and monitoring and evaluation: (a) at the national level; and (b) at the state level.

Component 5: Contingent Emergency Response Component (US$0 million).

37. Providing immediate response to an Eligible Crisis or Emergency, as needed.

Table 1: Project Cost by Component *(in US$ million, incl. taxes)*

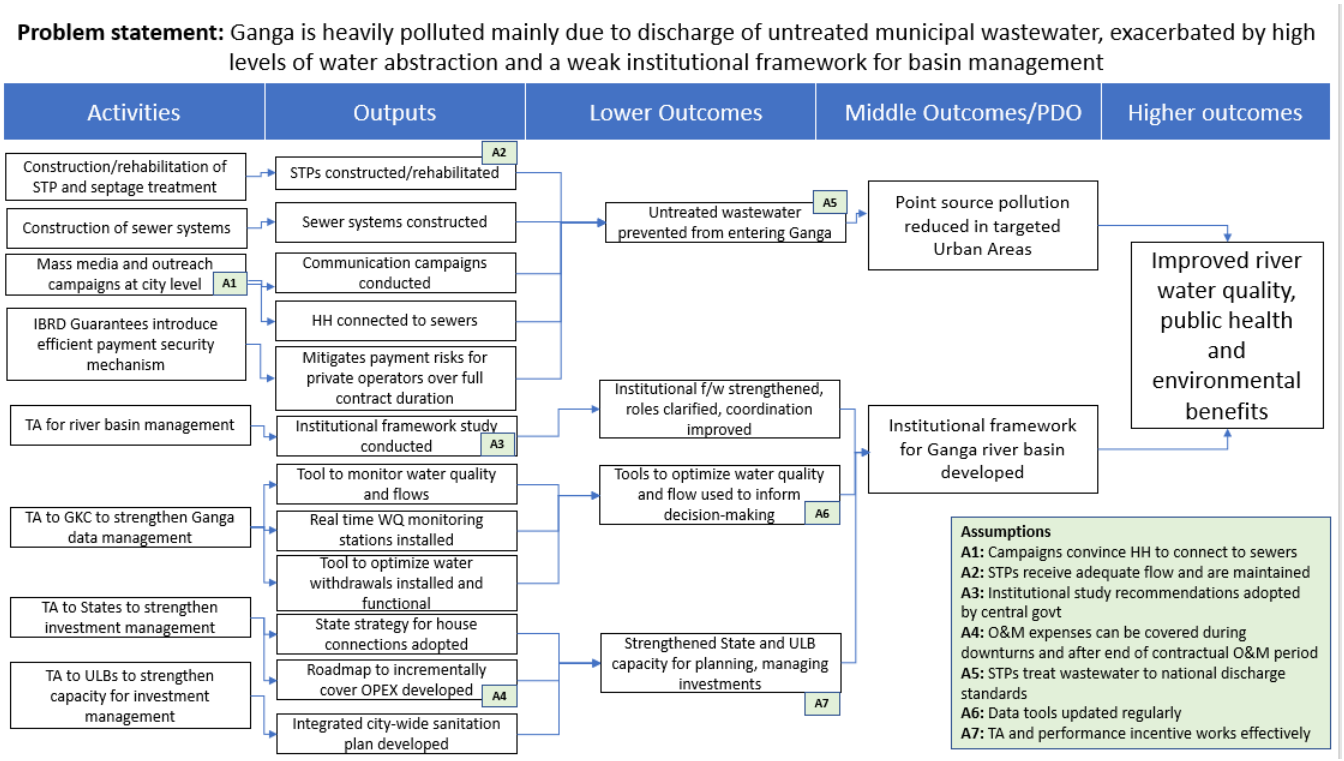
	Total Cost	IBRD	%	Counterpart Financing	%
Component 1: Institutional Development	30.0	19.0	*63%*	11.0	*37%*
Component 2: Infrastructure Development	1,045.0	345.0	*33%*	700.0	*67%*
Component 3: IBRD Guarantee	19.0	19.0	*100%*	0.0	*0%*
Component 4: Program Communication & Managament	24.0	16.0	*67%*	8.0	*33%*
Component 5: Contingent Emergency Response Component	0.0	0.0	*100%*	0.0	*0%*
Front-end-fee	1.0	1.0	*100%*	0.0	*0%*
TOTAL PROJECT COSTS	**1,119.0**	**400.0**	***36%***	**719.0**	***64%***

C. Project Beneficiaries

38. The direct beneficiaries of the Project are 6 million people who will benefit from wastewater collection and treatment infrastructure and services improvements that are financed by the Project. The Project will also impact a broader range of beneficiaries such as tourists and pilgrims who visit the urban centers on the banks of the Ganga and its tributaries. Government officers and technical staff engaged in Ganga management agencies will benefit from capacity building under the Project, including training on wastewater management, procurement, environment and social safeguards and gender sensitization. Women will benefit through enhanced opportunities for employment in technical and management roles in national and State level implementing agencies and through measures to make workplace more gender sensitive. Further, the Project will help reduce the time women spend caring for children and other family members who fall ill because of inadequate sanitation. Other important benefits will be the increase in property prices due to better sanitary conditions in urban areas where sewers are installed, better sanitation services; reduced water pollution; and improved health outcomes.

D. Results Chain

39. The proposed Project contributes towards achieving the medium-term objectives of the *Namami Gange* Program, focusing on pollution abatement and improved water quality monitoring. It supports the longer-term vision of a clean and healthy Ganga through the DoWR,RD&GR to develop an institutional framework for Ganga basin management and to strengthen capacity at State and municipal levels for planning, financing and managing sanitation services.



E. Rationale for Bank Involvement and Role of Partners

40. The World Bank has been a long-term partner of the GoI in water resources management and Ganga rejuvenation. The Bank is the largest external source of financing to the GoI's efforts to clean the Ganga. Through the ongoing NGRBP, the Bank has provided critical support which helped shape the *Namami Gange* Program and supported the establishment and development of the NMCG into a highly functional program management agency. The Bank also supports other major programs in water resources management, including the National Hydrology Project, the National Groundwater Management Improvement Program, the Uttar Pradesh Second Water Sector Restructuring Project and the Dam Rehabilitation and Improvement Project, and draws from the convergence between these operations to strengthen Ganga basin management. For example, sustainable groundwater utilization and recovery of groundwater levels, planned under National Groundwater Management Improvement Program, can ultimately lead to increased lean season base flow in tributaries of the Ganga. The monitoring of surface and groundwater data, supported under the National Hydrology Project, will enable evidence-based implementation of e-flows management tools.

41. The Bank has significant global experience in urban services, river basin management and environmental management. In India, the Bank is using a range of instruments and approaches to support reforms in urban water and wastewater management, for example, supporting water supply and sewerage service delivery reform in Shimla, Himachal Pradesh through a series of Programmatic Development Policy Loans; demonstrating city-wide continuous piped water supply under the Karnataka Urban Water Supply Modernization Project; and a pipeline operation in Punjab to improve municipal services delivery including urban water supply. It also has the capacity to facilitate the transfer of

knowledge and experience to India and to promote India's experience to the world, including through twinning arrangements. The collaboration with the 2030 Water Resources Group , a public, private and civil society partnership administered by the Bank's Water Global Practice, has helped convene stakeholders to strengthen river basin management in the Hindon sub-basin of the Ganga, where the Saharanpur investment proposed for support under this Project, is located, and in Bundelkhand, where e 2030 Water Resources Group and the Government of Israel are implementing a pilot of improved farming and water management practices.

42. The Bank has extensive experience in PPPs in water, sanitation sector and other sectors. Together with the IFC, the Bank has been instrumental in working with NMCG to successfully adapt the HAM from the highways sector to the urban wastewater treatment sector. This innovative approach has been well received by the market and has become the solution of choice for NMCG for investments involving wastewater treatment.

43. NMCG works with a wide range of development partners, including the European Union (EU), through the EU-India Partnership, Germany's GIZ and KfW, Japan International Cooperation Agency (JICA), the Government of Israel and other technical and financial partners. The Project will build on and complement activities supported by the EU-India Partnership and Germany's GIZ to strengthen Ganga basin management. The South Asia Water Initiative (SAWI), funded by the Governments of the United Kingdom, Australia and Norway, has also been an important source of technical assistance, particularly in the area of strategic basin planning.

F. Lessons Learned and Reflected in the Project Design

44. The following lessons drawn from the ongoing NGRBP and the World Bank's global experience in river conservation are reflected in the Project design:

i. *Match ambition with execution capability*: The ongoing NGRBP set an ambitious river basin management goal at a time when the program management agencies at national and State level had recently been created and were yet to establish functional and technical capabilities to deliver on this mandate. The Central line ministry for the Project at launch was the MoEF&CC, a policy and regulatory ministry which was relatively less suited for program implementation. Given the complexity of the Project, the preparation time was inadequate. As a result, the detailed technical designs for investments were not ready by Project appraisal and the Project adopted a framework approach for the entire infrastructure component. Implementation also suffered due to differences in priorities of Central and State governments with the latter delaying their financial contributions equivalent to 30 percent of the cost of investments.

The proposed SNGRBP benefits from the course corrections carried out by the GoI to empower program management agencies and accelerate implementation. The *Namami Gange* Program and the associated actions by GoI were a breakthrough in revitalizing the government's efforts to rejuvenate the Ganga. The transfer of program management from the MoEF to the MoWR, RD&GR brought in enhanced Project design, implementation and supervision capabilities and simplified the governance structure. The passage of the Government Authorities Order 2016 empowered the NMCG to carry out the mandate envisaged by the NGRBP in 2011. In terms of investment readiness, new investments have been identified under SNGRBP during preparation. Design and bidding

documents for wastewater treatment investments in Agra, Meerut and Saharanpur (Sub-component 2.1) are at advanced stages of preparation and will include documentation related to land acquisition, statutory permissions and the Bank-cleared Environment and Social Due Diligence Report (ESDDR). The tenders for these investments are expected to be launched in June 2020 for Agra and Meerut and August 2020 for Saharanpur.

ii. *Integrated long-term planning at basin level*: A key lesson learnt from successful international examples of river clean-up is the need for a long-term, basin-wide and multi-sectoral approach to address river pollution instead of a 'city-by-city' approach. The design of the *Namami Gange* Program explicitly recognizes the need for basin-wide planning and incorporates a coordination mechanism at national and State levels which involves key stakeholders in multiple sectors. The proposed Project will build on this foundation and support the development of options for institutional strengthening and critical tools to manage water quantity and quality at a basin level. The extension of World Bank support through a Second NGRBP recognizes the long-term nature of river clean-up programs and positions the Bank as a reliable partner of the GoI in this effort.

iii. *Last mile connectivity optimizes the development outcome:* A key lesson learnt from the ongoing NGRBP is that house service connections to the sewer system are critical to achieve optimal utilization of STPs, pollution abatement and public health outcomes. Investments for sewer network extensions under the ongoing NGRBP did not include house connections to sewers, which were left as the responsibility of the household and ULBs. Connection speed was slow and uneven, leading to underuse of the networks and lower flows to STPs than anticipated. The State of UP integrated financing from the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), a centrally sponsored scheme, to provide house service connections to sewer networks financed under the *Namami Gange* Program.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

45. The proposed SNGRBP will utilize the institutional and implementation arrangements in place for the *Namami Gange Program*, which are also used for the ongoing NGRBP and have been strengthened in recent years. These implementation arrangements are outlined below:

(i) *National level:* The National Ganga Council, headed by the Prime Minister and with the Chief Ministers of five mainstem States as members, is the apex body. The Ministry of Jal Shakti (MoJS) is the key Central Ministry through its DoWR, RD&GR. The Central Ministry is supported by its key technical bodies e.g. the Central Water Commission (CWC) and the Central Ground Water Board (CGWB). The CWC and the CGWB, along with the CPCB (under the MoEF&CC), are responsible for water resources assessment through monitoring surface water and groundwater, as well as providing technical quality assurance. The NMCG is the implementation arm of the DoWR, RD&GR for the *Namami Gange* Program. An Empowered Task Force (ETF), chaired by the Union Minister of Jal Shakti, with the Chief Secretaries of the five Ganga mainstem States as members, is responsible for co-ordination and advice on matters relating to rejuvenation, protection and management of Ganga River and its tributaries. The ETF is responsible for approval of investments above Rs 10 billion (US$143 million), while NMCG is empowered to approve investments up to that amount.

(ii) *State level:* In each State, a State Ganga Committee is the apex body and is also designated as an

Authority under the Environment (Protection) Act, 1986. This Committee has been assigned the task of overseeing implementation of various programs and investments related to Ganga rejuvenation within the State. The nodal department at State level is typically the Urban Development or the Water Supply and Sanitation Department. The State Mission for Clean Ganga (SMCG) is an extended arm of the NMCG at State level to coordinate implementation of activities and it reports to the State nodal department. Executing Agencies (EAs) which possess the relevant technical expertise are identified at State level to implement specific investments.

(iii) *District level:* A District Ganga Committee is constituted in all districts located on the banks of the Ganga and is designated as an Authority under the Environment (Protection) Act, 1986. The role of this Committee is to plan and implement measures and interventions for rejuvenation, protection, restoration and or rehabilitation of degraded areas abutting the river Ganga and or its tributaries. This level has not been active thus far.

(iv) *City-level:* For pollution abatement investments undertaken at city level, it was planned that a tripartite Memorandum of Agreement be signed between the SMCG, the State EA and the respective ULB which lays out their roles and responsibilities. However, this has not been implemented thus far, the proposed Project will work to revive these, adapting their content based on the results of the institutional framework study on institutional arrangements.

46. NMCG will continue to be responsible for overall Project implementation: The NMCG, under the administrative control of the DoWR, RD&GR, is headed by a Director General (equivalent in rank to an Additional Secretary of the GoI), who is supported by five Executive Directors (equivalent in rank to a Joint Secretary of the GoI). The NMCG staff comprises 167 technical and administrative professionals with expertise in procurement, PPP, finance, safeguards, communications, monitoring and evaluation and so on. Given the complexity of the Project and scale of investments, NMCG will (a) retain a Project Management Consultant to assist in supervision of investments and efficient Project management; (b) retain a financial management and procurement consultant; and (c) appoint a Transaction Advisor and Project Engineer for each HAM contract financed under the Project. At State level, SMCGs are the extended arm of the NMCG and will coordinate and oversee implementation of activities in the State.

47. Investments are executed by different EAs, which are typically parastatal agencies responsible for urban water supply and sewerage in each State. The three discrete investments in Agra, Meerut and Saharanpur are located in UP and their EA will be the UP *Jal Nigam*, a parastatal responsible for water supply and sewerage provision in UP. The investments to be carried over from the ongoing NGRBP to the proposed SNGRBP are located in UP, Bihar and West Bengal. The corresponding EAs are the UP *Jal Nigam*, Bihar Urban Infrastructure Development Corporation (BUIDCO), and the Kolkata Municipal Corporation and the Kolkata Metropolitan Development Authority in West Bengal. Each EA has gained extensive experience in preparation, contracting and management of wastewater infrastructure investments under the ongoing NGRBP. The EAs will continue to be responsible for all contract management, including procurement, supervision, and payments, with support from NMCG and the respective SMCG.

48. The NMCG and SMCGs will be responsible for planning, investments selection, quality assurance, procurement, contract management, and monitoring and evaluation under the SNGRBP. The allocation of roles and responsibilities, including administrative and fiduciary arrangements, between the NMCG, SMCG and the EA shall continue as under the ongoing NGBRP. The NMCG will collaborate with other technical agencies, including CPCB and the MoJS's CWC, to draw upon their specialized expertise

and supplement the capacity of the main implementing agencies. The NMCG will also continue to collaborate with international, national and local knowledge institutions, private sector business houses and industries, and civil society groups.

49. Adequate staff, capacity and resources are available and will be further augmented in NMCG and SMCGs to ensure that planning, supervision, monitoring and reporting activities under SNGRBP are efficiently discharged. The NMCG and SMCGs are responsible for applying the framework developed under NGBRP that now applies to the *Namami Gange* Program as a whole, regardless of the source of financing. This Program Framework comprises:

(i) Investments framework for selecting and implementing investments;
(ii) Detailed implementation process flow (step-by-step process covering planning, preparation, appraisal, implementation, initial operations, long term operations, monitoring and evaluation, along with roles and responsibilities of the entities involved);
(iii) Guidelines for infrastructure investments preparation;
(iv) Environmental and Social Management Framework (ESMF);
(v) Governance and Accountability Action Plan;
(vi) Communication Strategy and Action Plan;
(vii) Financial Management Manual; and
(viii) Project Procurement Manual.

50. **Implementation Support**: Project implementation support will follow the arrangements in place for the ongoing NGRBP. It will be carried out by a team of World Bank specialists and expert consultants based primarily in New Delhi and specializing in specific dimensions of the Project with a special focus on wastewater collection and treatment, water quality monitoring and modeling, river basin and environmental management, urban planning, and program communications. The team will also rely on additional expertise to provide technical assistance and implementation support on other aspects as required. This support will include national and international staff or consultants to maximize knowledge exchange and value addition.

51. An additional focus on institutional development will be undertaken to support NMCG to fulfill the mandate given to it via the Government Authorities Order of 2016. Relevant capacity building activities and systems will be developed to increase interaction between implementing agencies and the people. Areas of specific attention will include technical preparation, social and environmental management, procurement, communications and grievance redressal.

B. Results Monitoring and Evaluation Arrangements

52. **NMCG is responsible for overall Program and Project monitoring whereas SMCGs and EAs are responsible for monitoring State-level activities.** EAs will be responsible for investment supervision, which will entail routine quality certification at various stages of construction, providing the basis for payment certification. SMCGs will oversee the implementation of investments carried out by EAs and the institutional development activities implemented in the States. The NMCG will ensure coordination and overall implementation of activities. It will help convene State and National Agencies for activities involving inter-State or national focus.

53. Quarterly monitoring reports will be prepared by NMCG with inputs from EAs and SMCG. Each report will include information on overall and investment-wise technical and financial progress, implementation and monitoring of social and environmental aspects, quality assurance, and monitoring of key performance indicator to inform the results framework. The NMCG has an online Management Information System (MIS) that tracks the progress of various activities of the *Namami Gange* Program, including activities financed by the Project.

C. Sustainability

54. Government ownership and commitment. The clean-up and rejuvenation of the Ganga enjoy broad public support and commitment at the highest political levels in India. The GoI's strong commitment to the *Namami Gange* Program has been demonstrated by: (i) the establishment in 2016 of the National Ganga Council headed by the Prime Minister and vested with the responsibility for 'superintendence, direction, development and control' of the Ganga basin (Government Authorities Order 2016), (ii) strong fiscal support in the form of a US$3 billion budgetary allocation from the GoI for the *Namami Gange* Program over the period 2015-20 and long-term commitment to a multi-phased approach which will graduate from pollution abatement to address river basin management in a holistic fashion; (iii) establishment of dedicated multi-tier implementation arrangements for the *Namami Gange* Program from Central to district levels; and (iv) a range of vibrant communication activities undertaken by the NMCG from ground-level activation events, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign (the *Kartavya Ganga* [Duty towards Ganga] campaign produced under the ongoing NGRBP). The mainstem State governments have shown ownership to an extent by establishing and operationalizing Ganga Committees at State and district levels to guide the implementation of the *Namami Gange* Program. Nevertheless, significant political and governance risks remain, as described in section VII below.

55. Sustainability of investments. The Project design incorporate several measures to ensure sustainability of assets financed by the proposed SNGRBP:

(i) The Project will finance long-term contracts between EAs and private operators, with a minimum of 10 years of O&M built into DBOT contracts, and 15 years of O&M built into HAM PPP contracts, for all wastewater investments. O&M payments will be linked to satisfactory performance of the STPs and will be covered by the Central government over the life of the contract.

(ii) The Project will support the participating State governments to develop a strategy for increasing connections to the sewer system, plan to enhance public awareness and grievance redressal, and improve services provision (refer Sub-components 1.3 and 2.3 at II B: Project Description), which is expected to contribute to an improvement in the willingness to pay for wastewater services. These strong outreach and communication activities, together with new sewers and house service connections in targeted locations, will facilitate utilization and sustainability of assets.

(iii) ULBs where wastewater investments are located are expected to be responsible for payment of O&M expenses after the end of the contract (in 10 or 15 years for DBOT and HAM investments, respectively). Given the limited capacity of ULBs, the Project will support the strengthening of ULBs' capacity to plan and manage wastewater investments. To facilitate sustainability, the EAs will be supported to develop a transition plan and an asset handover protocol. The private operators will establish operating procedures and provide training to relevant staff for managing and supervising

operations.

(iv) The GoI decided to introduce the use of an IBRD Payment Guarantee to mitigate the risk of delays or default in HAM PPP payments under Sub-component 2.1, in lieu of the existing payment security mechanism.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis

(i) Technical Analysis

56. **Technical design:** The technical design of infrastructure investments under the Project seeks to balance the objectives of pollution abatement with achieving clean and livable cities over the long term. The National Urban Sanitation Policy (NUSP) of the GoI (2008), and the lessons learnt from the ongoing NGRBP, shows that technology selection should be incremental. The NUSP notes that even if sewers are ideal for dense settlements, they may not be feasible to execute immediately due to financial, technical and socio-economic constraints. Hence, the NUSP goes on to State that the objective of improving the sanitary conditions in the city can be addressed through interim solutions (e.g. on-site septic tanks or community septic tanks if space is limited) with a view to upgrade later to a more sophisticated system such as sewerage. Another interim solution that immediately addresses the objective of pollution abatement and contributes to the incremental improvement in sanitary conditions at a city level is Interception and Diversion (I&D) of wastewater and its treatment before discharge, along with the option of co-treatment of septage generated by on-site systems at the STPs.

57. Accordingly, the design of the Project includes two main types of investments:

i. I&D of wastewater flowing through drains into the river with pumping stations and conveyance systems and the construction and/or rehabilitation of STPs to treat the wastewater prior to discharging it in the river. Such investments promote co-treatment of septage and the construction of discharge points at STPs or main pumping stations for septage generated by on-site sanitation facilities.

ii. Wastewater collection through underground sewerage, pumping stations, and treatment at STP.

58. Sub-component 2.4 will identify additional investments during Project implementation to promote holistic city-wide sanitation. This can potentially include extension of sewerage in cities where initial investments have been made under the ongoing NGRBP and/or will be made under the proposed SNGRBP to saturate wastewater collection and promote last mile connectivity in these cities. The GoI is also thinking about a next phase, which consists of integrating the city and river management in city area, to promote the rejuvenation of wetlands and increase biodiversity.

59. Although the NGRBA was dissolved by the GoI in 2016, the NGRBA Program Framework, developed with the support of the ongoing NGRBP, continues to be followed for the selection, appraisal and execution of investments. The NGRBA Program Framework outlines the following technical appraisal aspects which will be followed for the three new municipal wastewater treatment investments identified

under the proposed SNGRBP (details of individual investments are at Annex 3: Project Description) and for any new investments that are taken up under a framework approach:

(i) Selection of investments to be determined by their relative impact on reducing the pollution load entering the Ganga. The three cities where the proposed investments are located are the largest pollution hotspots on their respective tributaries of the Ganga.

(ii) New Project investments will be designed based on latest available guidelines/manuals/rules of national technical agencies, including Central Public Health and Environmental Engineering Organization and CPCB. The treated effluent shall comply with the relevant discharge standards.

(iii) Investments shall be designed for a period of 30 years for civil works and 15 years for electro-mechanical equipment. The designs for all investments, including pumping station, sewage and septage treatment plants, shall consider future scenarios including anticipated sewage flows from current and planned land uses in the Project Area and contribute to city-wide coverage. Each design shall be based on an estimate of sewage flows from the population in the catchment, validated by flow measurements, details of industrial effluents if any (type of industries, flows), characterization of sewage, industrial and mixed effluents, detailed engineering surveys (topographic surveys, etc.), site investigations (soil sampling, etc.), and shall comply with the requirements of relevant codes and standards.

(iv) Assessment of the condition and performance of existing assets to ensure that these existing assets are rehabilitated and incorporated into the new systems wherever cost-effective.

(v) Preparation of Detailed Project Reports (DPR) that identify technically feasible solutions and assess their lifecycle costs to arrive at the least-cost solution. The DPR evaluate technologies that can comply with the discharge standards and for purposes of estimation of capital and operating cost, selects the one with lowest lifecycle cost, that is proven to be suitable for local conditions and which provides required degree of treatment. Since choice of technology is left open to the bidders to propose, the DPR and the bid documents provide guidance to the bidders on the key parameters to be considered in the design.

(vi) The technologies to be adopted in the investments shall have all regulatory and environmental clearances.

(vii) The design should include adequate and reliable alternate power supply arrangements to ensure satisfactory performance of the facility.

(viii) The investment should include a suitable sludge management strategy which ensures in situ treatment of sludge and subsequent safe disposal either at the site or at an approved landfill.

(ix) Anaerobic digestion of sewage sludge and ensuing energy recovery from biogas, a by-product of anaerobic digestion mandated for all STPs with capacities of 40 MLD and above.

(x) Where feasible, the option for sale of treated wastewater to industries (e.g. thermal power plants within 50 kilometers of a sewage treatment plant are mandated to purchase and use treated wastewater) and / or agriculture).

60. In addition to the three new investments, five ongoing investments in sewage collection and treatment that were initiated under the NGRBP will be carried forward to the proposed SNGRBP when the ongoing NGRBP closes on December 30, 2021 (details at Annex 3: Detailed Project Description). These

investments have also been appraised according to the technical criteria in the NGRBA Program Framework outlined above.

61. The procurement strategy supported under the proposed SNGRBP is an important part of its technical design and risk mitigation. Earlier Ganga clean-up programs focused on creating sewage treatment infrastructure, and the O&M of these assets did not receive adequate attention, resulting in a cycle of 'build-neglect-rebuild'. To address this challenge from a procurement perspective, NMCG, with support from World Bank and IFC, carried out a detailed analysis of the comparative advantages of various PPP models for STP construction and maintenance, including Engineering, Procurement, Construction (EPC), DBOT, pure annuity model and HAM (which had been adopted in the highways sector in India). This analysis was reviewed by experts drawn from a consortium of the Indian Institutes of Technology. The key findings were:

(i) Traditional contracts like EPC and item-rate contracts are not suitable for STP investments as these focus on asset construction, which incentivizing lower construction cost and not lowest lifecycle cost, as a result optimizing O&M costs does not receive enough attention.

(ii) DBOT achieves better risk allocation compared with traditional contracts. However, since the CAPEX is paid at commissioning, there is less incentive to build assets with a long-life cycle. Further, the operator has little capital at stake to ensure effective O&M under this approach.

(iii) Under a PPP annuity approach, the private operator finances the entire capital investment through a combination of debt and equity and is paid an annuity after construction over the contract duration to cover principle repayment and return on investment. This pure annuity approach was not retained as it put too much risk on the private operator and the financial sector. A Hybrid Annuity Model PPP or HAM PPP is a variant of this approach wherein a part of the capital investment (say, up to 50 percent) is paid by government through construction linked milestones and the balance is paid through an annuity over a 10-15-year contract duration. This approach, which was developed in the highway sector, was adapted to the specificities of the sanitation sector.

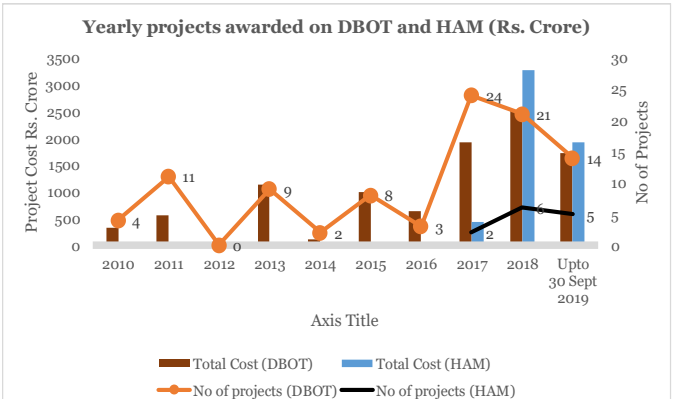
62. The analysis concluded that the HAM PPP contract is the preferred approach for the development and maintenance of STP as it offers certain advantages over other contractual forms:

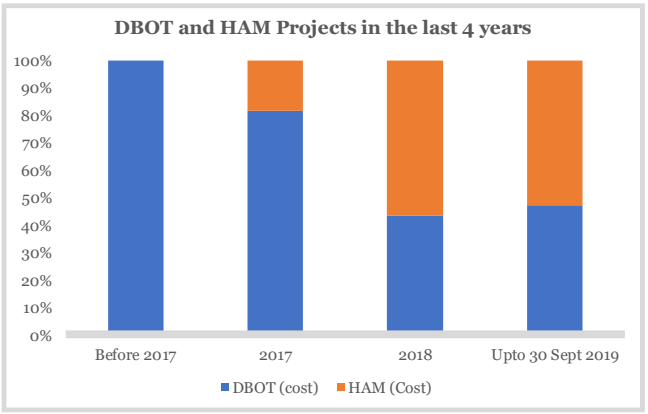
- The HAM PPP contract achieves an appropriate allocation of risks between the government and the private operator. From the government's perspective, the HAM contract incentivizes the private operator to complete the construction of assets on time and ensure their sustained performance over time. It also addresses with the Government's interest to ensure that services are delivered more efficiently and at a lower cost compared with the pure annuity model. From the private operator's perspective, the financing risk of the investment is shared with the government. The Central government taking on payment obligations under the HAM contract de-risks the private operator from weaknesses in payment of user charges for wastewater treatment and weak capacity of municipal governments to enforce and collect such charges.
- Both CAPEX and O&M annuity payments are linked to the performance of the treatment plant. Hence, the risk, and cost, of failure (e.g. non-functional/over-designed STP, non-compliance with discharge standards, poor O&M, etc.) is transferred to the private sector, which is better placed to efficiently mitigate this risk. The HAM PPP contract also incentivizes the private operator to generate savings or revenue in innovative and environmentally friendly ways, such as generating power through biogas

or selling treated wastewater for reuse.

63. The Cabinet of the GoI approved the use of the HAM PPP approach in January 2016. Under this approach, 40 percent of the capital cost is paid to the concessionaire based on achievement of contractual milestones during construction and the balance 60 percent is paid as CAPEX annuities over 15 years, in addition to O&M annuities. Most of the contracts awarded prior to 2017 were based on the DBOT model. Thereafter, HAM has emerged as the preferred approach for NMCG and the market players for investments involving STPs, while DBOT is preferred for investments focused on sewer network construction. On that basis, just two years after its introduction, the share of investments using HAM has exceeded 50 percent of the total annual amount of sanitation investments procured by NMCG, but only 25 percent of the number of projects, which suggests that investments procured using HAM PPP are therefore much larger than those using DBOT PPP (Figure 1).

Figure 1: *Namami Gange* Projects Awarded under DBOT and HAM





64. **Market Study:** As a part of Project preparation, a market study on emerging lessons from the HAM PPP approach was carried out. The key findings of the market study are:

i. While in the past, there was no clear preference in the market for one contracting model – HAM or DBOT – over another, of late the first ten HAM PPP contracts have consistently attracted more bidders than DBOT contracts during the same period. In 2019, the average number of bidders per new investment declined for both HAM and DBOT contracts, possibly due to the overall financial stress in the construction industry.

ii. In terms of quoted prices for HAM contracts, the competition appears to be healthy and the lowest quoted price is often on par or lower than the cost estimate sanctioned by NMCG.

iii. Reputable international firms have subsidiaries in India or form joint ventures which are incorporated in India and hence are treated as Indian companies. They participated in first bids but, from their perspective, are not competitive on simple build and operate technology, their comparative advantage is on high-tech or complex treatment systems. Foreign companies do not bid directly, mainly because of taxation and other issues irrespective of type of contract or sector.

65. The three new investments under the proposed SNGRBP will be procured using the HAM PPP contract. The investments that will be carried forward from the ongoing NGRBP to the proposed SNGRBP include three DBOT contracts, one HAM contract and one investment combining DBOT for network

construction and HAM PPP for STP construction (see Annex 3: Project Description for details). As of September 2019, more than 120 projects with a total sanctioned cost of Rs.128 billion (US$1.8 billion) have been undertaken by NMCG through DBOT contracts. Since the roll-out of the HAM in 2016, NMCG has awarded 7 HAM contracts (totaling US$770 million), and 10 more (totaling US$600 million) are at different stages of preparation and bidding (refer Figure 1).

(ii) Economic and Financial Analysis

66. An economic and financial analysis (EFA) has been prepared for the Project. In addition, an update of a program level economic analysis of the *Namami Gange* Program, of which the Project is a slice, was also undertaken.

67. EFA of Project Investments in Wastewater Treatment: An EFA for discrete Project investments in wastewater treatment under the proposed SNGRBP was carried out using the methodology for Cost Benefit Analysis (CBA) proposed by the United Nations Environment Program[33]. This methodology for estimating the Net Present Value (NPV) is based on a Cost of No Action versus Cost of Action (CNA-CA) approach. The analysis considered two types of benefits: environmental and health.

68. Infrastructure investments made under the Project have two major components: sewer network and STPs. Whereas all investments financed by the Project will result in environmental benefits, only sewer network investments will lead to health benefits as presented below.

Investment	Network	STP	Environmental Benefits	Health Benefits
Munger	Y	Y	√	√
Begusarai	Y	Y	√	√
Buxar	Y	Y	√	√
Digha Kankarbagh	Y	Y	√	√
Howrah	N	Y	√	X
Agra	N	Y	√	X
Meerut	N	Y	√	X
Saharanpur	N	Y	√	X

69. In order to estimate the cost of environmental impact, the shadow prices of undesirable outputs are estimated based on the assumptions provided in a UNEP report (2015). This Project is expected to result in GHG emissions over the period of Project life and therefore the shadow price of carbon has been factored in the estimation of economic benefits of the Project. The data on potential health benefits per capita has been taken from *Economic Impacts of Inadequate Sanitation in India* (2011) by the Water and Sanitation Program[34]. The resulting health and other economic benefits of a clean river have not been considered because that would require additional information which is not available.

70. The Benefit to Cost ratio of Project investments in ranges from 1.8 to 3.6 using a discount rate of 15 percent. The Economic Rate of Return ranges from 22 percent to 60 percent, whereas at Project level,

[33] United Nations Environment Program. 2015. Economic Valuation of Wastewater: The cost of action and the cost of no action
[34] *http://documents.worldbank.org/curated/en/820131468041640929/pdf/681590WSP0Box30UBLIC00WSP0esi0india.pdf*

the economic return is expected to be around 35 percent. These investments are likely to directly benefit a population of around 1.4 million[35] people. The results of the cost benefit analysis are presented below.

Investments	With 15% Discount Rate			With 10% Discount Rate			Economic Returns
	NPV of Total Benefits (Rs. Crore)	NPV of Total Cost (Rs. Crore)	Cost Benefit Ratio	NPV of Total Benefits (Rs. Crore)	NPV of Total Cost (Rs. Crore)	Cost Benefit Ratio	
SNGRBP	**₹ 6,856.4**	**₹ 2,765.7**	**2.5**	**₹ 12,470.1**	**₹ 3,769.2**	**3.3**	**35%**
Munger	400.7	184.2	2.2	720.9	229.6	3.1	27%
Begusarai	262.9	145.9	1.8	447.1	177.8	2.5	22%
Buxar	221.1	103.5	2.1	397.6	128.8	3.1	27%
Digha Kankarbagh	1726.5	792.9	2.2	3114.3	972.8	3.2	27%
Howrah, Bally and Baranagar	1034.2	353.6	2.9	1895.8	509.5	3.7	47%
Agra	1114.4	503.2	2.2	2042.5	752.2	2.7	41%
Meerut	1561.7	434.5	3.6	2863.4	648.2	4.4	60%
Saharanpur	534.2	246.8	2.2	979.1	349.3	2.8	35%

71. Economic Analysis of the *Namami Gange* Program: An economic analysis of the *Namami Gange* Program was carried out to evaluate its benefits relative to its costs. This builds on the seminal cost benefit analysis of the Ganga Action Plan[36] which had also been updated to inform the preparation of the NGRBP. Consistent with this approach, it has been updated again to reflect the *Namami Gange* Program. Specifically, it undertakes the following: (i) updates estimates of non-user and user benefits of the Ganga as a function of the quality of the water and applies the benefit functions to derive values for the benefits of the proposed actions under the *Namami Gange* Program; and (ii) compares these benefits with the costs of the actions to provide quantifiable net benefits. This updated analysis finds a substantial increase in non-user benefits after allowing for changes in inflation and real income since the 2000 study. A comparison of the costs and benefits is given in the table below for the two elasticities of benefits with respect to income. The data show that benefits are well in excess of costs in both cases, particularly in the case of the higher income elasticities. The benefit to cost ratio is 2.5 in the base case and 8.5 in the high elasticity case and the internal rates of return are 32 percent and 90 percent, respectively. A detailed description is at Annex 5.

[35] Based on investments including sewer network component
[36] Markandya A and Murty MN. 2000. *Cleaning-up the Ganges: A Cost Benefit Analysis of the Ganga Action Plan*

Net Benefits of the *Namami Gange* Program

	Base Case Income Elasticities of WTP	Higher Income Elasticities of WTP
NPV of Costs US$Mn.	2,006	2,006
NPV Benefits US$Mn.	5,013	17,111
NPV Net Benefits US$Mn.	3,190	15,288
Benefit Cost Ratio	2.5	8.5
IRR	32%	90%

B. Financial Management

72. The following FM arrangements are proposed for the Project. Further information is in Annex 5

(i) **Disbursement and Eligible expenditures:** The total Project cost is estimated at US$1,119 million, of which US$400 million will be IBRD-financed. The method for disbursement of funds by the Bank will be "Reimbursement". The IBRD Loan will finance 100 percent of the Central share of eligible Project expenditure up to US$381 million and subject to a maximum limit for each sub-component.[37] Under the Infrastructure Development Component, the Bank will finance 100 percent of the Central government's share of eligible expenditure excluding land and rehabilitation & resettlement (R&R) costs, if any. For infrastructure investment contracts carried forward from the NGRBP, the existing cost sharing ratio between Center and State will continue.

(ii) **Flow of Funds:** NMCG is registered as a Society and will receive Project funds in an earmarked Project bank account from the budget of the DoWR, under the MoJS. NMCG will transfer funds to each SMCG on a quarterly basis for the implementation of infrastructure investments approved by NMCG based on demand for funds submitted by the respective SMCG. The NMCG will release installments to SMCGs only on receipt of expenditure statements for previous release and after adjustment of any unspent balance. The State Government will release its share of funds, if any, to the SMCG within two months of the receipt of the installment from the NMCG. Fund flow arrangements will be the same as that of the ongoing NGRBP. As required by GoI, in 2017 NMCG has switched over to Public Financial Management System (PFMS), which is a standard system of fund flow and primary bookkeeping designed for central sector schemes like the *Namami Gange* Program. Currently, all project bank accounts of NMCG, SMCGs and EAs are registered with PFMS and payments at all levels are happening through the PFMS system.

(iii) **Interim Unaudited Financial Reports (IUFRs):** Each SMCG will submit quarterly IUFRs to the NMCG in agreed formats. The NMCG will consolidate the IUFRs received from the SMCGs along with its own and submit a quarterly consolidated IUFR to the Bank within 45 days of the end of each quarter.

(iv) **External Audit**: Annual External audits of NMCG and SMCGs will be conducted by the Comptroller and Auditor General (C&AG) and State Auditor General (AG) respectively under Standard Terms of Reference agreed between the C&AG, DEA and the Bank for audit of Bank-financed projects. Pursuant to the World Bank Policy on Access to Information, the Bank will require that the NMCG disclose the audited financial statements on the Project website. The annual audited Project

[37] These limits are laid down in the Table "Project Cost by Components" in Annex 3.

financial statements of the NMCG and SMCGs will be submitted to the Bank, which will make these statements available to the public through its external website.

(v) **Internal Audit:** The NMCG and each SMCG will also have internal audits to assess the effectiveness of internal controls and to provide independent assurance on the adequacy of internal controls. Internal audit arrangements of the proposed SNGRBP is being further strengthened based on learnings from the ongoing NGRBP.

(vi) **Due diligence of EAs:** The EAs of the proposed SNGRBP are the same parastatals as those of the ongoing NGRBP. The EAs have adequate accounting and reporting systems to account for Project resources and expenditures.

(vii) **FM Manual:** An FM Manual was prepared for the ongoing NGRBP that laid out the detailed financial management processes of this project, including budgeting, fund flows, internal control frameworks, accounting, financial reporting and auditing. The Manual has been updated to reflect specific requirements of the proposed SNGRBP. It is an integral part of the *Namami Gange* Program Framework.

(viii) **FM Risk Rating: Moderate.** Under the ongoing NGRBP, FM-related concerns have included: delays in submission of IUFRs and audit reports; lack of internal audits for part of the implementation period; and staffing inadequacies in SMCGs. Most of these concerns have been addressed over time, but the timeliness and quality of audit reports remains a challenge. NMCG has initiated discussion with C&AG for timely submission of audit reports. Also, under the proposed SNGRBP, the coverage of internal audits will be increased. The FM risk of the Project at this stage is rated as 'Moderate'.

C. Procurement

73. **Procurement regulations**: Procurement for the proposed SNGRBP will be carried out in accordance with the World Bank's Procurement Regulations for IPF Borrowers for Goods, Works, Non-Consulting and Consulting Services, dated July 1, 2016 (revised in November 2017 and August 2018). Unless otherwise agreed with the World Bank, the World Bank's Standard Procurement Documents, Requests for Proposals, and Forms of Consultant Contract will be used. For Procurement under PPP Concessions and Similar Private Sector Arrangements, the selection will be carried out under the provisions of paragraph 6.42-6.45 of Bank Procurement Regulations. Procurement will be carried out in accordance with the provisions of the Project Procurement Strategy for Development (PPSD) and the Procurement Plan that may be updated from time to time with the World Bank's approval (details in Annex 5).

74. **E-Procurement**: The Project will use electronic procurement systems (viz. National Informatics Centre (NIC) platform) for aspects of the procurement process, including: issuing Procurement Documents and addenda, receiving applications/quotations/Bids/Proposals, and carrying out other procurement actions. This system has been assessed by the World Bank and was found to be acceptable.

75. **Procurement capacity**: The procurement arrangements will continue as under the ongoing NGRBP, building on the significant experience acquired and national and State levels, in particular for large PPP procurement and management. NMCG will retain the responsibility of overall Project implementation, funds allocation and investment monitoring. SMCGs shall coordinate at the State level

and EAs will be responsible for implementation of works through contractors. The EAs will be responsible for detailed procurement management functions like preparing and issuing tenders, opening and evaluation of the tenders, placing contracts, managing contract, regular supervision, and authorization of payments. NMCG will continue the practice of appointing Transaction Advisors to help the EAs from preparation to award and closure of contracts.

76. Risks and mitigation measures, including impact of COVID-19. The potential procurement risks are: (i) delays in the procurement process; (ii) poor participation of bidders in bidding process; (iii) delays in decision-making due to bureaucratic processes; (iv) non-compliance with agreed procurement arrangements; (v) lack of a satisfactory procurement complaint handling system; and (vi) impact of COVID-19 on the financial, infrastructure and construction sectors. Although the severity and duration of the impacts of COVID-19 are uncertain, they are expected to aggravate the stress on the financial sector, increasing the difficulty of reaching timely financial closure. The government's increasing need for resources to mitigate the impact of COVID-19 and economic slowdown may limit its ability to spend on infrastructure in the short term. The construction sector, also under stress may face more challenges related with project completion, new project financing and order inflows, on account of disruptions in the movement of labor and materials in the wake of COVID-19.

77. The following risk mitigation measures were developed in consultation with the implementing agencies: (a) use of skilled procurement staff for handling procurement activities; (b) adequate publicity, slicing and packaging of the works to maximize the interest of bidders; (c) careful design of qualification requirements for such packages and conducting vendor meets to understand concerns and suggestions of potential bidders; (d) monitoring of the Procurement Plan; (e) training provided by the World Bank; (f) use of e-procurement; (g) disclosure of procurement-related information; (h) appropriate handling of complaints; and (i) phase tender publication over time, organize pre-bid meetings and more broadly, work with Client to propose arrangements such as payment advances or other stimulus to help private operators go back to normalcy. The design of the Project is in itself a mitigation measure, by proposing infrastructure investments at a critical time and by introducing an IBRD guarantee for payment security for the three new HAM PPP investments to be procured under the Project. The IBRD Guarantee will provide 'AAA' risk mitigation with respect to the long-term payment obligations by the GoI under these contracts. Hence, it will help attract private investment and commercial financing for these investments (refer Section I Component 3 for details).

78. Justification for using HAM contracting model: As a part of project preparation, a market study on emerging lessons from the HAM contracting model was carried out for further details see Section III A: Technical Analysis.

79. Procurement Risk Rating: The overall procurement risk rating for the Project is assessed as 'Moderate' based on the risk factors and mitigation measures. Procurement risk and the progress on various mitigation measures will be reassessed during the implementation phase and the risk rating will be updated accordingly.

Legal Operational Policies

80. OP 7.50 on International Waterways: The Ganga River and its tributaries are considered international waterways for the purpose of the World Bank's Operational Policy 7.50 "Projects on

International Waterways". In fulfilment of this policy, a notification was sent to the Governments of China, Bangladesh and Nepal on December 27, 2019. No objection to the Project was received.

Safeguards

(i) Environmental Safeguards

81. Safeguards Category: Overall, the proposed Project will have a positive impact on targeted urban areas and the Ganga river. However, the Project will have the following potential impacts and risks during construction and operation phases:

- siting and design of treatment and disposal facilities in sensitive locations;
- management of site, health and safety issues during construction;
- potential risk of inadequate operation of facilities leading to impacts on water quality;
- disposal of treated sewage and sludge from the treatment facilities and their impact on the receiving environment; and
- loss of land, livelihood or sources of livelihood.

82. Based on this, the Project is assigned a safeguards category of "A" and Operational Policies 4.01 Environmental Assessment, 4.04 Natural Habitats, and 4.11 Physical Cultural Resources, are triggered.

83. Environmental Safeguards: The Ganga faces extreme pollution pressures and significant threats to its biodiversity. The proposed Project interventions to enhance sewage collection and treatment will have multiple positive environmental benefits. It is envisaged that the Project interventions, by reducing the pollution load in the river, will protect and enhance sustenance of these sensitive habitats. This will support efforts to conserve endangered species such as Gangetic Dolphin, freshwater crocodile and other flora and fauna that depend on the river. A recent survey[38] indicated that the mortality rate of Gangetic Dolphin reduced compared to the previous years. One of the reasons could be improved water quality and water availability in the river.

84. Safeguards Instruments: The investments identified to date under the proposed Project are located in the States of UP, Bihar and West Bengal, either on the main stem or tributaries of the river within these States. For each of the three HAM PPP investments to be procured under the Project, an Environmental and Social Due Diligence Report (ESDDR) was prepared. As the exact locations of additional infrastructure investments to be funded under the Project are not yet known, NMCG prepared an Environmental and Social Management Framework (ESMF). The ESMF outlines the procedures for screening investments for their impacts, the types of safeguard instruments to be prepared and the institutional responsibilities to prepare the instruments. The ESMF clarifies the responsibility for preparation of safeguards documents in case of different types of PPP contracts as follows:

(i) *HAM PPP contracts:* Preparation of ESDDR is the responsibility of the NMCG/EA and the preparation of an investment-specific Environment and Social Impact Assessment (ESIA) will be the

[38] Wildlife Institute of India, Conserving Gangetic Dolphin, Smart Strategy Implementation and Adaptive Management for the Ganga River (WII – GACMC, 2019).

responsibility of the winning bidder, based on the design that each selected concessionaire would have prepared after contract signing.

(ii) *DBOT contracts*: an upfront ESIA is the responsibility of NMCG/EA.

85. Institutional Arrangements: The NMCG recognizes environmental and social issues and plans to mitigate them through a set of management procedures detailed in the ESMF. The NMCG and SMCGs will ensure that policies and procedures described in the ESMF are applied to all investments financed under the proposed SNGRBP.

86. Disclosure: Advanced drafts of the ESMF, which includes an RPF, and ESDDRs were reviewed by the Bank and were disclosed in-country and on the World Bank's external website on February 21, 2020. A final ESMF, which includes an RPF, was reviewed by the Bank and disclosed in country on March 24, 2020 and on the World Bank's external website on April 6, 2020.

87. Climate assessment: The Project locations are present across varying geo-climatic conditions and are exposed, to varying degrees, to the risk of drought and flooding. The vulnerability to climate risks and the adaptive capacities to manage them varies at the State and local levels. The monthly flows during the monsoon are projected to increase under a future climate change scenario. Increased water flow and sedimentation in the Ganga basin due to climate change will lead to more floods in India. Flash floods in the upper regions of the river basin also trigger landslides and are expected to increase in frequency and intensity with rising temperature. Droughts are more common too, because there are now more days with no rain at all. Based on the results of the climate screening exercise, the Project design will incorporate adaptation measures to address the risks of climate vulnerability. Climate screening of the Project found the impact rating to be moderate. Climate and geophysical hazards are likely to impact the structural integrity, materials, siting, longevity and overall effectiveness of the investments. Investments under the Project will include household connections to sewerage system, wastewater treatment and disposal, and septage management. Investments involving wastewater treatment plants beyond 40 MLD capacity will be required to establish an energy recovery facility to minimize net electricity consumption.

88. Climate co-benefits: The total climate co-benefits in this Project amount to US$54.77 million (13.7 percent). The Project has potential for increasing climate co-benefits.

89. Green House Gas Accounting: The GHG Accounting assessment used the latest Intergovernmental Panel on Climate Change guidance of 2019. It quantifies the net annual average emissions at 63,979 tCO2-eq and the emissions during the economic lifetime at 4,053,299 tCO2-eq (gross) and 1,919,426 tCO2-eq (net). These emissions are obtained on the assumption that wastewater treatment technology used will be Sequential Batch Reactors, which is among the most emissive as its nitrification and denitrification process releases nitrogen gas (N_2) in the atmosphere. The choice of technology will be determined by the private operator for each investment under the Project and will conform to national discharge standards for STPs. The total emission levels may therefore decrease but the Project is likely to remain a net emitter. The economic analysis costed GHG emissions at shadow price of US$80/ton. Taking this into consideration reduces the NPV of the Project by US$38 million or 3 percent.

(ii) Social Safeguards

90. Key Issues. While communities are expected to benefit from the Project, its implementation may lead to adverse social impacts. During construction of investments, these might potentially include:

- loss of land or structures;
- loss of livelihood and/or loss of access to areas for livelihood support;
- loss of common property resources, and
- public safety issues because of labor influx and construction activities.

91. Operational Policies Triggered. Operational Policies 4.11 Physical and Cultural Resources and 4.12 Involuntary Resettlement are triggered. OP 4.11 has been triggered considering the presence of number of historic and heritage structures in the Project area and cultural significance of the Ganga river. OP 4.12 has been triggered as social due diligence carried out for three HAM based investments shows that the investments may lead to loss of small piece of land (which will be purchased through mutual negotiation on willing buyer – willing seller basis), potential loss of livelihood and will cause inconvenience to residents around the construction zone. However no involuntary resettlement is envisaged. Investment-specific ESIA will be carried out and ESMP / RAPs will be prepared as required as per the Resettlement Policy and Land Acquisition Framework (RPLAF) that has been prepared as part of ESMF. OP 4.10 Indigenous Peoples is not triggered as the experience of the ongoing NGRBP shows that urban areas where investments are being implemented across all the five states does not have tribal population. Even if some tribal households are found, they have largely assimilated with the mainstream population

92. Social Safeguard Instruments. As not all investments have been identified, NMCG updated the ESMF prepared for the ongoing NGRBP to include the baseline information on tributaries to be included in the proposed SNGRBP. The ESMF is to be applied to all investments under the proposed Project. The ESMF includes a Resettlement Policy Framework (RPF), which specifies the procedures, probable impacts, eligibility, entitlements, and other measures to be followed in the event of resettlement and/or land acquisition. The ESMF also includes a Gender Development Framework (GDF), which will help analyze gender issues during the preparation stages of the Project and design interventions to address women's needs. Gender analysis will be part of the Social Impact Assessment (SIA).

93. Institutional Arrangements: NMCG is responsible for providing overall guidance implementation of ESMF provisions. At State level, the SMCG will be responsible for ensuring implementation of ESMF procedures in all investments. Social specialists have already been appointed in NMCG and all SMCGs. All EAs will designate Social Coordinators at the investment level.

94. Citizen Engagement: The Project includes a robust citizen engagement strategy: (a) community/stakeholder consultations as the primary tool to promote stakeholder participation in the Project design and implementation process; (b) robust communications and public outreach program to mobilize citizens, community groups, academics, private sector, and so on as key actors to achieve a clean and healthy Ganga; (c) citizen monitoring committee to be established at investment level to assess and generate feedback on the Project; and (d) GRM to respond to the needs of beneficiaries, including Project-affected persons.

95. Gender-specific considerations and gender-based violence (GBV)/sexual exploitation and abuse. The primary gender gap pertaining to the operation is low participation of women in technical roles, as engineers and planners in the water and waste management sector. To address this, the operation will: a) review and implement institutional guidelines related to women's re-entry and advancement; and b) develop a network of women mentors (women professionals in technical roles) and women interns by offering internship opportunities to women students enrolled in STEM courses. Further, the proposed SNGRBP will also: a) provide technical training opportunities for women professionals; b) offer field placements; c) support improving the work environment for women staff by providing clean and separate sanitation facilities in the office and at work sites; d) explore provision of safe and reliable transport to support field visits and late working hours; and e) strengthen the functioning of the Internal Complaints Committee in accordance with the GoI's Sexual Harassment Act, 2013.

96. The GBV risk assessment carried out for the ongoing NGRBP indicated the Project is low risk for GBV and accordingly an action plan was prepared which is under implementation by Project implementing agencies and contractors. Since there is continuity of participating States and carry-forward of selected investments from the ongoing NGRBP to the proposed SNGRBPSNGRBP, the risk GBV risk assessment is retained and the action plan will be updated to include any new investments. The Project will follow the recommendations of the GBV Good Practice Note.

V. GRIEVANCE REDRESSAL

97. Grievance Redress Mechanisms (GRMs): The ongoing NGRBP has a multi–tier grievance redress system established national, State and executing agency levels. Grievances of any kind are submitted through various mediums (e.g. a dedicated toll-free number, direct calls to concerned officials, online via a dedicated portal, in written form, etc.) and are addressed. The same grievance redress mechanism will continue for SNGRBP as well.

98. Communities and individuals who believe that they are adversely affected by a World Bank supported Project may submit complaints to existing Project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address Project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit *http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service*. For information on how to submit complaints to the World Bank Inspection Panel, please visit *www.inspectionpanel.org*.

VI. KEY RISKS

99. The overall risk for the Project is rated as Substantial. The individual ratings for risk categories are summarized in the datasheet of this document. Key risks of note are described below:

100. Political and Governance: Substantial. The priority and commitment accorded to the Ganga clean-up by successive national governments remains high. The *Namami Gange* Program is a flagship program of the Central government and a stated priority of the current Prime Minister, who chose in 2014 to contest the national elections from Varanasi, a major city located on the banks of the Ganga. Ownership is uneven across basin States and is related to political alignment, which is susceptible to change over time. In addition, project management capabilities vary across States. Hence, the political and governance risks are rated as Substantial. The Project design has incorporated measures to mitigate such risks. NMCG is selecting investments on the basis of clear and published technical criteria. The Project will engage with the States, EAs and sub-State level institutions early to build ownership, clarify roles and responsibility sharing. It also proposes TA support to improve capacities of EAs for PPP contract management.

101. Macroeconomic risk: Moderate. Until recently, this would have been rated Low in view of the robust finances and strong fundamentals of the economy. However, the supply and demand disruptions caused by COVID-19 will likely aggravate the economic slowdown and stress in the financial sector. In view of the rapidly evolving circumstances of the pandemic, it is difficult to predict to what extent this will affect the Indian economy and the *Namami Gange* Program. The macroeconomic risk is therefore rated as Moderate. The World Bank has worked with the GoI to design an emergency response to the COVID-19 pandemic and will continue to monitor the evolution of the situation and to provide adapted support going forward. At a Project level, the use of an IBRD Guarantee provides risk mitigation with respect to the long-term payment obligations of the government under the three HAM PPP investments and hence will help mobilize private investment and commercial financing for these projects. The investments in infrastructure by the Project will contribute to stimulating economic recovery and job-creation after the COVID-19 pandemic.

102. Sector strategies and policies: Substantial. The use of the HAM PPP contracts for wastewater treatment has received a good response from the market. While there is increasing evidence of successful implementation of HAM PPPs during the construction phase, there is as yet insufficient indication of their effectiveness during the O&M phase. This introduces a potential risk that this innovative model may not be able to deliver on its promise to keep the private sector involved and meet discharge standards throughout the 15-year O&M phase. The initial experience of the first generation of HAMs now starting the O&M phase under the *Namami Gange* Program is encouraging, with private operators reportedly meeting discharge standards. This risk will be mitigated by close joint supervision by EAs, SMCGs, NMCG and the Bank to identify and address potential O&M issues early on.

103. Recent changes introduced by the GoI that make standards for sewage discharge more stringent will increase the cost of wastewater treatment, affect the choice of treatment technology and reduce the market of private operators immediately able to run plants that are capable of treating wastewater to the revised standards. This risk will be mitigated by NMCG and the Bank through the bidding documents of the three HAM PPPs to be procured under the Project to find the right balance between stricter technical criteria and ensuring sufficient qualified competition. The Project will support the organization of market consultations to explain the new discharge standards, their expected impacts on sanctioned costs and encourage operators to adapt to this new reality and be able to submit bids in keeping with the Project implementation schedule.

104. The *Namami Gange* Program is organized around three phases, starting in 2015 and likely to extend to beyond 2028. When the Program was launched, a budget was initially approved for a period of

five years from 2015-20 and this has been extended through December 2021. The high level of political commitment to the Program suggests that an extension of the *Namami Gange* Program will be approved by GoI in due course.

105. Technical design: Substantial. The infrastructure, construction and banking sectors and the economy as a whole are under stress. Several major Indian infrastructure construction companies and one of the largest private banks have recently filed for bankruptcy. The three DBOT contracts to be carried forward from the NGRBP, Begusarai, Munger and Buxar, which combine sewer network extension and STP construction, all experienced termination during the construction phase due to under-performance or bankruptcy of the private operator. The consequences of the current national lockdown due to the COVID-19 pandemic for the economy are unknown at this point. The roll-out of more stringent discharge criteria in this context will further increase the stress. The infrastructure investments under the Project will also help mitigate the consequences of the COVID-19 pandemic. It will contribute to stimulate the economy and job-creation. The Project design also include concrete measures to improve preparedness and resilience of investments to such shocks, and to be able to reallocate funds for emergency response if required.

106. The private sector and financial markets have demonstrated their technical understanding of the proposed HAM PPP and the attractiveness of this contractual model for delivering infrastructure investments. However, due to the limited access to long-term financing for HAM PPP contracts, bidders may face increasing constraints in obtaining the required amount of commercial financing and, therefore, in reaching financial closure on a timely basis. Such constraints will also be reflected in higher risk premia charged by the private operators. These risks are considered substantial in the current economic context and considering the COVID-19 outbreak, unless adequate measures are introduced by the GoI to open additional liquidity in the market and stimulate the infrastructure and financial sectors. The mitigation measure to address financing and payment risk includes introduction of an IBRD guarantee for payment security for the three new HAM PPP to be funded under the Project. The IBRD guarantee will provide additional comfort to private investors and operators in mitigating payment risks for the full contract duration. NMCG and the Bank will continue to monitor the financial markets for liquidity and access to long-term capital and will enhance the financial due diligence by requesting that letter of comforts from identified financiers be submitted jointly with bids and align the timing of financial closure accordingly.

107. There is a risk of large variation of effluent quality in I&D investments, which may be more difficult to treat than wastewater collected in sewer networks. Wastewater tapped from open drains is more subject to dilution during rain events or to contamination by industrial wastewater. HAM PPP contracts include mitigation measures for this risk (namely if effluent is above or below the contractual range, the private operator will not be liable to penalties for not meeting the discharge standards). However, variable pollution loads at STPs' inlets may affect the chemical and bacteriological treatment processes for some time, which may create a liability. Additional mitigation measures include real-time water quality monitoring at STPs' inlets and outlets and close supervision, by NMCG and the SMCGs, EAs and the Bank, of private operators' capacity to stabilize treatment processes quickly. Another I&D risk is that most drains carry large quantities of solid waste, some part of which is small enough to pass through the screens and negatively affect the capacity of pumping stations and STPs to function properly. Mitigation measures under the Project include ensuring that the designs of pumping stations and STPs include high quality screening systems and maintenance at key locations, well-crafted stormwater overflows, and promoting timely planning and development of sewer networks.

108. Institutional capacity for implementation and sustainability: Substantial as a result of uneven ratings at various administrative levels. At the national level, the risk to institutional capacity is low. NMCG has evolved into a strong, well-staffed and effective institution. It has gained substantial expertise and has a good track record in designing and implementing over 310 various investments under the *Namami Gange* Program, of which over 150 in wastewater. It has successfully introduced the innovative HAM PPP contract to complement DBOT contracts. The proposed study on strengthening the institutional framework for Ganga basin management will assess and mitigate potential risk as it reviews roles and responsibility-sharing and proposes options for Ganga basin management. The Project will include legal covenants in place under the ongoing NGRBP, requiring "*maintaining qualified personnel and resources sufficient to carry out project management*" and ensuring "*continuity of the leadership of the NMCG and the SMCGs"* (refer to Datasheet).

109. At the State level, the institutional capacity risk is Moderate. SMCGs face staffing and capacity constraints, which undermine their capacity to supervise and monitor investments. Investments in each State will be implemented by the State EA, which is an established *parastatal* with demonstrated experience in implementing investments including execution of a quality assurance function. However, the staffing situation in SMCG and EAs is uneven and, as demonstrated by recent experience, can be impacted by unpredictable decisions at the state level. This risk will be mitigated by ensuring knowledge and experience exchange from NMCG to SMCGs, by temporary secondment of NMCG staff and/or consultants to SMCGs, and by internal staff allocation when EA allows it, consistent with the legal covenant in place under the ongoing NGRBP, which states: "*DOWR and the States shall maintain a dedicated, multi-disciplinary team of suitably qualified personnel in each Executing Agency (EA) with resources sufficient to carry out their respective parts of the project*". This risk has been mitigated by introduction of the above legal covenant in the proposed Project.

110. The institutional risk at ULB level is high. ULBs have weak capacity, lack autonomy in functioning and are financially near-completely dependent on the State government. While ULBs have the Constitutional mandate for water and sanitation service delivery, in reality, the water and sanitation service delivery is *de facto* implemented by the State government on financing aspects and by State EAs on technical aspects. Due to the inherent weaknesses and poor finances of ULBs, the private sector has been reluctant to enter into PPP contracts with ULBs. The *de facto* primacy of the State government and the EAs in this sphere leaves the ULBs generally insufficiently informed or involved, although they have an important role in granting permissions for construction, in coordinating planning with other works and in encouraging and supporting households to connect to sewer networks, when they are included in investments. The design of the Project is in itself a robust mitigation measure against the risk of weak ULB capacity and finances. The design of PPPs under the Project ensures that payments for CAPEX and up to 15 years of OPEX are covered by the Central government. EAs and private operators retain the responsibility not only of building the assets but also of managing them, under the close supervision of NMCG and the SMCGs, during the 10 or 15 years of O&M under the PPP contracts. The Project will also engage ULBs early in the process of investment preparation and will support them to develop integrated city-wide sanitation plans. It will also provide performance incentives to ULBs that show improvement in planning and management of wastewater services.

111. The sustainability risk is Substantial. The absence of a revenue model for NMCG, and at the ULB level for wastewater collection and treatment, introduces a risk to the long-term sustainability of the assets funded under the Project. Mitigation measures under the Project include assessing, in close

collaboration with the Central and State governments and ULBs, pragmatic roles and responsibility-sharing arrangements for the operations of the assets. The Project will also support the preparation of a plan and a roadmap to establish O&M arrangements, develop related policies for long-term sustainability of service delivery at the completion of the PPP contracts and introducing a performance-based approach to funding allocation combined with dedicated technical assistance to support reform for greater sustainability. GoI may be interested in scaling up such approaches at the Program level in a later phase.

112. Fiduciary: Moderate. Procurement and FM risks are considered Moderate thanks to the considerable experience gained by NMCG, the SMCGs and the EAs under the ongoing NGRBP and the broad alignment of the *Namami Gange* Program with Bank procurement requirements. Nevertheless, there is a possibility that some of the EAs require improving audit arrangements and financial management of investments. The mitigation measures to address them is to ensure close monitoring of investments by NMCG and the Bank during Project implementation. Procurement risks, including due to COVID-19, consequences of the national lockdown in India and mitigation measures are presented in Section II.B.

113. Environmental and Social: Substantial. The risk of delayed and insufficient communication to key stakeholders, and limited understanding of the risks by ULBs, key line departments and community level stakeholders warrant an Environmental and Social risk rating of Substantial. EAs' awareness of these risks has substantially improved since the start of the NGRBP. Environmental and social risks related to known investments supported under the Project have already been identified and suitably mitigated. Mitigation measures includes maintaining Project management support to SMCGs and EAs in the five States in which NGRBP is implemented, to ensure that experienced environmental management and social development specialists are available at NMCG and SMCGs throughout Project implementation. The Project will promote introducing septage management, which is currently unregulated or only partially managed by ULBs. NMCG will continue its efforts to increase awareness and communication activities to key stakeholders to enhance their knowledge and capacities and will institutionalize the monitoring of environmental and social due diligence procedures in all investments.

114. Stakeholders: Substantial. Some investments are likely to pose challenges to both institutional stakeholders and beneficiary communities. There is scope to improve coordination between the Ministry of Jal Shakti's own agencies (in particular between NMCG and CWC), and other agencies such as CPCB (MoEF&CC), and with their equivalents at the State level. These institutions will also be compelled to follow environmental norms set forth by NMCG and others, to ensure that the efforts to reduce pollution are sustained. Since these institutions are not involved or insufficiently involved in the ongoing NGRBP, NMCG will continue its advocacy and coordination efforts to ensure that they comply with pollution reduction measures, directly or through the contractors they manage.

115. At the ULB level, the reliance on interception and diversion (I&D) of open-air drains carrying wastewater and not including the development or extension of sewerage networks creates a risk of not sufficiently cleaning the city, as it does not improve human and environmental health in the cities. I&D is a technically more attractive solution to meet the overall goal of cleaning the river. I&D is comparatively faster to implement and gives large flows of wastewater into STPs from the day of commissioning. The Project design itself includes mitigation measures by promoting the development of participatory and citywide planning of wastewater infrastructure, supporting the preparation of sewer network investments

and supporting workshops to mobilize funds for their implementation, and setting up funds under the Sub-component 2.4 which may include funding some of these investments.

116. At the community level, disruption during construction, and the potential reuse of treated wastewater in agriculture or other domestic uses or sale of treated water to industries by the contractor could pose challenges as they may require the development of new pipelines and facilities not included in the investments, would require clear mechanisms to ensure technical and financial sustainability of these additional infrastructure, and represent a risk of pollution incident or local flooding in case of malfunction. This risk would be mitigated by close supervision and by NMCG for all investments under the *Namami Gange* Program. Moreover, GRM systems in place under the ongoing NGRBP will be utilized under the proposed Project.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework
COUNTRY: India
Second National Ganga River Basin Project

Project Development Objectives(s)

The objective of the Project is to reduce point-source pollution from targeted Urban Areas of the Ganga river basin and support the Central Ministry to strengthen the institutional framework for Ganga river basin management.

Project Development Objective Indicators

Indicator Name	PBC	Baseline	End Target
Reduce point-source pollution from targeted Urban Areas of the Ganga river basin			
Amount of BOD pollution load reduced due to Project interventions (Metric tons/year)		0.00	30,000.00
Number of STPs constructed or rehabilitated under the project which meet the national discharge standards at least 95 percent of the time (Number)		0.00	8.00
Support the central ministry to develop an institutional framework for Ganga river basin management			
Adopted recommendations of the study on institutional framework for Ganga river basin management are implemented (Percentage)		0.00	80.00
A public online system for continuous monitoring of water quality and flow in the Ganga and selected tributaries is functional (Yes/No)		No	Yes

Intermediate Results Indicators by Components

Indicator Name	PBC	Baseline	End Target
Institutional Development			
Number of States which have a roadmap for sustained O&M sanitation assets beyond the timeframe funded by Central Government (Number)		0.00	1.00
A system for more detailed water balance tracking in key reaches is developed and implemented to guide operational flow regime optimization (Yes/No)		No	Yes
Detailed assessment of environmental flow options for all impacted river reaches completed, documented and disseminated (Yes/No)		No	Yes
Number of ULB with an integrated city-wide sanitation plan informed by a GIS and roadmap for financing long-term operation and maintenance approved by the ULB (Number)		0.00	2.00
Percentage of female staff in NMCG and state-wise EAs (Percentage)		4.30	20.00
Share of grievances redressed within 30 days of receipt (Percentage)		80.00	90.00
Infrastructure Development			
Wastewater treatment capacity created under the project (Liters (Million))		0.00	800.00
Volume of wastewater treated due to project interventions (Liters (Million))		0.00	600.00
Number of facilities setup for fecal sludge treatment under the project (Number)		0.00	5.00
Number of water quality monitoring stations generating real-time data (Number)		76.00	150.00

Indicator Name	PBC	Baseline	End Target
Nb of km of network laid under the project (Kilometers)		0.00	800.00
Nb of house connections delivered under the project (Number (Thousand))		0.00	200,000.00
Program communication and management			
Number of mass media campaigns implemented to promote behavior change (Number)		0.00	4.00
Share of core staff positions filled in each implementing agency maintained above 80% at any point in time (Percentage)		80.00	90.00

Monitoring & Evaluation Plan: PDO Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Amount of BOD pollution load reduced due to Project interventions	Quantity of Biochemical Oxygen Demand (BOD) abated based on wastewater treatment at STP, consolidating real-time monitoring of BOD quantity at inlet minus the quantity of BOD at the outlet of each STP built or rehabilitated under the Project.	Daily consolidation of measurements, monthly reporting from States to NMCG and consolidation by NMCG in their quarterly	While the ultimate measurement mechanism should rely on real-time water quality monitoring systems installed during the Project and	It is calculated by taking the difference between the BOD concentration at the inlet and outlet points of the STP in mg/l. Volume and BOD data will be provided every 2 hours by the real-time water quality monitoring devices installed at each STP, allowing to	S/CPCB and NMCG

		reports, shared to the Bank.	fed the data into NMCG's monitoring interface, interim solutions based on self-measurement and independent spot-checks may be used until the RTWQM and interfaces are in place.	calculate the quantity of BOD avoided for each time slot. The data will be consolidated on a monthly basis.	
Number of STPs constructed or rehabilitated under the project which meet the national discharge standards at least 95 percent of the time	Number of STPs constructed or rehabilitated under the project which are in compliance with the national discharge standards for BOD at least 95 percent of the time	Quarterly, through NMCG Quarterly Progress reports	Real-time water quality monitoring stations installed under the Project will provide every 2 hours a data point on volume, BOD, COD, TSS, pH at inlet and outlet of	Volume and BOD data will be provided every 2 hours by the real-time water quality monitoring devices installed at each STP. An STP will achieve the requirement of this indicator if less than 19 increments of 2 hours show data above the discharge standard for BOD. (A month has 365 increment of 2 hours, 5% is 18.25)	S/CPCB and NMCG

			each STP funded or rehabilitated under the Project. This data will be fed into NMCG's monitoring interface. Interim solutions based on self-measurement and independent spot-checks may be used until the RTWQM and interfaces are in place.	Every increment for which the discharge standard is not met will lead to applying the contractual daily penalty for not meeting the discharge standard to the operator.	
Adopted recommendations of the study on institutional framework for Ganga river basin management are implemented	This indicator will monitor the completion of the study on institutional framework for Ganga river basin management and that the adopted recommendations of the study are being implemented.	quarterly, based on actual implementation of the adopted recommendations.	DoWR, RD & GR of the MoJS, in collaboration with NMCG, which will record progress through their	NMCG Quarterly report and regular Bank supervision	DoWR, RD & GR of the MoJS

			quarterly progress reports		
A public online system for continuous monitoring of water quality and flow in the Ganga and selected tributaries is functional	Interface integrating data from the national Water Resources Information System (CWC-managed), tailored to NMCG's needs of monitoring continuous (real-time or frequent updates) water quality and river flow and feeds an online system available to the public.	Quarterly from year 2	India Water Resources Information System	Real-time collection from WRIS, including of data contributed by real-time water quality monitoring stations installed under the Project and the NGRBP.	NMCG and CPCB

Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Number of States which have a roadmap for sustained O&M sanitation assets beyond the timeframe funded by Central Government					
A system for more detailed water balance tracking in key reaches is developed and implemented to guide operational flow regime optimization	Tool to consolidate in space and time: level in reservoirs, abstraction from irrigation canals, domestic and industrial use, e-flow requirement and major events (Khumb) and optimize use for greatest	One-off tool development	NMCG to coordinate with CWC and State agencies	WRIS and other direct arrangements as required	NMCG

	environmetnal and economic benefits.				
Detailed assessment of environmental flow options for all impacted river reaches completed, documented and disseminated	Detailed assessment of environmental flow options for all impacted river reaches completed, documented and disseminated	One-off	NMCG	Quarterly progress reports	NMCG
Number of ULB with an integrated city-wide sanitation plan informed by a GIS and roadmap for financing long-term operation and maintenance approved by the ULB	Each ULB to develop a plan for city-wide coverage integrating sanitation and treatment development, through piped or on-site solutions, supported by a full GIS mapping of wastewater networks, pumping stations, STPs, FSM discharge points and eixsting property data. Options for financing long term O&M will promote utility creation through institutional isolation of sanitation service, possible revenue streams and autonomy in governance. The plan preparation will seek to stimulate ULBs to update property databases for revenue generation. The plan will seek to integrate river and wetland	One-off for each city	ULB	Plans approved by ULB city councils, States Urban Development Departments to support and NMCG to supervise	ULB, States Urban Development Departments, NMCG

	management, drainage and solid waste to develop holistic decision-making at the urban metro / catchment level.				
Percentage of female staff in NMCG and state-wise EAs	This indicator will measure female staff who are able to progress from their current grades in NMCG and EAs during the project implementation period.	Once a year, starting Year 2	Data from NMCG and state level EAs	Administrative/HR data from state level EAs	state level EAs
Share of grievances redressed within 30 days of receipt	NMCG, SMCG and EAs to monitor the number of grievances redressed within 30 days of receipt and the share of the total this represents. A grievance is reddressed when the complainant receives a response to the issue raised.	Quarterly, Year 2 Onwards	EAs, SMCG, NMCG	Consolidated data on GRM monitoring maintained at NMCG and SMCG	EAs, SMCG, NMCG
Wastewater treatment capacity created under the project	Measures the capacity of wastewater treatment facilities constructed or rehabilitated under the Project	Quarterly	Progress reports	EA monitoring, SMCG and NMCG supervision	EAs, SMCG, NMCG
Volume of wastewater treated due to project interventions	This indicator measures the volume of wastewater conveyed to STPs built or rehabilitated under the Project	Quarterly, Year 2 Onwards	Operational real-time water quality monitoring data from the Sewage	STPs built or rehabilitated under the Project will be equipped with real-time monitoring systems providing	NMCG/EAs

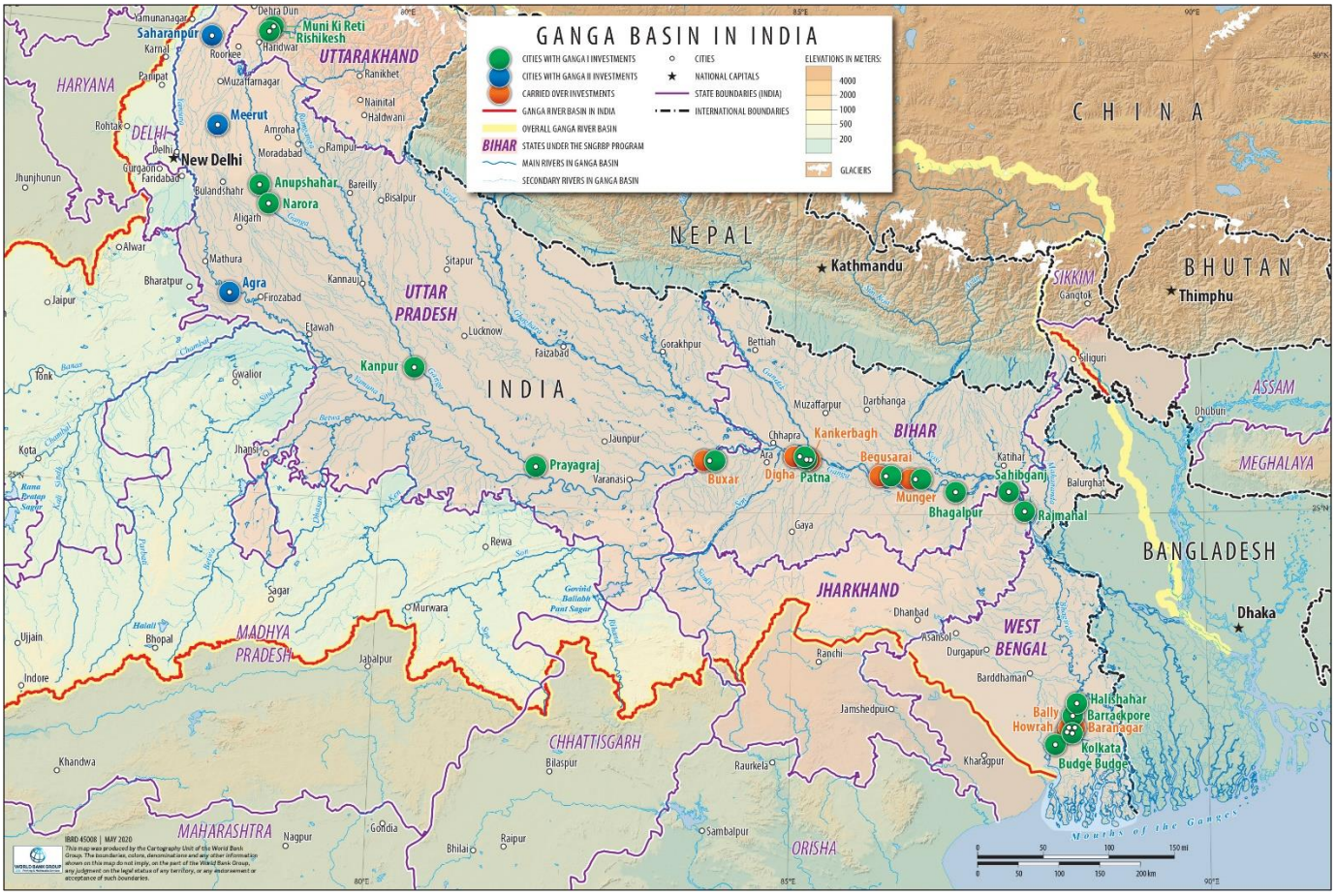
			Treatment Plants	every [2 hours] a data point on volume monitoring at inlet of each STP. This information will be collected on a monthly basis by consolidating the 365 increment of 2 hour measurement during the month.	
Number of facilities setup for fecal sludge treatment under the project	Measures number septage treatment facilities created (standalone or co-treatment at STP)	Quarterly	Progress reports	EA monitoring, SMCG and NMCG supervision	EAs, SMCG, NMCG
Number of water quality monitoring stations generating real-time data	Self-explanatory. Target value to be determined. Stations will be proposed at inlet and outlet of each STP built or rehabilitated under the Project, station upstream and downstream each major urban center and at each nalla discharging drainage water into the Ganga or selected tributaries	Quarterly	Progress reports	SMCG – SPCB and NMCG -CPCB supervision	SMCG, NMCG
Nb of km of network laid under the project	Sum of sewerage nework length laid (sewerage network and rising mains) in investments under the project	Quarterly	Progress reports	EA monitoring, SMCG and NMCG supervision	EAs, SMCG, NMCG

Nb of house connections delivered under the project	Number of households in which greay water and blck water outlets are conveyed to a sewer network built rehabilitated or operated under the Project	Quarterly	Progress reports	EA monitoring, SMCG and NMCG supervision	EAs, SMCG, NMCG
Number of mass media campaigns implemented to promote behavior change	This indicator measures the outreach campaigns developed and its effectiveness to plan and implement behavior change for pollution reduction, whether mass-media campaigns implemented by NMCG or targeted campaigns implemented by States or sub-State institutions	Quarterly, Year 1 onwards	NMCG and state level institutions	NMCG Quarterly Progress report will consolidate and monitor progress	NMCG and state level institutions
Share of core staff positions filled in each implementing agency maintained above 80% at any point in time	Core staff positions include Director-level positions and key procurement, FM safeguards and M&E staff	Quarterly	NMCG, SMCG and EAs	To be included in NMCG Quaterly progress reports, which will consolidate information from States quarterly progress reports	NMCG, SMCG and EAs

VIII. INDICATIVE TERMS AND CONDITIONS FOR THE GUARANTEE

A Summary of Indicative Terms and Conditions of a Proposed IBRD Guarantee with a Letter of Credit in Support of Governmental Payments is provided in Annex 7.

ANNEX 1: Indicative Map of the Ganga basin



ANNEX 2: Ganga Water Quality Data

1. The water quality of the Ganga has been assessed as unfit for many 'best uses', particularly 'bathing' in several stretches (see Table 1), as designated by Central Pollution Control Board (CPCB) water quality standards. The best-use classes designated by CPCB are:

- A- Drinking Water Source without conventional treatment but after disinfection;
- B- Outdoor bathing (organized);
- C- Drinking water source after conventional treatment and disinfection;
- D- Propagation of Wild life and Fisheries;
- E- Irrigation, Industrial Cooling, Controlled Waste disposal.

2. From its source in Gangotri in the State of Uttarakhand until Kannauj in Uttar Pradesh (UP), the river water quality is fit for bathing based on a combination of the three key parameters – Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Fecal Coliforms (FC)[39]. Once the river enters Kannauj, water quality sharply deteriorates and from there on until discharge into the Bay of Bengal, the level of FC is higher than the permissible level for bathing[40]. In addition, there are three critical stretches where BOD is also higher than the permissible level: from Kannauj to Prayagraj, and from Varanasi to Ghazipur in UP, and from Tribeni to Uluberia in West Bengal.

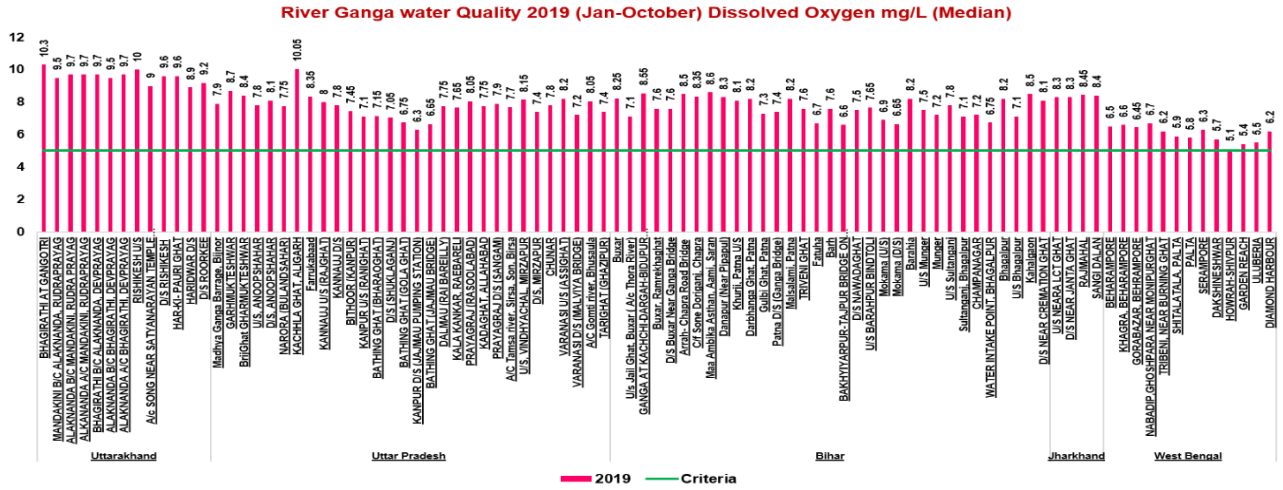
Table 2.1: Primary Water Quality Criteria for Bathing, as per Environment Act Amendment Rules (2000), notified by Ministry of Environment, Forests and Climate Change

Criteria	Rationale
1. Faecal Coliform 500 (desirable) MPN/100ml: 2500 (Maximum Permissible) 2. Faecal Streptococci 100 (desirable) MPN/100ml: 500 (Maximum permissible)	To ensure low sewage contamination. Faecal coliform and faecal streptococci are considered as they reflect the bacterial pathogenicity. The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal changes, changes in flow conditions etc.
3. pH: Between 6.5-8.5	The range provides protection of the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing.
4. Dissolved Oxygen: 5 mg/l or more	The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately U/s which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediments
5. Biochemical Oxygen Demand 3 day, 27°C: 3 mg/l or less	The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases.

[39] Bathing class water quality corresponds to the following standards: BOD: 30 mg/L, DO: up to 5 mg/L, and FC: 2,500 per 100 ml.
[40] NMCG, 2020, Water Quality in River Ganga.

3. **Beginning in 2019, the water quality of the Ganga started to show modest yet encouraging improvements**. The Central Pollution Control Board (CPCB) of the GoI reports that, in 2019, levels of Dissolved Oxygen (DO) met the bathing water quality threshold for DO in the entire main stem of the Ganga (over 2,500 km). Between 2014 and 2019, levels of DO, Biochemical Oxygen Demand (BOD) and Fecal Coliforms (FC) improved in several stretches of the main stem of the river. During an unprecedented national lockdown from March 2020 onwards to curb the spread of COVID-19, industries stopped operating, agricultural activity halted, and rivers carried much less solid waste. This, and higher flows in the river compared with the same period in 2019, led to a reportedly visible improvement in the water quality of the Ganga and some of its heavily polluted tributaries. The National Mission for Clean Ganga (NMCG) and CPCB are using this opportunity to document the share of the pollution generated by domestic wastewater, as it is the source of pollution least affected by the lockdown, which could be used as a baseline for further action to reduce pollution discharges into the river basin. As of April 2020, official measurements by the CPCB are yet to be released[41].

Figure 2.1 Ganga Water Quality, Jan-Oct 2019: Dissolved Oxygen, mg/l (median)



Total locations- 93
Complying- All locations

https://economictimes.indiatimes.com/news/politics-and-nation/lockdown-health-of-river-ganga-improves/ articleshow/ 74946264.cms?from=mdr> Accessed April 7, 2020

Figure 2.2 Ganga Water Quality, 2014 vs 2019, Jan-Oct: BOD, mg/l (Median)

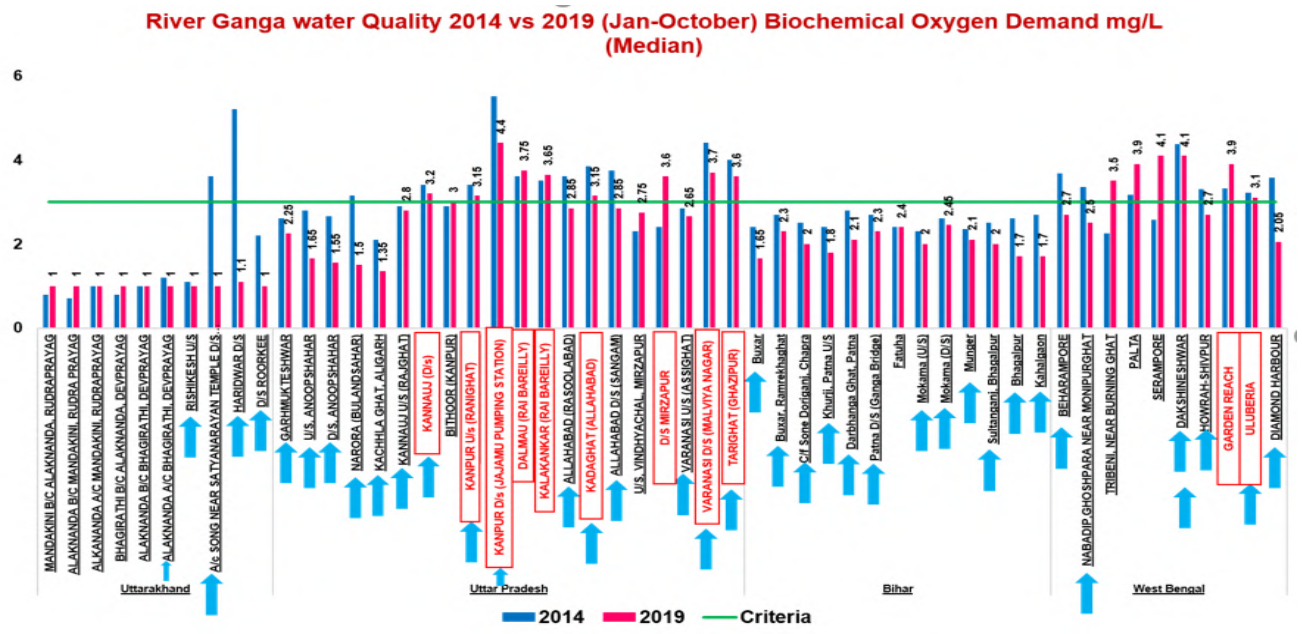
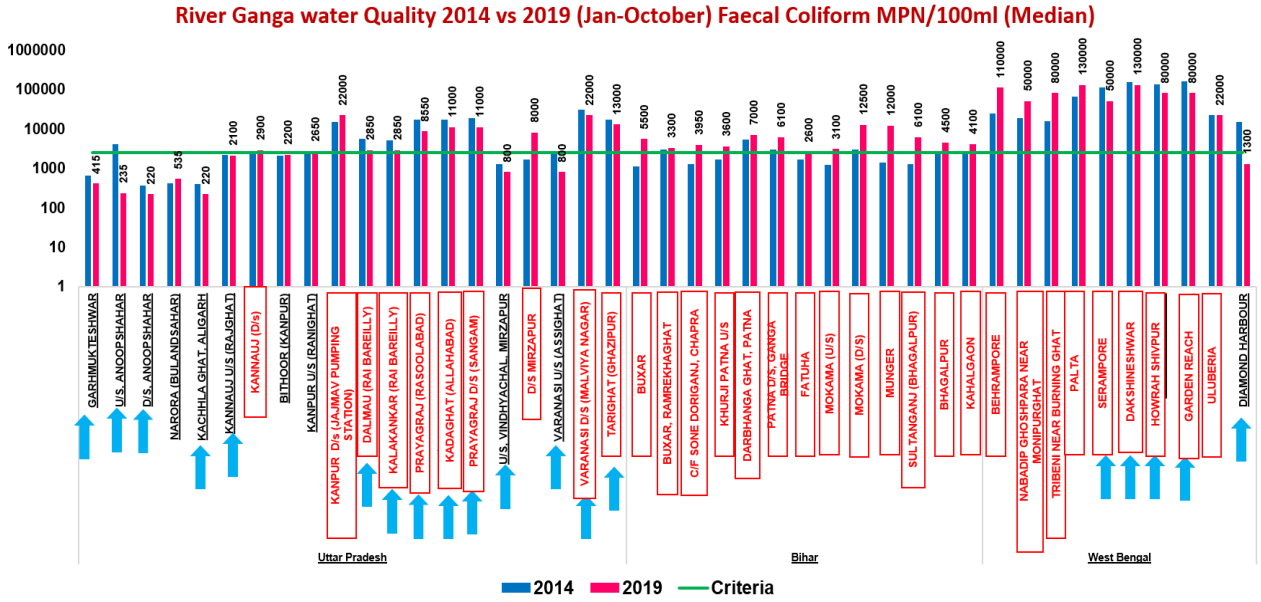


Figure 2.3 Ganga Water Quality, 2014 vs 2019, Jan-Oct: FC, MPN/100ml (Median)



ANNEX 3: Detailed Project Description

Component 1: Institutional Development: This component will support to the national, State and municipal governments to strengthen implementation and financing arrangements and develop a framework to improve Ganga river basin management.

Sub-component 1.1 – Strengthen the institutional framework for Ganga basin management

1. *Institutional and Stakeholder Assessment and development of an institutional framework for Ganga River Basin Management:* This sub-component will support the DoWR,RD&GR in strengthening the framework for Ganga river basin management. It will fund consultants' services and technical assistance arrangement to carry out a comprehensive analysis of the functions and mandates of key institutions at Central, State and sub-State levels involved with aspects of Ganga River Basin Management, of the relevant laws and regulations, and of possible options for NMCG to operationalize the mandate it received through the Government Authorities Order of 2016. Key institutions will include, at the national level, the DoWR,RD&GR, NMCG, other relevant agencies involved in collecting data and monitoring flows (CWC), water quality and pollution (CPCB), including non-point source pollution, and groundwater levels and abstraction (CGWB) the Governments of the eleven States of the Ganga river basin and State and sub-State-level institutions (SPCB, SGWB, etc.). This study will make recommendations on options for strengthening the institutional framework for Ganga river basin management, describing the roles and responsibility sharing among key institutions and a roadmap for their implementation. The study will focus on data collection, monitoring and use for either strategic planning, forecasting and decision making. It will take into account the changing climate context in the Ganga basin and how institutional arrangements can be designed to enhance climate resilience, especially for poor and vulnerable sections, and identify gender gaps and measures to address these. It will be conducted with wide stakeholder consultation throughout its implementation: at the beginning to ensure that it fully understands and integrates the perspectives of Central, State and local administrations and a range of other key stakeholder groups including major cities/ULBs and water consumers (farmers associations, industries, etc.); to present and discuss the options considered and roadmaps for their implementation to seek feedback and ensure that these options are sensible for all stakeholders; and at the end create large ownership on the recommended approach. NMCG will organize a presentation of the study recommendations, integrating the results of the consultations, for final review and adoption by the Central and State levels, and will record the adopted recommendations. This sub-component will also finance technical assistance to support the implementation of the adopted recommendations of the study. The component will support analytical work and policy-level discussions to develop institutional guidelines to promote women's entry and career progression in technical roles in river basin management. Proposed interventions will include tracking the number of women recruited and encouraging retention of women staff at NMCG and SMCGs through rolling out best-practices/pilots around leadership training for women, re-entry options post maternity leave, preferences for on-site deputations, on-the-job training/skilling choices including sabbatical/study leave options for securing professional degrees and international exposure visits.

Sub-component 1.2 – Development and application of tools to monitor and inform decision making for river basin management

2. This sub-component will develop critical tools to improve river basin management and strengthen evidence-based decision-making for Ganga basin management.

3. *Interface for water quality and flow monitoring:* Develop a publicly available online interface integrating water quality and quantity data and information from the national Water Resources Information System (WRIS). NMCG will use this interface for continuous monitoring of water quality and flow in the River Ganga and its tributaries, including to indicate whether STPs equipped with real-time water quality monitoring systems are meeting discharge standards. This sub-component will also engage consultants to provide recommendations for development of a basin-wide water quality and flow monitoring framework, and to develop the protocols and capacity for its use in informing evidence-based decision making. This will include overall system design, gap analysis and a detailed time-bound plan (with targets and indicators) to bridge identified gaps. The Project would then allocate fund to support implementation of an approved plan.

4. *Real time water quality monitoring:* Support NMCG (in coordination with the Central Pollution Control Board and State Pollution Control Boards) to install additional real-time water quality monitoring stations at strategic locations and to ensure data is feed into the WRIS, and from there, to the interface described above. The number, type and location of new stations, will be specified in the above-mentioned plan. First priority will be monitoring at inlet / outlet locations of STPs built or rehabilitated under the Project. Second priority may be upstream and downstream of major urban areas, and the discharge points for major drains. The Project will explore how real-time water quality data can inform compliance of STPs with national standards in real-time, thus automating enforcement of PPP contracts provisions on discharge standards.

5. *System to monitor water allocation and flows in Uttarakhand and Uttar Pradesh:* The Ganga river basin concentrates the largest agricultural area and irrigation areas in India, a number of large hydropower dams, over 40 percent of India's population and many large industries. As a result, the pressure of competing demands for Ganga water for hydropower, irrigation, industry, human settlements and social/cultural needs, have led to significant water withdrawals from the river and its tributaries, especially in Uttarakhand and Uttar Pradesh. Withdrawals are expected to increase with demographic and economic growth. If not managed, this increasing demand for water could undermine the ability of pollution reduction efforts to improve river water quality. Approximately 60 percent of the Ganga's total annual flow is diverted for canal irrigation alone; at Haridwar, diversions represent 80 percent of the total annual flow, and at Narora, they represent 90 percent of the total annual flow (CPCB 2015). The impact of these diversions is most acutely felt in the dry season, which is also when the demand for hydroelectric power generation is greatest. In recognition of this, NMCG recently made a notification on environmental flows (e-flows), making compliance with a minimum e-flow level mandatory for all existing and future projects. This activity will engage consultants to develop a system to monitor major water withdrawals in Uttarakhand and Uttar Pradesh (extending to Varanasi – the end of the most polluted stretch) and develop a tool that uses these data together with data on dam reservoir levels, canal diversion volumes, and e-flows requirements, to dynamically assess the river water balance. The tool would be used to compare temporal and spatial patterns of supply and demand, monitor e-flow compliance, and develop scenarios that optimize the economic and environmental outcomes from the available water consumed. The activity will use data from existing flow monitoring to the extent possible. It will finance goods and minor works to install flow monitoring stations at critical locations in order to improve the accuracy of the water balance. All data generated under this component will be fed

into the WRIS. At a later stage, this tool could also inform the piloting of eco-compensation i.e. mechanism to compensate the upstream area of a watershed for providing ecosystem services.

6. *Environmental flows technical consultations*. Over the last 10 years there have been a range of different efforts in the Ganga basin to investigate e-flows, but none have been comprehensive or led to implementing a realistic e-flow regime. This sub-component will support an evidence-based, participatory investigation of environmental flow (e-flow) options, for all river reaches across the Ganga basin where substantial flow regime modification has occurred. It will engage consultants to undertake a comprehensive new basin-wide investigation of e-flow options, including scientific assessments of the likely ecological benefits of the e-flow options on the environmental health of the river and tributaries, on improving biodiversity and wetland rejuvenation, as well as on cultural and social aspects of the Ganga. The investigation will focus on the mainstem of the Ganga and on major tributaries (including the Yamuna, Hindon, and Ramganga). It will use data and tools developed as a part of other activities under this component and will be conducted with wide stakeholder consultation to discuss e-flow recommendations that balance environmental and economic outcomes, and to discuss incentives for keeping more flow in the river. This sub-component will also help support initial strengthening of a river basin planning process.

7. *Strengthening the Ganga Knowledge Center (GKC)*. This sub-component will provide technical assistance support to strengthen the GKC as the repository of data and information on the Ganga river basin, to make such data and information publicly available online along with a feedback mechanism and to promote its use as an input to communication and outreach campaigns (under Sub-component 4.1 and by other stakeholders) targeting either specific stakeholders or the general public to make the link between their actions and river conditions and advocate behavior change at scale. The TA will also support GKC in developing its forecasting capacity, using the data and information collected under the above tasks to inform scenario modelling to explore water management options that balance economic, environmental and social factors, including gender considerations. It is expected that this modelling will build on the significant effort supported by the Bank and the South Asia Water Initiative (SAWI, a trust fund financed by the governments of the United Kingdom, Australia and Norway) in participatory river basin modelling, to inform decision-making, to run scenarii of impact of proposed activities on water quality and quantity in the Ganga river basin, and report on such impacts to inform decision making.

8. The Communication and Outreach program (Sub-component 4.1) will support the consultations and communication activities to be implemented under each of the above listed activities. Improved monitoring and optimization of water quality and flow supported under this sub-component can strengthen resilience to climate-influenced changes in water quantity and quality.

Sub-component 1.3 – Support to Participating State Governments and ULBs to strengthen their capacity for wastewater service delivery and river management. This sub-component will provide technical assistance to improve the capacity of the State line department and participating ULBs to improve wastewater and river management, based on the recommendation of the study to be carried out in Sub-component 1.1.

9. *Support to participating States.* This sub-component will support selected States, including the States where the Project will finance investments, in studying possible options, roles and

responsibility sharing between parastatal EA and ULBs for O&M arrangements of wastewater service delivery from an institutional, technical and financial capacity stand-point with the aim of ensuring long-term sustainability of service delivery. These studies will inform the preparation by the participating State governments, of a roadmap for sustained O&M of sanitation assets beyond the 15 years funded by the Central government under the current PPP arrangements, and of additional policy pieces, such as a State level sanitation strategy, a connection strategy for household sewer connections; and a roadmap to generate revenues, possibly through tariffs, making it possible to incrementally cover O&M costs.

10. *Strengthening ULB capacity:* In the PPP projects under the NGRBP, capital expenditures and 10 to 15 years[42] of operational expenditures are provided in full by the Central government. This dilutes the incentive for States or ULBs to engage into recovering O&M expenses from users. However, the opportunity to introduce user fees and set the basis for sustainability is best done when provided with a new or improved service and the incentive for ULBs to engage is greater if the funding made available by the Central government is conditioned to performance improvement. Therefore, this activity will fund consultants' services to encourage ULB in taking a more active role in the sustainable management of the assets funded under the Project and will develop a comprehensive technical assistance package to support them. It will support participating ULBs, on a demand basis, to strengthen their planning, institutional, technical and financial capacity to manage wastewater. This sub-component will also benchmark each of the ULBs supported under the NGRBP and this Project, based on their progress on strengthening their planning, institutional, technical and financial capacities to manage wastewater services. The top ranked ULBs will be added to the criteria, currently solely focused on amount of pollution discharged into the river, to set priority for allocation of additional funding through the performance-based incentive described at Sub-component 2.4.

11. The support to each ULB will be tailored to the needs and interests of each ULB and could include all or parts of the below proposed activities, which will be carried out through consultants' services and technical assistance.

12. In terms of planning, this sub-component will promote the development, in cities where investments will be funded under the Project, of a comprehensive long-term city-wide inclusive sanitation plan integrating not only future urban growth, water demand, wastewater generation and management (network, non-network, I&D and treatment and reuse), but also drainage, solid waste, and river and wetland management and rejuvenation in the city area. The TA will promote creating or updating a GIS mapping the wastewater network and treatment facilities and linking, whenever possible, households and costumer information to better understand the current revenue stream of property taxes funding the wastewater management. Such plan will help inform discussion on where it makes economic sense to invest to develop or extend sewer networks and house connections and where to support non-network solutions for fecal sludge collection, transport, and treatment to maximize environmental and public health benefits through city-wide sanitation coverage. These plans will promote catchment and holistic approaches and will encourage participation of key stakeholders and consultation with the general public at key stages. The plan will then be used to structure investments and technical assistance activities which could be proposed for funding by programs available to ULBs such as the national government's urban

[42] DBOT PPP entail 10 years of O&M while HAM PPPs have 15 years of O&M.

missions (AMRUT, Smart City), State government funds, or could be presented to multi/bilateral development banks (e.g. ADB, KfW, JICA) and international technical assistance agencies (e.g. GIZ), possibly though funding workshops at ULB or State level.

13. On the institutional side, the TA package would include working with interested ULBs to isolate sanitation service delivery in an institutionally dedicated unit and cost center; provide training to staff mapped to this unit on sanitation and PPP contract management, so that they can be the ULB counterpart for PPP contract management during the O&M Phase.

14. On the financial side, the TA would support ULBs willing to update their property database, which currently forms the revenue basis for sanitation fees, and record properties into the sanitation GIS, with the understanding that a share of the incremental tax revenue generated will be channeled to the sanitation service cost center. It will also explore options to introduce or strengthen dedicated user fees for water and sanitation services. With respect to service management, the TA will prepare a framework for service level benchmark monitoring system, help ULBs create or strengthen staff capacities to improve integrated planning, implementation and monitoring of sanitation service delivery.

15. This component will directly contribute to improved operational efficiencies of wastewater collection and treatment systems financed under the SNGRBP (see Component 2) and include relevant training on climate change.

16. **Sub-component 1.4 – *Namami Gange* Program Emergency response preparedness.** This sub-component will provide Consultant's service and technical assistance to assess the preparedness of investments under the *Namami Gange* Program to respond to an emergency related to a health-crisis or natural disaster and develop a set of recommendations and principles to increase the resilience of investments implemented under the Program. This sub-component will also develop emergency preparedness plans at program and investment levels, establishing the protocol to follow in case of a health crisis requiring people to confine in their homes as was the case for the COVID-19 crisis or in case of a natural disaster such as flood, earthquake, drought or extreme climate event and making concrete recommendations to increase the resilience of investments implemented under the Project.

Component 2: Infrastructure Development

17. **Sub-component 2.1: Wastewater treatment investments**. The NMCG has identified three HAM investments in the State of UP in the cities of Agra, Meerut, and Saharanpur, located on the Yamuna, Kali and Hindon tributaries of the Ganga, respectively. These investments were selected because they are the largest pollution hotspots on these tributaries which are not yet the focus of an interments under the *Namami Gange* Program. Each investment will consist of goods and works to intercept and divert wastewater currently flowing through open drains into the river with pumping stations and conveyance systems and the construction and/or rehabilitation of STPs, which will allow to treat 100 percent of the wastewater generated by these cities prior to discharging it in the tributaries of the Ganga river. The private operator will be encouraged to include in its design specific measures based on early lessons from the COVID-19 crisis. Additional measures may be supported under Sub-component 2.3 to integrate the recommendations of the emergency preparedness plans to be developed in parallel under Sub-component 1.4. These investments will

be procured using the HAM PPP approach, and will be combined with activities under Sub-component 1.3 to promote planning of sewerage network extension, helping ULBs interested in securing funding for their implementation, possibly through the framework approach under Sub-component 2.4 and will be partially funded under the Project as presented in the table below. A description of each investment is included in the Appendix to this Annex below.

Table 1: Total cost of new investments including interest payment and inflation indexation

	Investment	State	Tributary	Description	Total Cost (US$ million)	Cost under SNGRBP (US$ million)
1	Agra	UP	Yamuna	HAM: I&D, STP	170	60
2	Meerut	UP	Kali (East)	HAM: I&D, STP	140	55
3	Saharanpur	UP	Hindon	HAM: I&D, STP	90	35
	Total				**400**	**150**

18. As a part of Project preparation, a market study on emerging lessons from the HAM contracting model was carried out. The key findings of the market study are at Section III. A (i) Technical Analysis.

19. **Sub-component 2.2: Carry forward of selected investments from NGRBP to SNGRBP***:* This sub-component will finance selected investments currently under implementation under the ongoing NGRBP that will be carried over to the proposed SNGRBP at the closing of NGRBP (December 30, 2021). It is anticipated that five investments will be carried over: Digha Kankerbargh (HAM and DBOT) in Bihar, Howrah, Bally, Baranagar (HAM) in West Bengal (these are the first two HAM contracts funded under the ongoing NGRBP), and three investments in Begusarai, Munger and Buxar (all DBOT) in Bihar. The DBOT contracts in Begusarai, Munger and Buxar were procured under the ongoing NGRBP and faced delays as the NMCG terminated the DBOT contracts with the private operators for lack of performance, leaving unfinished works. These investments were also selected because each will bring the treatment capacity to 100 percent in each city and, except in Howrah, Bally, Baranagar, they will also develop full sewerage network coverage and target 100 percent house connections in these cities. Moreover, these investments are complementing ongoing investments under the NGRBP. The Digha-Kankerbargh investment will complement investments under the ongoing NGRBP to will bring both sewage network coverage and treatment capacity to 100 percent in Patna, the capital of the State of Bihar. In West Bengal, the proposed investment will increase the sewage treatment capacity in Kolkata from 21 percent to 54 percent. The ongoing NGRBP is financing the Tolly Nallah investment in Kolkata, which combined with another investment under preparation, will, upon completion, bring the sewage treatment capacity in Kolkata, the capital city of West Bengal, to 100 percent. For each of these investments that are carried forward from the ongoing NGRBP to the proposed SNGRBP, the Project will fund the balance of capital expenditure (CAPEX) and the first three years of operational expenditures (OPEX). The balance OPEX will be financed by GoI. The Appendix to this Annex provides details of each investment.

Table 2: Total cost of carried over investments including interest payment and inflation indexation

	Investment	State	Description	Total Cost (US$ million)	Cost under SNGRBP (US$ million)

1	Digha Kankerbargh	Bihar	HAM and DBOT	230	86
2	Howrah, Bally, Baranagar	West Bengal	HAM	182	38
3	Begusarai	Bihar	DBOT	39	12
4	Buxar	Bihar	DBOT	29	8
5	Munger	Bihar	DBOT	55	16
	Total			**535**	**160**

20. **Sub-component 2.3: Improving Investments resilience to COVID-19-like emergency crises.** This sub-component will support the implementation of the recommendations of the emergency preparedness plans developed under Sub-component 1.4 to improve the resilience of service delivery and to support service providers to respond to similar crisis or shock. These may include goods and works to develop remote management capabilities, increase the stocks of chemicals on STP sites and develop renewable energy generation capabilities on site to allow maintaining service provision in case of restricted movements of people and to supplement electricity supply.

21. **Sub-component 2.4: Introducing a performance-based incentive for ULBs***:* This sub-component aims to introduce criteria to allocate funding to ULBs based both on measures for pollution source prioritization and their performance in strengthening planning, management, and cost recovery of wastewater service delivery to promote holistic approaches at city level. A framework approach will be used to identify potential additional investments during Project implementation. The NMCG is considering investments to extend sewage networks in cities where initial investments have been made under the ongoing NGRBP and/or will be made under the proposed Project to saturate wastewater collection and promote last mile connectivity in these cities.

22. Learning the early lessons from the COVID-19 pandemic, each investment will include dedicated equipment and protocols to improve resilience in case a health crisis requires limiting people's movements. These will focus on protecting the health and safety of the staff and their families, by having quality personal protection equipment in sufficient quantities for sanitation workers and ensure that sanitation workers are considered priority workers for testing; develop SCADA systems and automation allowing the remote management of key treatment facilities, to continue operating facilities in a lockdown situation; and secure supply chains for chemicals and ensure stock of at least two months' worth of chemical on site to be able to sustain treatment and have flexible and adaptive protocols to optimize response to a specific crisis or emergency.

23. These interventions will support reduction in the volume of untreated wastewater discharged into water the Ganga and its tributaries. This will reduce flood risk and impact of floods as floodwaters will be less contaminated[43]. Hence, these interventions will increase residents' resilience to these climate-exacerbated events. The proposed investments that have a sewer network component will have a positive impact on the urban environment in targeted cities and increase their climate resilience.

24. Further, the design of the investments encourages energy efficiency and requires that any STP of 40MLD or more includes an energy recovery system to reduce energy costs. Options to

[43] The rehabilitated and new climate-resilient sanitation infrastructure will be less likely to be overwhelmed and/or damaged.

reduce Green House Gas (GHG) emissions will also be encouraged. Since January 2016, the GoI has made it compulsory that treated wastewater be reused by all thermal power plants located within 50km of a STP.

Component 3 – IBRD Guarantee

25. *Current form of Payment Security:* The HAM PPP contracts create long-term liabilities for NMCG for the payment of annuities to the private operator over fifteen years of O&M period. For the HAM-PPP projects, NMCG establishes an escrow-based payment security mechanism for two purposes – providing payment security and making quarterly payments. For the payment security, NMCG maintains a minimum balance ("Minimum Escrow Balance") required to meet the next two upcoming milestone payments during the Construction Period; and two years of O&M Payments (Capex Annuities, O&M Charge, Power Charges, etc.) during the operations period. The Escrow Agreement is entered between NMCG, State Agency, Concessionaire and the Escrow Bank for the benefit of the Concessionaire. The concession payments are made from the Escrow Account once the State Agency clears the invoice raised by the Concessionaire. Failure of NMCG to maintain the Minimum Escrow Balance for 90 days is treated as NMCG event of default in the Concession Agreement.

26. *IBRD Guarantee as cost effective alternate Payment Security:* Maintaining Minimum Escrow Balance in the Escrow Account has been a useful project-specific interim arrangement to kick-start a large program like *Namami Gange*. The maintenance of Minimum Escrow Balance locks-in capital for 15 years of contract incurs sunk cost for the Government at higher cost of capital, which could otherwise be committed to project investments. In addition, with the potential for scaling-up of the program, alternative cost-effective risk mitigation mechanisms can be considered by the Government. To optimize the design and funding needed for the payment security, the NMCG is considering the use of an IBRD Guarantee as a more cost-effective payment security mechanism. Consistent with international experiences in offering similar World Bank guarantees as payment security mechanism, the IBRD guarantee will be offered to cover only two rolling quarters of annuity payments during the fifteen years of O&M period. The benefits of using an IBRD Guarantee for the overall program include:

- Replacing the need to hold 2 years of O&M period payment in the Escrow Account with an IBRD Guarantee for 2 Quarters would free up significant amount of upfront capital which can be allocated to new investments. This will further help optimize use of scarce public resources in the context of post-COVID-19 priorities of the Government.
- Replacing the need to maintain the Minimum Escrow Balance with an IBRD Guarantee would offer a savings of 50% of the annual costs of providing a payment security;
- Building a track record for more efficient payment security mechanisms under the HAM PPP;
- Incentivizing payment discipline to all parties through contractual arrangements associated with IBRD guarantees, which will be an important element to improve private investors' confidence in the sanitation sector.

27. *The proposed IBRD Guarantee will be structured as a payment guarantee* to backstop certain payment obligations of NMCG under the three HAM-PPP contracts. The principal risk the IBRD

Guarantee will mitigate is that of contractual payment default by NMCG under those contracts due to unavailability of funding in the relevant Escrow Account to meet periodic O&M payment requirements. The risk of unavailability of funding in the Escrow Account arises from inadequate allocation of funding by Government for these HAM-PPP investments over the life of the contracts. The proposed IBRD Guarantee is expected to provide comfort to the private operators that the annuity payments will be made in a timely manner. Following the core principle of World Bank Guarantees – that of partiality – the coverage of payment risk will only be partial, that is, a maximum of two quarterly O&M period payments for the three HAM-PPP investments.

28. *Market testing of IBRD Guarantee as alternative payment security*: To assess the market appetite, NMCG and Bank conducted a market testing workshop on 6th February 2020 with a number of key developers, operators and commercial lenders. The objective of this market testing exercise was to discuss with private sector on the potential consideration of IBRD Guarantees as risk mitigation package for HAM-PPP projects in lieu of the maintaining Minimum Escrow Balance at the Escrow Account. Around 37 participants representing various equity investors, operators, advisors, public and private commercial banks attended the meeting. The participants showed strong interest and asked NMCG to consider offering IBRD Guarantee for the next round of HAM-PPP projects. Based on the feedback, the NMCG had requested the Ministry of Finance for the potential use of IBRD Guarantee to cover the payment obligations during the O&M phase under the three HAM PPP investments proposed under Sub-component 2.1.

29. *Sizing of IBRD Guarantee:* The sizing of the guarantee is estimated to be US$ 19 million to match with the expected sum of two quarterly O&M period payments of the three HAM-PPP projects. Considering the guarantee coverage period of 15 years, the proposed guarantee sizing includes additional buffers for increase in inflation and appreciation of the local currency. The O&M period payments include a pass-through provision for incorporating actual inflation on Opex costs. Because the guarantee is offered in US Dollars and the payments under the HAM-PPP contracts are in Indian Rupee, the proposed guarantee sizing has to factor in currency appreciation. The calculation of guarantee sizing involves use of shadow O&M period cost figures of the three HAM-PPP contracts developed by the NMCG and the Bank. As these contracts are in procurement stage, the analysis to arrive at the sizing is not included here.

30. *Indicative Structure of Proposed IBRD Payment Guarantee:* As provided in the indicative Term Sheet, the proposed IBRD payment Guarantees will be offered through a Standby Letter of Credit (SBLC) structure to be issued by a commercial bank (SBLC Bank, as a beneficiary of the IBRD Guarantee). The SBLC will be drawn by the Escrow Agent if NMCG fails to transfer the amount required to meet an upcoming quarterly O&M payment. Once the SBLC is drawn, the amount drawn converts into a short-term loan to NMCG under a Reimbursement and Credit Agreement (RCA) between NMCG and the SBLC Bank. If NMCG fails to repay the SBLC Bank this short-term within the prescribed duration (say, 12 months), the SBLC Bank can call on the IBRD Payment Guarantee. Any payment made by IBRD under the IBRD Guarantee will trigger an obligation on the part of GoI to repay IBRD under the Indemnity Agreement with IBRD. The Indemnity Agreement will require the GoI to repay IBRD on demand, or as IBRD may otherwise direct. The decision to procure one or more SBLC Banks for three projects will be made after the procurement of HAM-PPP contracts are completed and private operators are identified. The SBLC Bank will be competitively procured in conjunction with the NMCG.

Figure 1: Proposed IBRD Payment Guarantee– Indicative Fund Flow Structure

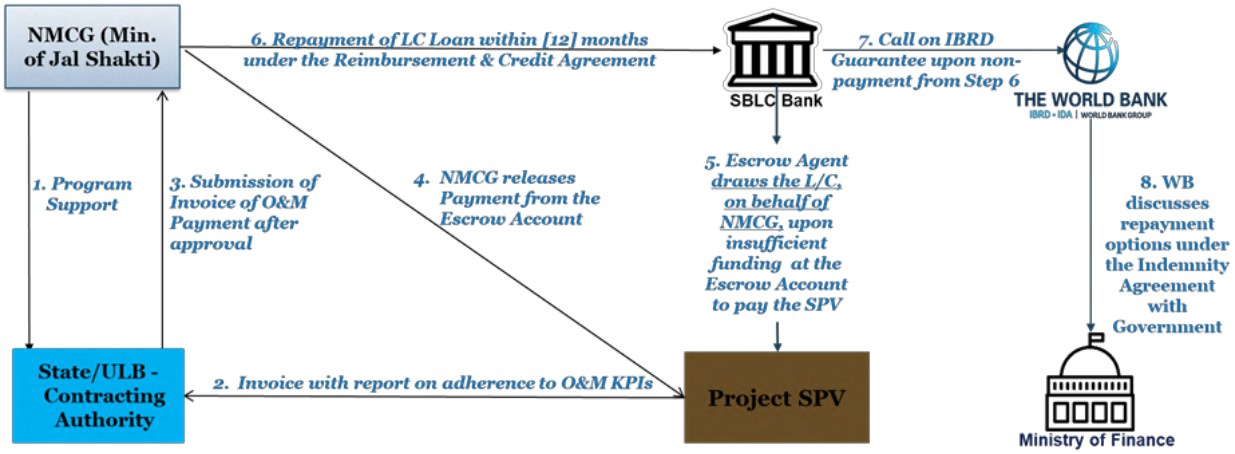
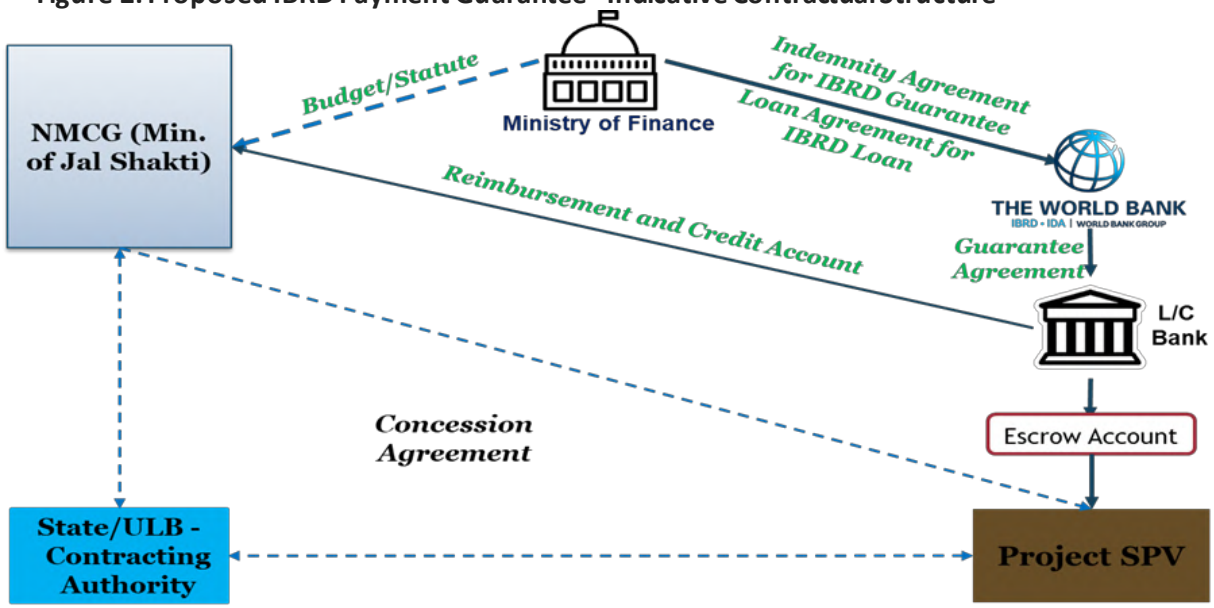


Figure 2: Proposed IBRD Payment Guarantee– Indicative Contractual Structure



31. *Guarantee structure contributes to a reduced risk exposure for IBRD:* The proposed IBRD Guarantee will mitigate only the risk of GoI's payment default due to inadequate allocation of funding by the Government to meet contractual payment obligations of NMCG to private sector under the three HAM-PPP projects. The proposed IBRD Guarantee is not exposed to project implementation or private sector performance risks, instead assumes sovereign risk of India (an investment grade country) and therefore represents a low risk exposure for the Bank on potential

call on the guarantee. For the existing HAM-PPP projects, there has been no delays or lack of adequate funding allocation from the GoI, thus confirms the Government's interest to continue providing funding support to the program.

Component 4 – Program communication and management

Sub-component 4.1: Communication and Outreach Program.

32. There is widespread recognition that the success and sustainability of the Ganga rejuvenation program will, as with other river clean-up efforts globally, hinge also on high levels of public awareness and stakeholder participation, and on securing tangible changes in behavior of stakeholders whose practices and activities impact water quality and usage in the river. Also, given the emotive status of the Ganga in India, the sensitivities and concerns of a wide range of stakeholders need to be considered in the design and implementation of any program of interventions.

33. The NMCG has, with the support provided under the first NGRBA Project, sought to integrate these communication objectivities into its program. It continues to conduct a range of vibrant communication activities ranging from ground-level community engagement, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign (the *Kartavya Ganga* campaign) aimed at changing specific behaviors that impact the river (such as ritual practices of pilgrims coming to the river, or and persuading city-dwellers to connect to sewer networks).

34. NMCG's existing communications and outreach capacities allow them to be pivoted rapidly to disseminate COVID-19 related awareness messages, and it is already using its social media channels[44] and its network of grassroot workers – Ganga *Praharis* or Messengers – who are working on relief activities to relay important health-related information to the public. The clear links between the COVID-19 advisable actions, the importance of handwashing with soap and the larger WASH agenda allow these messages to be integrated seamlessly into ongoing campaigns, and these activities will be scaled up and/or calibrated to include other relevant messages as the knowledge-base and the situation evolves.

35. As the Ganga Rejuvenation program moves beyond immediate pollution abatement activities to addressing longer-term issues of securing adequate flows in the river and ensuring the sustainability of interventions and investments, the Communications & Outreach program will need to expand its focus, messages and target audiences.

36. This Project sub-component will support a range of outreach activities and communications campaigns aimed at:

    - strengthening public understanding and support for the Ganga rejuvenation program and mobilizing widespread participation in it;
    - catalyzing the critical changes in stakeholder behavior and practice needed to achieve the objectives of rejuvenating the river; and
    - setting up two-way platforms for ongoing stakeholder dialogue and engagement; and

[44] Twitter handle @cleanganganmcg and Facebook Namami Gange

- enabling NMCG to publicly communicate the activities, impacts and benefits achieved, as well those planned.

37. The sub-component will finance the development of mass media campaigns at the national and State level aimed at awareness creation or promoting improved stakeholder practices and behaviors, e.g. higher uptake for connections to sewers or the adoption of water-efficient agricultural practices. These mass media campaigns will be complemented by city-focused outreach and public engagement interventions.

38. Communications and outreach activities will be leveraged to create a network of women professionals in technical roles (engineers and planners) and women students in science, technology, engineering and mathematics (STEM) to enter the wastewater management sector, as described in Section III. Implementation Arrangements. These young women will be provided with paid internship/apprenticeship offers on a competitive basis in NMCG and SMCGs. The component will also create a collective of women in managerial positions at NMCG and include them as ambassadors in information dissemination and outreach campaigns targeting women students. The proposed gender action will introduce young women to the world of work and develop a pipeline of future women technical professionals keen on working in the sector.

39. The Communications & Outreach program will also support NMCG's engagement and consultations with stakeholders on an ongoing basis to ensure they are as constructive and meaningful. it will also help develop channels for the dissemination of the data and information being generated under activities of component 1 and use it to inform the Communications and Outreach campaign of activities.

40. This component will directly contribute to a more reliable, better managed, and more intensely used sanitation system by increasing the number of connections to the sewer network, thereby raising the beneficiaries' satisfaction with sanitation services and resilience to floods.

Sub-component 4.2: Project Management support

41. This component will support NMCG in coordinating and implementing Project activities, including incremental and administrative expenses and critical consultant support. It will comprise:

- **Incremental and administrative expenses:** Support the costs of office infrastructure and equipment, incremental professional staffing, training, and operational costs, for NMCG and SMCGs in the five States currently implementing the NGRBP. This support will enable these agencies to manage the *Namami Gange* Program and not just activities financed by the Project.
- **Consultants:** Support procurement of critical consultants e.g. project management unit (PMU) within NMCG and if required, within EAs; preparation of safeguards documents; compliance with fiduciary procedures; design review and supervision consultants; transaction advisory for HAM contracts.

42. Consistent with the arrangements under the ongoing NGRBP, the Project will finance 100% of the management support at the national level. At the State level, the Project will finance the

central share of 70% of management support costs, the remaining 30% will be borne by the State.

Component 5 – Contingent Emergency Response Component (US$ 0 million).

43. This Component provides the opportunity for the Government to request the Bank to re-allocate Project funds to support emergency response to an adverse health crisis or natural event that causes a major disruption and require immediate response and/or reconstruction effort. This component would draw resources from the unallocated expenditure category and/or allow the Government to request the Bank to re-categorize and reallocate financing from other Project components to partially cover emergency response and recovery costs. An Operations Manual specific to Component 5 would need to be prepared.

44. Disbursements would be made against a positive list of critical goods or the procurement of works, and consultant services required to support the immediate response and recovery needs. All expenditures under this component, should it be triggered, will be in accordance with paragraph 11 of OP 10.00 and will be appraised, reviewed and found to be acceptable to the Bank before any disbursement is made. In accordance with paragraph 11 and 12 of OP 10.00, this component would provide immediate, quick-disbursing support to finance goods (positive list agreed with the Governments), works, and services needed for response, mitigation, and recovery and reconstruction activities. Operating costs eligible for financing would include the incremental expenses incurred for early recovery efforts arising as a result of the impact of the major natural disasters.

45. Goods, Works and Services under this component would be financed based on review of satisfactory supporting documentation presented by the government including adherence to appropriate procurement practices in emergency context. All supporting documents for reimbursement of such expenditures will be verified by the Internal Auditors of the Government and by the NMCG, certifying that the expenditures were incurred for the intended purpose and to enable a fast recovery following the damage caused by adverse health crisis or natural events, before the Application is submitted to the Bank. This verification should be sent to the Bank together with the Application.

46. Specific eligible expenditures under the category of Goods include: (i) construction materials; water and wastewater treatment supplies and equipment; water, land and air transport equipment, including supplies and spare parts; (ii) medical supplies and equipment; (iii) school supplies and equipment; (iv) petroleum and fuel products; (v) construction equipment and industrial machinery; and (vi) communications equipment.

47. Specific eligible expenditures under the category of Works may include urgent works (repairs, rehabilitation, construction, etc.) to mitigate the risks associated with the health crisis or natural disaster event for affected populations.

48. Specific eligible expenditures under the category of Services may include urgent studies (either technical, social, environmental, etc.) necessary as a result of the effects of the health crisis or natural disaster (identification of priority works, feasibility assessments, delivery of related analyses, etc.).

in US$million, incl. taxes	Total Cost	IBRD	%	Counterpart Financing
Project Cost by Component				
Component 1: Institutional Development	**30.0**	**19.0**	***63%***	**11.0**
1.1 – Development of an institutional framework for Ganga basin management	2.0	2.0	*100%*	0.0
1.2 – Development and application of tools to monitor and inform decision-making for river basin management	20.0	9.0	*45%*	11.0
1.3 – Support to participating State Governments and ULBs to strengthen their capacity for wastewater service delivery and river management	7.0	7.0	*100%*	0.0
1.4 – *Namami Gange* Program Emergency response preparedness	1.0	1.0	*100%*	0.0
Component 2: Infrastructure Development	**1,045.0**	**345.0**	***33%***	**700.0**
2.1 - Wastewater treatment investments	400.0	150.0	*38%*	250.0
2.2 – Carry-forward of selected investments from NGRBP to SNGRBP	535.0	160.0	*30%*	375.0
2.3 - Improving Investments resilience to COVID-19-like emergency crises	10.0	5.0	*50%*	5.0
2.4: Introducing a performance-based incentive for ULBs	100.0	30.0	*30%*	70.0
Component 3: Innovative financing	**19.0**	**19.0**	***100%***	**0.0**
IBRD Guarantee	19.0	19.0	*100%*	0.0
Component 4 – Program communication and management	**24.0**	**16.0**	**67%**	**8.0**
4.1: Program Communication and Outreach	12.0	6.0	*50%*	6.0
4.2: Program Management support	12.0	10.0	*83%*	2.0
Component 5 – Contingent Emergency Response Component	**0.0**	**0.0**	**100%**	**0.0**
TOTAL BASELINE COSTS	**1,118.0**	**399.0**	***36%***	**719.0**
Physical contingencies		0.0		
Financial contingencies		0.0		
TOTAL PROJECT COSTS	**1,118.0**	**399.0**	***36%***	**719.0**
Interest during implementation		0		
Front-end fees		1.0		
TOTAL FINANCING REQUIRED	**1,119**	**400.0**	***36%***	**719.0**

Appendix to Annex 3: Description of each investment

49. This appendix presents a description of each investment to be procured or carried forward under the Project.

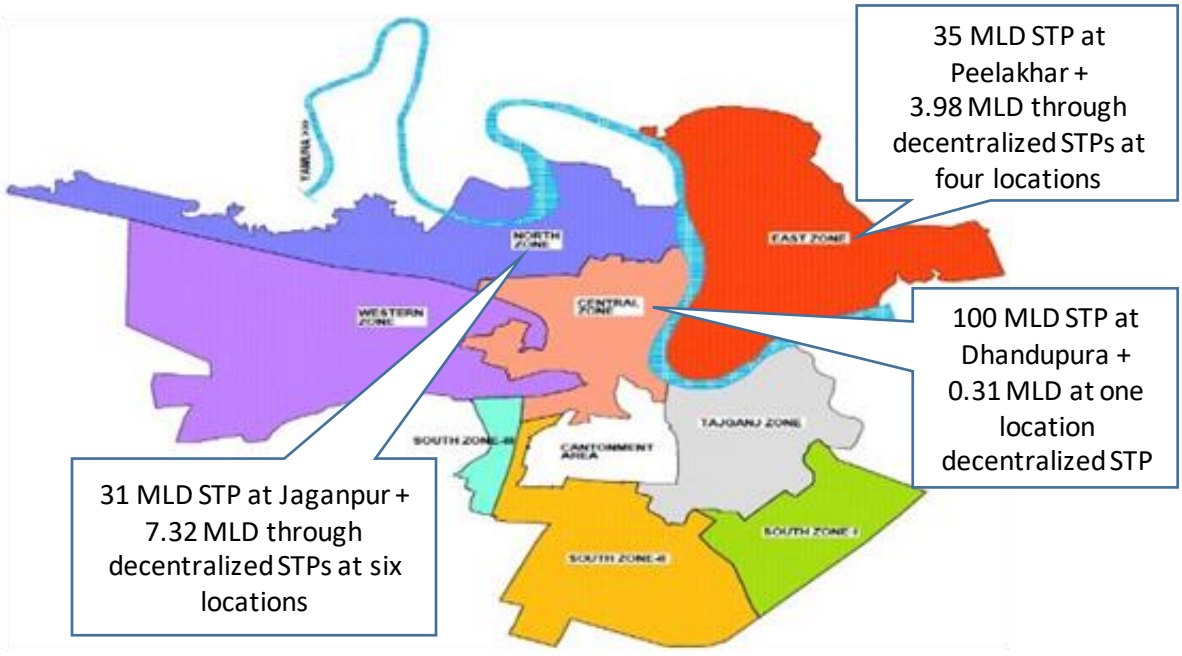
I. Agra Wastewater Treatment Works (I&D, HAM)

50. Agra is the home of the iconic Taj Mahal and a major regional urban center in western UP. It is located on the western bank of the Yamuna river, about 200 km downstream from New Delhi. Agra has a population of 1.79 million (Census 2011). Agra's elevation varies from 150 to 170 meters above sea level and groundwater table is between 2.3 and 23 meters below ground level. The Agra municipal area covers about 121 km^2 and is divided into 90 wards. While the main part of the city, Cis-Yamuna is on the western side of the river; the City has spread onto the eastern side, which is called the Trans-Yamuna area. Agra is a major tourist destination, it is included in the Golden Triangle tourist circuit along with New Delhi and Jaipur, and in the UP-Heritage Arc tourist circuit along with the cities of Lucknow and Varanasi.

Sanitation Status in Agra

51. The first drainage scheme for Agra was built in 1917. It was rehabilitated and extended in 1945 & 1965. UP Jal Nigam prepared the Agra Sewerage Master Plan in 2008 with a design horizon of 2050. As per this master plan, Agra is divided into nine sewerage zones[45] as shown in Figure 3.

Figure 3: Sewerage Zones in Agra and Project Investments



[45] *Central Zone, Northern Zone, Western Zone, Eastern Zone, Taj Ganj Zone, Southern Zone I, Southern Zone II, South Zone III and Cantonment Zone*

52. The current sanitation situation of Agra is as follows:

- ***Drains:*** To date, most of the city wastewater is discharged directly into multiple open-air drains across the city, creating an unhygienic environment. Agra has90 drains which currently carry a total volume of 286.85 MLD. Of these, 29 drains are intercepted and diverted to existing STP's, while the remaining 61 drains discharge untreated wastewater into the Yamuna river. The proposed investment under the SNGRBP Project will tap all 61 drains that are currently untapped and will convey the wastewater flow to 3 centralized STPs and 10 decentralized STPs.
- ***Sewer Network***: Agra has 572.34 km of sewerage system covering 30 percent of the city and operated and maintained by the Agra Jal Sansthan. Due to tremendous population growth, influx of tourists and urbanization, different sections of existing sewerage network are partially and/or fully saturated, carries reduced flow and the existing STPs are not receiving designed flow. All sewerage development projects including planning, construction and commission of the projects are executed by the UP Jal Nigam (UPJN). UPJN has proposed a new project under AMRUT for laying an additional 251 km of sewer network in the Western Zone of the city, which will increase the city sewer coverage to close to 50 percent of the population.
- ***SPS:*** 26 SPS intercept and divert 29 drains across Agra and convey the wastewater flow to STPs.
- ***STP:*** There are 9 existing decentralized (small-scale) STPs in Agra city, representing a combined capacity of 220.75 MLD. Presently, all STPs are functioning and are in good condition, zone wise details of sanitation system in Agra city is presented below in Table 1. Recently, UPJN has awarded an O&M contract to a private operator for the management of STPs for 10 years.

What investments will the Project finance in Agra and how will they change the sanitation scenario in the city?

53. The wastewater treatment investment under the Project includes the construction of 3 centralized STPs, detailed in Table 2 and 10 decentralized STPs (Table 3). These STPs represent a combined installed capacity of 177 MLD along with sewage pumping stations to tap 61 drains. This will create capacity to treat nearly 100 percent of the wastewater generated by Agra for the next 10 years, according to population projections. This investment will use the HAM PPP contract and will include 15 years of O&M fully financed by the Central Government. The bids shall be invited on technology neutral basis for STPs. The UPJN is preparing bid document with the help of a Transaction Advisor.

Table 1: Existing and proposed wastewater treatment infrastructure in Agra

Zone	Sewer Network	Drain Tapped	IPS/SPS/MPS	Existing STP (MLD)	Proposed STP (MLD)
East Zone	41.23 km	1. Ispat Nagar nala 2. Foundary Nagar Nala 3. Naraich Nala 4. Ram Bagh-I Nala 5. Rambagh-II Nala 6. Etmad-ud Daula Nala 7. Mal Godown Nala 8. Industrial Area Nala 9. Peelakhar Nala	3 No. IPS (Naraich and Etmad-ud-daula) 1 no. MPS at Peelakhar	10 MLD STP at Peelakhar 4.5 MLD at Kalindi Vihar	35 MLD STP at Peelakhar + 3.98 MLD through decentralized STPs at four locations financed under the proposed SNGRBP
North Zone	108.55 km	10. Amar vihar-I Nala; 11. Amar vihar-II Nala 12. Burhi ka Nagla Nala	2 Nos. IPS; 1 no. MPS	2.25 MLD STP at Buri ka Nagla. 14 MLD STP at	31 MLD STP at Jaganpur + 7.32 MLD through

Zone	Sewer Network	Drain Tapped	IPS/SPS/MPS	Existing STP (MLD)	Proposed STP (MLD)
		13. Anurag Nagar Nala 14. Manoharpur Nala		Jaganpur	decentralized STPs at six locations; financed under the proposed SNGRBP.
West Zone	155.40 km		3 Nos. SPS/IPS; 1 no. MPS	40 MLD STP maintained by UPJN & 36 MLD STP maintained by ADA at Sadarban	251km Sewage network under AMRUT
Central Zone	70.72 km	15. Rajwah Nala 16. Balkeshwar Nala 17. Sub-Balkeshwar Nala 18. Waterworks Nala 19. Krishna Colony Nala 20. Paliwal park Nala 21. Bhairon Nala 22. Khoja Nala Tapping 23. Peepal mandi Nala 24. Mantola Nala 25. Baluganj Nala 26. Khairati tola 27. Sanjay Place drain	7 Nos. SPDS/IPS (Rajwah, Balkeshwar, Sub Balkeshwar, Water Works, SPS Sanjay Place, Bhairon and Khoja); 1 no. MPS at Khairati tola	78 MLD STP at Dhandupura	100 MLD STP at Dhandupura + 0.31 MLD at one location decentralized STP; financed under the proposed SNGRBP
Cantonment Zone	-	-	-	-	-
Tajganj Zone	131.84 km	28. Taj East nala	3 Nos. SPS/IPS; 1 no. MPS	24 MLD STP Dhandhupura New	-
South Zone I					-
South Zone II	63 km	29. Devri Road Nala	1 No. MPS Taal Semri	12 MLD STP Devri Road	-
South Zone III	1.4 km				-

Table 2: Proposed Centralized STPs of total 166 MLD

Sl. No.	Centralised Treatment Plant	Sewerage Zone
1	**35 MLD** Aerobic Process with Biological Nutrient Removal technology based STP at Peelakhar	Eastern Zone
2	**31 MLD** Aerobic Process with Biological Nutrient Removal technology based STP at Jaganpur	Northern Zone
3	**100 MLD** Aerobic Process with Biological Nutrient Removal technology based STP at Dhandupura	Central Zone

Table 3: Proposed Decentralized STPs of total 11.6 MLD

Sl. No.	Decentralised Treatment Plants (Bio-digester Based Package Treatment)	Sewerage Zone
1.	1.0 MLD STP for K K Nagar Drain	**North Zone**
2.	0.02 MLD STP for Kailash Mandir	
3.	0.6 MLD STP for Kamayeni Hospital	
4.	2.35 MLD STP for Wyepur Drain	
5.	0.35 MLD STP for Artoni Drain	
6.	3.0 MLD STP for Gailana and Transport Nagar	
7.	0.30 MLD STP for Jalma Drain	**Central Zone**
8.	1.13 MLD STP for Mau Nala I & II Drains	**Eastern Zone TRANS Area**
9.	1.1 MLD STP for Dharwale Baba I,II & Islam Nagar Drains	
10.	0.25 MLD STP for Peeli Pokhar Drain	
11.	1.5 MLD STP for Moti Mahal (I-VIII) & Indira Memorial Bridge Drains	

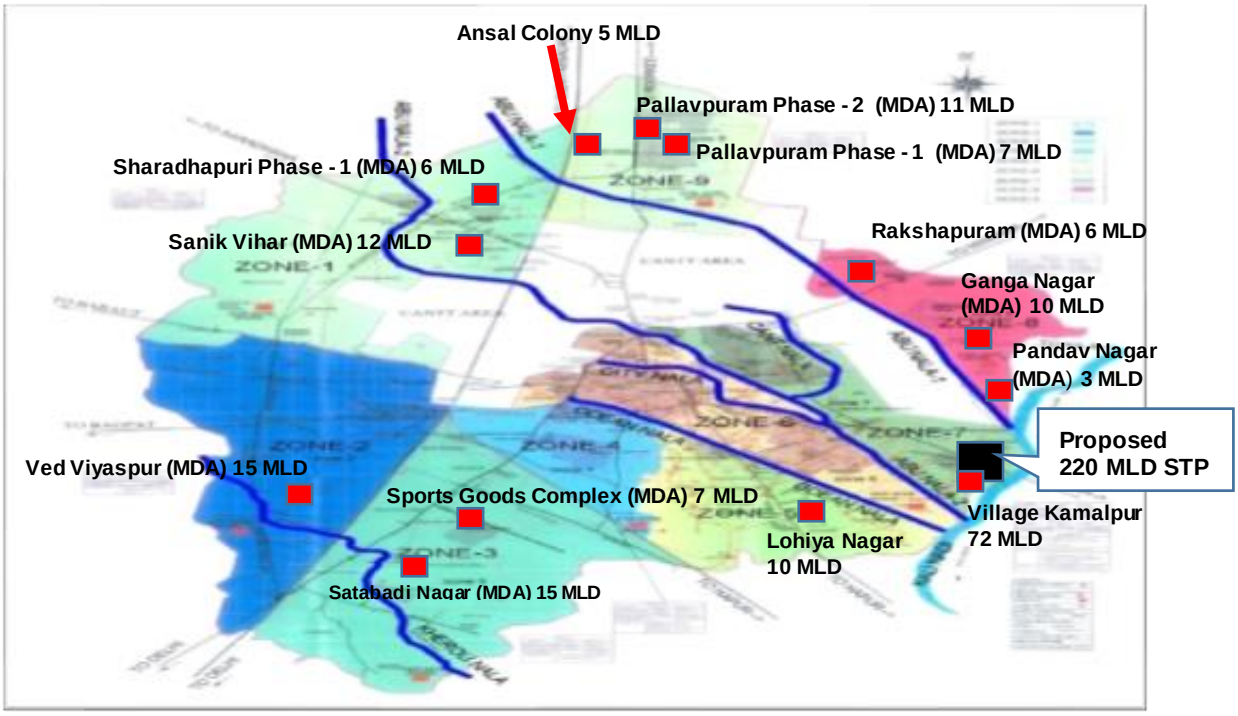
II. Meerut Wastewater Treatment Works (I&D, HAM)

54. Meerut is a city in western UP, located on the right bank of the Kali river about 70 km northeast of New Delhi, the national capital of India. It is the second largest urban center in the National Capital Region of Delhi and the second most important industrial center in UP. The city is experiencing rapid urbanization and high density of population in the core areas (4,781 persons/ km^2). The city has experienced a sharp increase in population from 0.29 million in 1961 to 1.4 million in 2011 (Census 2011). Meerut's elevation varies from 223 to 238 meter above main sea level. The groundwater table is generally about 5 to 20 meters below ground level. The Meerut municipal area has 90 wards and area is about 142 km^2. The city is one of the largest producers of sports goods, and the largest producer of musical instruments in India. The city is also an education hub in western UP.

Sanitation Status in Meerut City

55. The sewerage zones in Meerut city and location of investment under the proposed SNGRBP is at Figure 4.

Figure 4: Sewerage zones and STPs in Meerut and Proposed Location of Project Investment



56. In addition, few colonies developed by the UP Housing Board and Meerut Development Authority (MDA) has been covered by full sewer and handed over to Meerut Nagar Nigam. Thus, the total sewerage network including that of Nagar Nigam constitute is about 90 km of main sewer and 370 km of branch sewers which covers 25-30% of the area of the city at present. Limited area of the main city is covered by old sewer system at present.

57. The current sanitation status of Meerut is as follows:

- **Drains:** There are 5 major drains in Meerut, discharging 372 MLD domestic wastewater and industrial effluent (distillery based) in to the Kali river. Meerut Development Authority (MDA) has constructed 13 decentralized STPs, with a cumulative capacity of 179 MLD collected through sewer network. The wastewater of these drains has been tested by UPJN through SPCB and accredited laboratories, results shows that all parameters are within permissible limits of domestic sewage discharge.
- **Sewer Network:** Sewerage system in Meerut was introduced in 1975. The main components of the sewerage system comprise 460 km total length of network including 23 km trunk sewer and 7 SPS in Meerut Nagar Nigam and MDA area which covers around 30 percent of the area of the city at present. The intermediate pumping stations transfer the wastewater to main pumping station at Hapur Road in ward no. 19, whilst other pumping stations discharge the wastewater into different drains (Odean Nala) that finally discharges into the River Kali. A project named as Meerut Sewerage Scheme Part-I, Phase-I (Zone 5 &7) was sanctioned under Jawaharlal Nehru National Urban Renewal Mission of the GoI to build 237.15 km of sewerage network, 7550 manholes, 8660 sewer connecting chambers, 2 intermediate pumping stations, 2 main pumping stations, 1140 m rising main from 450mm to 1100 mm diameter and 72 MLD sewage treatment plant along with required allied works like pumping plants and power connection etc.
- **SPS**: There are 7 SPS in Meerut city, which interconnect through sewerage system and natural drains.
- **STP**: There are 13 of existing STPs at decentralized of 179 MLD capacity. Presently, all STPs are functioning and in good condition, details are presented below in Table 1.

58. ***What investments will the Project finance in Meerut and how will they change the sanitation scenario in the city?*** The proposed SNGRBP will finance interception and diversion of the main drains of Meerut city and conveyance of wastewater to an STP of 220 MLD. The bid shall be invited on a technology neutral basis under a HAM PPP including 15 years of O&M.

Table 4: Existing and proposed sewerage infrastructure in Meerut

Sr. No.	Location	Capacity of STP (MLD)	Proposed STP (MLD)
1	Ved Viyaspur (MDA)	15	
2	Satabadi Nagar (MDA)	15	
3	Sports Goods Complex (MDA)	07	
4	Pandav Nagar (MDA)	03	
5	Sharadhapuri Phase - 1 (MDA)	06	
6	Sanik Vihar / Sharadhapuri Phase – 2 (MDA)	(06 + 06)	
7	Pallavpuram Phase - 2 (MDA)	11	
8	Pallavpuram Phase - 1 (MDA)	07	
9	Rakshapuram (MDA)	06	
10	Lohia Nagar (MDA)	10	
11	Ganga Nagar (MDA)	10	
12	Ansal Colony (MDA)	05	
13	Village Kamalpur (Nagar Nigam, Meerut) under construction	72	220
	Total	**179 MLD**	**220 MLD**
	Grand Total	**399 MLD**	

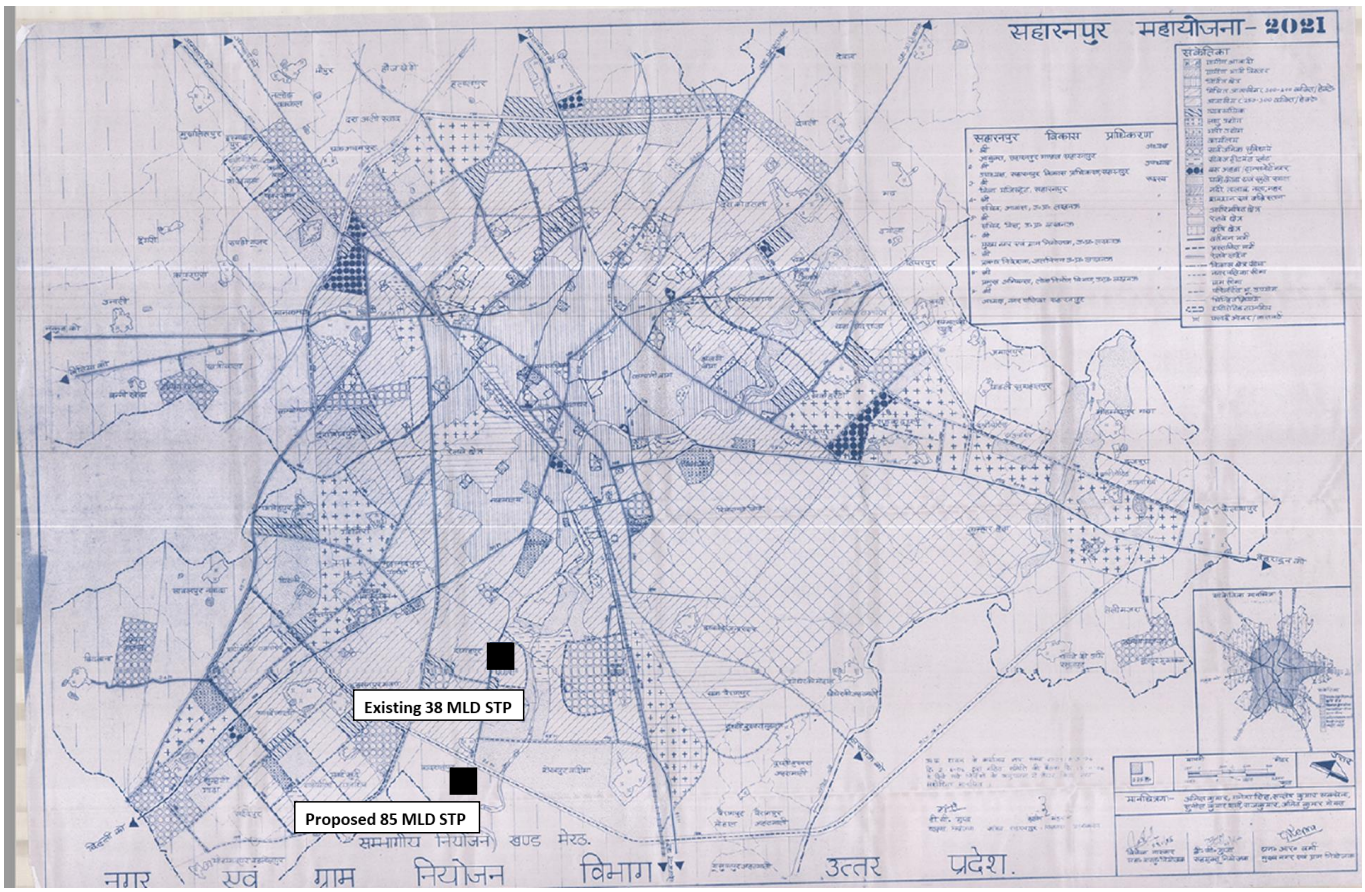
III. Saharanpur Wastewater Treatment Works (I&D, HAM)

59. Saharanpur city is situated close to the borders of the States of Haryana and Uttarakhand. It is located about 164 km from New Delhi, the national capital and 70 km from Dehradun, the capital of the State of Uttarakhand. Saharanpur city is situated in the upper doab region and is located on the land lying between two converging rivers, Yamuna and Ganga. Saharanpur is located on the banks of the Dhamola and Pandhoi river (a major tributary of river Hindon) with a population of 7.05 lakhs (2011 Census). Saharanpur has nearly flat terrain, elevation varies from 267 to 280 meters above main sea level and groundwater table is generally about 10 to 20 meters below ground level. The Saharanpur municipal area is divided into 86 wards and covers about 53 km^2. Saharanpur district is one of the prosperous districts of UP. There are several large-scale industries located in Saharanpur which include paper mills, dairy, textile industry and sugar mills.

Sanitation Status in Saharanpur Town

60. The existing and proposed wastewater pumping stations and treatment plant locations in Saharanpur are at Figure 5.

Figure 5: Existing and Proposed Wastewater treatment Infrastructure in Saharanpur



61. Saharanpur current sanitation status is as follows:

- **Drains:** 51 drains have been tapped under the Yamuna Action Plan – II in Saharanpur (table 1), collecting and treating 38 MLD of wastewater. These drains are overflowing due to population increase.
- **Sewer Network:** The total length of sewerage network in Saharanpur Nagar Nigam is about 111km in four sewerage zones, out of which 27.37km is trunk sewer and 84.15km is branch sewers. There are 3 Intermediate Pumping Stations (IPS) and 1 Main Pumping Station (MPS). The IPS pumps the sewage to the MPS from where it is pumped to a 38 MLD STP.
- **Sewage Treatment Plant (STP)**: There is a 38 MLD STP located at Praduman Nagar, maintained by UPJN. The STP is functioning and is in good condition.

What investments will the Project finance in Saharanpur and how will they change the sanitation scenario in the city?

62. The proposed investment will finance the interception and diversion (I&D) of 51 drains, the construction of 9 IPS, one MPS and an 85 MLD STP in Bashapur (Table 3). The bid shall be invited on a technology neutral basis under a HAM PPP including 15 years of O&M.

Table 1: Existing IPS/MPS at Saharanpur

Sr. No.	Name of IPS/MPS	No. of Nalas/ Drains tapped	Nearest Location	Capacity of IPS (MLD)
1	IPS-Dalmandi	8	Eastern side of River Pandhoi	6.9 MLD
2	IPS-Rakesh Theatre	14	Left and Right side of River Dhamola, Pandhoi	12.6 MLD
3	IPS- Govindnagar	17	Right side of Pandhoi river and between Rakesh theatre	24 MLD
4	IPS-Paduman nagar	12	Khalasi road, west river of Dhamola River.	38 MLD
	Total	**51**		

Table 2: Summary of Existing Sewer in Saharanpur City

Sr. No.	Sewerage Zone	No. of wards	No. of colonies	Trunk sewer (km)	Branch sewer (km)
1	Zone – 1	6	19	3.8	8.2
2	Zone – 2	11	90	9.45	20.95
3	Zone – 3	6	20	6	27
4	Zone – 4	7	28	8.19	28
	Total	**30**	**157**	**27.37**	**84.15**

Table 3: Details of Proposed I&D and STP in Saharanpur

Sr. No.	Name of IPS/MPS	No. of Nalas/Drains tapped	Capacity (MLD)
1	IPS-1 Near Numaish Camp	Janata Colony Drain, Numaish Camp-V shape Drain	1.57
2	IPS-2 Near Toilet block, Shakti Nagar	4 Nalas/Drains	3.77
3	IPS-3 Near Sapna Talkies	10 Nalas/Drains	9.31
4	IPS-4 Old Police Chowki	5 Nalas/Drains	2.86
5	IPS-5 Near Pahalwan Pulia	5 Nalas/Drains	6.43
6	IPS-6 Near Taj Nala	14 Nalas/Drains	95.30
7	IPS-7 Paper Mill Road	4 Nalas/Drains	11.50
8	IPS-8 Near Kanshi Ram Colony	6 Nalas/Drains	19.41
9	IPS-9 near Govindnagar 1	1 Nalas/Drains (Hati Gate)	22.18
10	MPS-(Inside the STP site)	Drains/Nalas of IPS-6, 8 and 9	136.89
		STP- Badshapur	**85 MLD**

IV. Investments to be carried forward from the ongoing NGRBP to the proposed SNGRBP

Digha Kankerbargh Zone in Patna Bihar

63. The investment combining the zones of Digha and Kankerbargh in Patna, the capital of the State of Bihar. It is composed of a HAM and a DBOT PPP contract. The DBOT part of the investment will develop 438km of sewer network to bring the city from no coverage to full coverage in both Digha zone and Kankerbargh, benefiting a population of 874,000. The HAM part of the investment will develop two STPs, one in Digha: 100MLD and one in Kankerbargh: 50MLD. These STPs will bring the treatment capacity from nil currently to 100 percent in Digha and in Kankerbargh. Moreover, Digha and Kankerbargh are the remaining parts of Patna city which were not covered by sewers and STP. Therefore, this investment will also bring Patna to full coverage by sewer networks and will bring the treatment capacity at city level from 57percent currently (including 40 percent developed under ongoing NGRBP-funded investments) to 100 percent.

Howrah, Bally and Baranagar, West Bengal.

64. This investment using a HAM PPP contract to rehabilitate or expand STPs in three towns located in the northern part of Kolkata, Howrah: 65 MLD, Bally: 40 MLD and Kamarhati & Baranagar: 60 MLD. These STPs will bring the treatment capacity in each city from nil currently to 100 percent and will treat wastewater intercepted and diverted from open air drains. This investment does not include developing sewage network in these cities. This investment will increase the treatment capacity of Kolkata, the capital city of the West Bengal State, from 21 percent to 54 percent. Combined with the Tolly Nallah STP investment which will add 117 MLD under the ongoing NGRBP, this will further increase the treatment capacity. Another investment is under preparation (DPR stage) to tap the remaining 11 drains discharging untreated sewage in the Ganga river, using I&D, and to further increase treatment capacity financed under the ongoing NGRBP. Once implemented, these investments will collectively bring the treatment capacity in Kolkata city to 100 percent.

Begusarai, Munger and Buxar, Bihar

65. Begusarai, Munger and Buxar are three towns of the State of Bihar which do not have any infrastructure for collection and treatment of wastewater. Although comparatively smaller, the investments in Begusarai, Munger and Buxar will develop sewage network and STPs allowing to bring coverage and treatment to 100 percent. These investments all experienced early termination of the contracts due to issues with the private sector. They are investment under the earlier cost sharing model of 70 percent by Central government (now 100% paid under the Project) and 30 percent by the State and the ULBs. They were selected under the Project because they require attention to fix what was not delivered under the original DBOT, and because of the opportunity given to work with States and ULBs and leverage on the financial commitment they need to provide for each of these investments.

66. **Begusarai** is a town of 146,000 inhabitants (2011 census) with no sewerage or treatment system. Most of households having septic tanks and effluent from these septic tanks is

discharged in open drains and these connected through natural drains, which ultimately connected to the Ganga river. A DBOT contract was awarded in 2011 to a private operator before the beginning of the NGRBP and was partly funded through retroactive financing. The contractor was not able to deliver, and the contract was terminated in 2017 by BUIDCO for lack of performance. A new bidding process was launched, following the same modalities as originally sanctioned. It was procured as a DBOT, which will be funded at 30 percent by the State of Bihar and 70 percent by the Central Government. The Project will finance 105 km of sewer network to which the 32,000 households the town counts will be able to connect. This will bring the sewerage coverage from nil to 100 percent. It will also develop a 17 MLD STP, which will allow treating the full extent of the wastewater generated by the town of Begusarai. The contract has been awarded in January 2020 and the private operator is initiating the mobilization and design phase.

67. **Buxar**: Buxar is a town of 137,000 inhabitants with no sewerage or treatment system. Houses are equipped with on-site sanitation facilities, with toilets mostly connected to septic tanks. Septic tank overflow and greywater from kitchen and bathrooms are discharged into the roadside drains that transport wastewater to the main natural drains, which ultimately discharge this wastewater untreated into the Ganga river. A DBOT contract was awarded in 2011 to a private operator before the beginning of the NGRBP and was partly funded through retroactive financing. The contractor was not able to deliver, and the contract was terminated in 2017 by BUIDCO for lack of performance. New bidding documents are under preparation, following the same modalities as originally sanctioned, namely a DBOT, which will be funded at 30 percent by the State of Bihar and 70 percent by the Central Government. The Project will finance 106 km (39 km already laid) of sewer network to which the 30,000 households the town counts will be able to connect. It will also build a 16 MLD STP. This will enhance sewerage coverage from nil to 100 percent and will allow treating the full extent of the wastewater generated in Buxar.

68. **Munger**: Munger is a town of 240,000 inhabitants with no sewerage or treatment system. The wastewater from septic tanks, kitchen and bathrooms is discharged into road side surface drains, which are generally connected to the main natural drains, which ultimately discharge this wastewater untreated into the Ganga river. A DBOT contract was awarded in 2012 to a private operator, who was not able to deliver, and the contract was terminated in 2016 by BUIDCO for lack of performance. A new bidding process was launched and is at bid evaluation stage. It follows the same modalities as originally sanctioned, namely a DBOT, which will be funded at 30% by the State of Bihar and 70 percent by the Central Government. The Project will finance 166 km of sewer network to which 50,000 households of the town counts will be able to connect. It will also build a 30 MLD STP. This will enhance sewerage coverage from nil to 100 percent and will allow treating the full extent of the wastewater generated in Munger.

ANNEX 4: Economic Analysis of the *Namami Gange* Program

I. Background

The economic analysis of the *Namami Gange* Program evaluates the benefits of the Program relative to its costs. This builds on earlier work, co-authored by the economist engaged by the World Bank to undertake this economic analysis and published in 2000[46] and on an update of the study that evaluated the NRGBP Project for reducing pollution loadings into the river in 2011. Specifically, it undertakes the following tasks:

i. Updates estimates of non-user and user benefits of the Ganga as a function of the quality of the water and applies the benefit functions to derive values for the benefits of the proposed actions under the current program.

ii. Compares these benefits with the costs of the actions to provide indicative values of the measurable and quantifiable net benefits.

This Annex is organized as follows. Section II updates the non-user benefits of the 2000 study. Section III does the same for the user benefits, other than those related to health, agriculture and fisheries. Section IV compares the estimated costs of Namami Gangi program. Section V reports the benefit-cost ratios for the clean-up program, taking account of the uncertainties on both the cost and benefit side. Section VI concludes, with a discussion on the limitations of the results.

II. Non-user Benefits of Cleaning the Ganga

Non-user benefits of any environmental asset are defined as those that derive from a person's knowledge of the existence of the asset independently of any use made of it. Thus people in India who treasure the Ganga for religious reasons even though they do not visit it are said to have a non-user benefit from its very existence. The 2000 study established that this value depended among other things on the quality of the Ganga. The quality measure was an average indicator for the whole river, based on annual average BOD levels at 14 monitoring stations[47]. It is calibrated so that if the Ganga meets bathwater quality standards everywhere (defined as no more than 1 mg of BOD per liter of water), then the index will take the value of 100. The actual value in 1995 was estimated at 48.63.

The benefits were quantified in monetary terms for the urban literate households of India in 1995, based on a survey of such households. The survey elicited such values as a function of a number of factors, one of which was water quality. The estimated function that provided the best fit (details of which can be found in Chapter 6 of the book) took the following form:

$$LogB = -1.53 + 1.4738 LogQ + 0.286 LogY$$

[46] Markandya, A. and M.N. Murty, "Cleaning-up the Ganges: A Cost Benefit Analysis of the Ganga Action Plan. Oxford University Press, New Delhi, 2000. This economic analysis has been undertaken by Anil Markandya, a co-author of this study.

[47] The original list was Rishikesh, Hardwar d/s, Garhmukteshwar, Kannauj u/s, Kannauj d/s, Kanpur u/s, Kanpur d/s, Allahabad u/s, Allahabad d/s, Varnasi u/s, Varnasi d/s, Patna u/s, Patna d/s, Rajmahal.

Where:

B = The non-use value per household expressed in 1995 Rupees per annum.

Q = The quality indicator for the Ganga, measured as a weighted average of the annual average BOD values at 14 monitoring stations.

Y= Household income expressed in 1995 rupees per annum.

The function indicates that the willingness to pay for improved quality increases by .28 percent for each one percent improvement in income. As noted at the time, this is on the low side compared to some other studies, but it is not outside the range of values that have been found[48]. Most of the evidence indicates a value that is less than one, although some recent studies have suggested that the value may be close to one or even above that[49]. In order to allow for the uncertainty in this elasticity two estimates are reported: one with the estimated elasticity of 0.28 as in the original study and the other with an elasticity of 1.0, which has been suggested by some more recent studies.

In order to transfer the function to estimate non-user benefits in the present, we need to adjust for inflation. Converting from 1995 prices to 2019 prices (latest data available) implies an increase in the price level by a factor of 4.44. Thus the new function becomes:

$$LogB = -0.98 + 1.4738LogQ + 0.286LogY$$

To estimate the change in non-user values of the Ganga for full bathing water quality throughout an update is needed for the latest year available of: (a) the number of urban literate households to whom the non-user benefits apply and (b) the average income of those households.

Number of urban literate households.

1) The number of urban literate households is only available for 2011 and is estimated at 79.5 million[50]
2) The urban literacy rate is estimated for the same year at 85%[51]
3) The percent of urban households that are Hindus is estimated at 74.82%[52]

The combination of the three sources gives a number of urban literate households at 97.5*0.85*0.7482 = 50.2 million. There are a number of approximations involved in this calculation, but it is the best that can be made given the information available. More recent data would reveal a higher number of households to whom the non-user benefits apply, as the total number of urban literature households will have grown since 2011 and the literacy rate will have risen a little.

Average income of those households

[48] In studies of the risk of mortality the income elasticity has been estimated in the range of 0.2 to 0.6 (Gerking, DeHaan and Schulze, 1988; Jones-Lee, Hammerton and Philips,1985; Alberini, Hunt and Markandya, Viscusi and Aldy, 2003). A study of the income elasticity for environmental improvements put the value at less than one (Kristom and Reira, 1996).
[49] Studies indicating a value greater than one are (Navrud and Lindhjem, 2010). Hammitt and Robinson (forthcoming).
[50] http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf
[51] http://censusmp.nic.in/censusmp/All-PDF/6Literacy21.12.pdf
[52] https://www.census2011.co.in/religion.php

An attempt has been made to estimate urban literate household income for a more recent year than 2011. This was done as follows:

1) The latest year for which income of urban literate household income is available is 2004-05, when it is estimated at Rs.99.852[53]
2) Adjusting for inflation to get it into 2019 prices gives a value of Rs.258,661 (WDI indicators)
3) Between 2004-05 there has been considerable growth in per capita incomes. The WDI indicators put the increase between those dates and 2019 at around 200%. Thus the average income of urban literate households in 2018 is estimated at Rs. 258,661*3 = Rs.791,659.

Allowing for these two changes over the past 23 years results in a very large increase the value of non-user benefits. The WTP figures for the river if it met bathing water quality standards everywhere are shown in Table 1.

The figures indicate an increase in non-user benefits in terms of rupees of a factor of between 13 and 36, depending on which elasticity of income taken. Of this inflation accounts for a factor of around 4.4, increases in number of urban literate households a factor of 2 and increases in real income the rest. In US dollar terms the benefits of bathing water quality increases by a factor of between 6.8 and 18.3. The difference between the increase in US$ terms and in rupee terms reflects in part the greater inflation in rupee terms.[54]

Of course, the program under consideration will not take the Ganga to bathing water quality throughout, so it is necessary to estimate the non-user benefits in terms of the change in water quality from its present level to the level that will be achieved through the program. In order to do that information is needed on expected changes in levels of BOD after the implementation of various components of the new program.

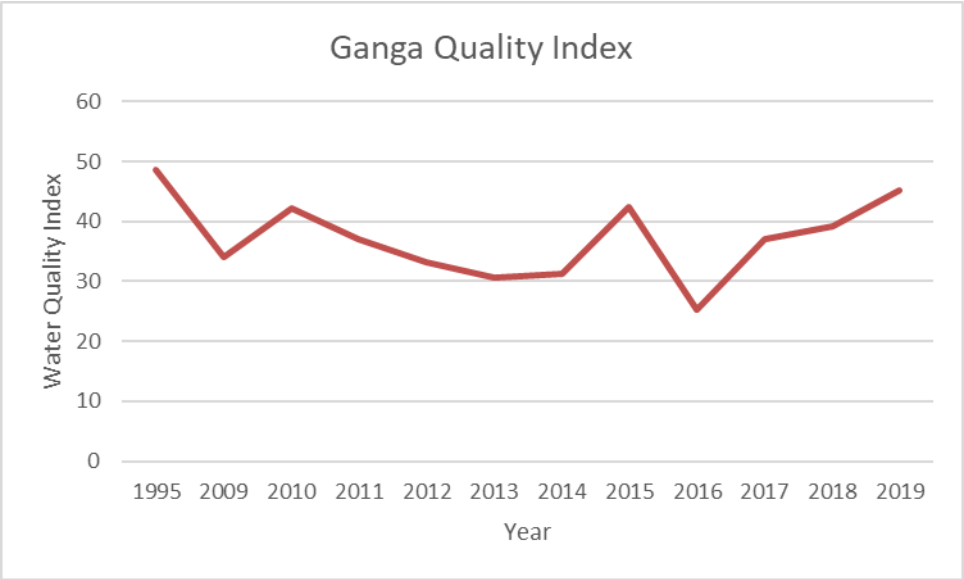
Table 1: Non-User Benefits WTP for Bathing Water Quality in the Ganga

		Units	In 1995	Adj. to 2018 Prices	2018 Values in 2018 Prices
	Nof of Urban Literate HH	Mn.	24.93	24.93	50.18
	Average HH Income	Rs./Yr	44,705	198,502	791,659
Elasticity = 0.286	WTP for Bathing Quality	Rs./Yr	558	2,478	3,680
	Total WTP for Bathing Quality	Rs.Mn./Yr	13,911	61,768	184,662
	Total WTP for Bathing Quality	US$Mn./Yr	395		2,699
Elasticity = 1.0	WTP for Bathing Quality	Rs./Yr	558	2,478	9,881
	Total WTP for Bathing Quality	Rs.Mn./Yr	13,911	61,768	495,826
	Total WTP for Bathing Quality	US$Mn./Yr	395		7,247
	Exchange Rate	RS./USD	35.2		68.42

[53] *http://www.thesuniljain.com/files/thirdparty/NCAER%20How%20India%20Earns%20Spends%20and%20Saves.pdf*. Table 2.24 from the cited source.

[54] The exchange rate in 1995 was Rs.35.2 to the US dollar, while in 2009 it was Rs.48.8, an increase of 38%. In the meantime, however, price inflation in India was 160%. Hence the increase in value in rupees is greater than the increase in value in dollars.

Figure 1: Water Quality Index for Ganga: 1995-2019

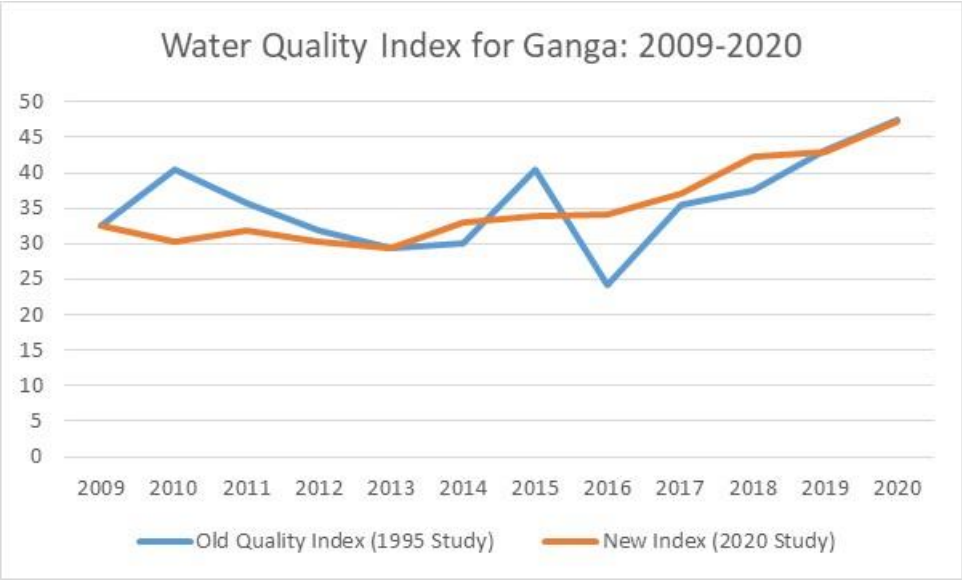


Source: NMCG, Data on water quality prepared by the CPCB and shared with the World Bank in April 2020

Data provided recently shows the water quality index between 2009 and 2019 based on the original set of monitoring stations. This is plotted in Figure 1, along with the 1995 value that was the reference point for the original study. The figure shows some fluctuations over the period, with every year being lower than the 1995 value: the starting point for water quality shifts from 48.63 in 1995 to 45.12 in 2019.

Since the original study the monitoring of the quality of the river has been expanded to 52 monitoring stations. As the new program needs to be evaluated relative to quality measured using data from these stations, the new index has been calculated for data from 2009 to 2020 and calibrated so that it coincides with the old index for 2009 (the one year for which both indices were reported). This allows the new index to be used to value improvements in quality relative to values estimated using the old index. The new and old indices are shown in Figure 2.

Figure 2: Old and New Indices of Water Quality in Ganga: 2009-2019



These estimates will be used to value the estimates of different configurations of water quality improvement under the ongoing program.

Extension to Include Hindus Not Living in India

Before going on to estimate use values an extension of the non-user benefits has been included. The team raised the possibility of extending the measurement of benefits to urban literate Hindus not resident in India. To do this an estimate of the Hindu population in the diaspora is required, along with its average household income.

There is an estimate of the population of Indian migrants across the globe from UN statistics[55]. For 2019 the figure was 17.5 million[56]. Not all, however, will be Hindus. To obtain an estimate of that a second source gives the Hindu populations of two countries: the USA and the UK, for which the latest Hindu populations are estimated respectively as 2.29 million and 0.84 million[57]. The corresponding total number of Indian migrants in those countries from the UN data are 2.7 million (USA) and 0.92 million (UK). Combining the two would indicate that 86% are Hindu. Applying that to the total Indian migrant population of 17.5 million would yield an estimate of 15.1 million.

The average household income of the Indian migrant population is not available. It will certainly be higher than that of the resident urban literate population. In 2018 the average for the latter is estimated at Rs792,000 or US$11,570 at market rates of exchange and US$43,660 at purchasing power exchange (PPP) rates. The PPP converted rate is probably closer to the income of non-resident Indians but it still likely to be an underestimate. Unfortunately, as there is no reliable figure,

55 *https://www.un.org/en/development/desa/population/migration/data/estimates2/estimates19.asp*
56 It is assumed that long-established Hindu populations of countries such as Indonesia, Malaysia etc. are not to be included in this estimate. The focus therefore is only on Hindu migrants from India (i.e. people born in India).
57 Shcheglov, Serguei. "Countries with The Largest Hindu Populations." WorldAtlas, Jan. 15, 2019, worldatlas.com/articles/countries-with-the-largest-hindu-populations.html.

a lower bound to their WTP for the program can be obtained by assuming the same income as for resident urban literate Indians.

Table 2 gives the value of Non-user benefits of bathing water quality if Indians living outside India are included. The value for 2018 increases relative to that in Table 1 by 30%.

Table 3 gives the corresponding values for different levels of bathing water quality when this group of beneficiaries is added to the total.

Table 2: Non-User Benefits WTP for Bathing Water Quality in the Ganga Including Indian Not-Resident in India

		Units	In 1995	Adj. to 2018 Prices	2018 Values in 2018 Prices
	Urban Literate HH in India	Mn.	24.93	24.93	50.18
	Literate HH Outside India	Mn.			15.10
	Average HH Income	Rs./Yr	44,705	198,502	791,659
Elasticity = 0.286	WTP for Bathing Quality	Rs./Yr	558	2,478	3,680
	Total WTP for Bathing Quality	Rs.Mn./Yr	13,911	61,768	240,232
	Total WTP for Bathing Quality	US$Mn./Yr	395		3,511
Elasticity = 1.0	WTP for Bathing Quality	Rs./Yr	558	2,478	9,881
	Total WTP for Bathing Quality	Rs.Mn./Yr	13,911	61,768	645,034
	Total WTP for Bathing Quality	US$Mn./Yr	395		9,427
	Exchange Rate	RS./USD	35.2		68.42

The value for different levels of quality is shown in Table 3, based on the new index and starting with the actual value in 2019. Again, the numbers go up by about 30% compared to the case where non-resident Indians are excluded.

III. User Benefits of Cleaning the Ganga

The 2000 study estimated the use benefits for two groups of people: those living within 0.5 km either side of the river in neighborhood of the cities of Allahabad, Varanasi and Calcutta; and those pilgrims who visited bathing ghats in the same areas. For local residents the sampling was limited to urban literate households and for pilgrims it was restricted to literate households. As for the non-use benefits, the WTP for improvements in water quality was estimated as a function of the quality, measured in BOD concentrations. The resulting equation for the whole sample was:

$$LogB = -1.73 + 1.651 LogQ + 0.258 LogY$$

Where:

B = The non-use value per household expressed in 1995 Rupees per annum.

Q = The quality indicator for the Ganga, measured as a weighted average of the annual average BOD values at 14 monitoring stations.

Y= Household income expressed in 1995 rupees per annum.

Table 3: Non-use Value of Water Quality Index for Different Quality Levels (US$ Mn.) Including Benefits to Non-Resident Indians

Value for Different Quality Levels		
Quality	US$Mn./Yr.	
	Low	High
42.945	940	2,524
45	1,007	2,704
50	1,176	3,159
55	1,354	3,635
60	1,539	4,132
65	1,732	4,650
70	1,932	5,186
75	2,138	5,741
80	2,352	6,314
85	2,571	6,905
90	2,797	7,511
95	3,030	8,134
100	3,267	8,773

The function indicates that the willingness to pay for improved quality increases by 0.26 percent for each one percent improvement in quality.

In order to transfer the function to estimate non-user benefits in the present, we need to adjust from inflation. Converting from 1995 prices to 2019 prices implies an increase in the price level by a factor of 4.44. Thus, the new function becomes:

$$LogB = -1.193 + 1.651 LogQ + 0.258 LogY$$

To apply it to the present date it is necessary to establish the groups over which the aggregation should be made. As in the case of the non-user benefits an estimated income elasticity of 0.258 and a higher elasticity of 1.0 are taken to obtain the estimated benefits. Table 4 indicates the key assumptions and calculations[58].

[58] It should be noted that there are two distinct groups of users: those living within 0.5 kilometer of the river who amount to a few hundred thousand and those visiting it for religious purposes, who amount to around five million. There is little likelihood double counting of benefits to include both groups.

Table 4: User Benefits for WTP for Bathing Water Quality in the Ganga

	In 1995	In 2018	Comment
Households Living Near the River			
No of Urban Literate HH (Mn.) living within 1 km	74,400	149,700	The same increase as for all urban households has been assumed
Average HH income	27,771	491,783	Increase in 2018 over 1995 is based on WDR data for all urban households
Using Income Elasticity of 0.258			
Mean WTP per HH (Rs. pa.)	582	3,690	Applying elasticity of 0.258 on HH income and adjusting for inflation
Total WTP (Rs. Mn. pa.)	43	553	Mean WTP times no of households
Total WTP (US$ Mn.)	1.2	8.1	
Pilgrims			
No of pilgrims Mn.	5.0	5.0	Some information on the increase is needed but as a lower bound the numbers are unchanged.
Average HH income	97,353	1,723,976	Increase in 2018 over 1995 is based on WDR data for all urban households
Mean WTP Per Person (Rs. pa.)	1,564	7,006	Applying elasticity of 0.258 on HH income and adjusting for inflation
Total WTP (Rs. Mn. pa.)	7,820	35,029	Mean WTP times no of persons
Total WTP (US$ Mn.)	222	514	
Total WTP for both groups (US$Mn.)	223	522	
Using Income Elasticity of 1.0			
Mean WTP Per HH (Rs. pa.)	582	10,299	Applying elasticity of 0.258 on HH income and adjusting for inflation
Total WTP (Rs. Mn. pa.)	43	1,542	Mean WTP times no of households

Total WTP (US$ Mn.)	1.2	22.5	
Pilgrims			
No of pilgrims Mn.	5.0	5.0	Some information on the increase is needed but as a lower bound we assume the numbers are unchanged.
Average HH income (Rs. P.a.)	97,353	1,723,976	Increase in 2009 over 1995 is based on WDR data for all urban households
Mean WTP Per Person (Rs. P.a.)	1,564	59,103	Applying elasticity of 1 on HH income and adjusting for inflation
Total WTP (Rs. Mn. P.a.)	7,820	295,517	Mean WTP times no of persons
Total WTP (US$ Mn.)	222	4,319	
Total WTP for both groups (US$Mn.)	223	4,297	
Exchange Rate Rs. / US$	35.2	48.8	

Note: The aggregation for resident households was done for those living within one km of the river, after comments from reviewers to say that 0.5 km, which was used for the survey was too limiting.

The figures indicate an increase in user benefits in terms of rupees of a factor of between 5 and 37, depending on which income elasticity we take. Of this inflation accounts for a factor of around 4 and increases in real income most of the rest. In US dollar terms the benefits of bathing water quality increases by a factor of between 2.3 and 19.3, depending on the income elasticity that is used. As before the difference between the increase factor in US$ terms and in rupee terms reflects the greater inflation in rupee terms relative to the devaluation of the rupee in terms of the US dollar.

As for the non-user case the next step is to estimate the user benefits in terms of the change in water quality from its present level to the level that will be achieved through the program. As for the non-user benefits case, a preliminary step is to calculate the value associated for different levels of user benefits. This is done in Table 5. Assuming an initial value of 43, representing the condition in 2019, an improvement to bathing standard throughout the river would yield a benefit of between US$361 mn. (i.e. US$480-US$119mn.) and US$3,012 mn. (i.e. US$4,006-US$994mn.).

Table 5: Use Value of Water Quality Index for Different Values

Value for Different Quality Levels		
Quality	US$Mn.	
	Low	High
43	119	994
45	128	1,072
50	153	1,275
55	179	1,493
60	206	1,723
65	236	1,967
70	266	2,223
75	298	2,491
80	332	2,771
85	367	3,063
90	403	3,366
95	441	3,680
100	480	4,006

IV. Extending the Benefits to Other Groups

Benefits other than to users and non-users

The results presented above are based on estimated use and non-use benefits only and furthermore on these benefits as expressed by the urban literate population of India. In the original study on which this report is based other benefits estimated included[59]:

- Health benefits in terms of less working days lost as a result of better water quality including sewerage farm workers who suffer less from worm and protozoal infections
- Benefits to farmers estimated as value of incremental farm output due to irrigation and savings in the cost of conventional fertilisers from making use of the partly treated water from sewage treatment plants.

The relative values of these benefits in that study were as follows: user benefits (33.6%); non-user benefits (60.9%); health benefits (3.5%), agricultural benefits (2.1%)[60]. Thus nearly 95% of the benefits of the project are from the user and non-user groups and these have been reevaluated for

[59] Estimates of possible benefits in terms of lower treatment costs were discussed but these were not considered reliable enough to be included in the analysis.
[60] The study also looked at distributional benefits from the project, in particular the benefits of employment creation among unskilled workers. These are not included in the figures given here.

the purposes of this study. It was not possible to transfer the health and agricultural benefits without a more detailed update and assessment of the current situation with respect to sewerage farm workers and other groups close to the river whose health may be impacted. The same applies to the possible irrigation benefits, where updated estimates of the amounts of sludge that could be provided from the STPs would be needed.

V. Envelope of Benefits and Costs of the Clean Up Program

In this sub-section the benefits of a clean-up program are provided, based on the changes in the water quality indicator, over the period 2021-2040 and compared to the costs.

In order to estimate the impact of the program on the new quality index constructed for the river the following data are used and assumptions made:

1. The current BOD loading of the river is 9,114 mld. Gross amounts are estimated at 12,000mld but existing STP remove 2,886mld.
2. These loadings would grow in line with population if no further treatment was introduced.
3. The new projects will remove a further 4,857mld when fully operational. Initially, in 2023, 70% of the capacity will be operational, building up in stages to 100% by 2035.
4. The index of quality at each monitoring station will improve proportional to the reductions in mld loadings throughout the river, subject to a minimum of 1mg/litre concentration of BOD. This is an approximation and should be replaced by modelling water concentrations as function of BOD loadings when data are available to do that.

Under these assumptions the projected quality index will take the path shown in Figure 3.

The present value of the benefits from the program at a 10% discount rate, from 2020 to 2040 are given in Table 6 for the two elasticity assumptions. In addition, future annual benefits are assumed to increase as the population who benefits from the river clean up increases, and as their real incomes of increase. Population projections to 2040 by state were taken from the Population Foundation of India[61]. Real per capita income growth to 2040 is taken as 4% per annum. Total benefits over the 20-year period are about US$5bn with the lower elasticities and US$17 billion with the higher elasticities. User benefits are between 13% and 31% of the total. The higher share for user benefits is in the case where the higher elasticities are applied, as in that case the WTP of pilgrims increases substantially given the increase in their incomes. Overall, however, non-user benefits dominate the benefits. If growth rates of per capita income are assumed to be zero the benefits decline by about 12%; if on the other had growth goes up to 6% per annum, they increase by about 6%.

[61] See: *https://assets.prb.org/pdf07/FuturePopulationofIndia.pdf*.

Figure 3: Index of River Quality Under the NGRBP Program

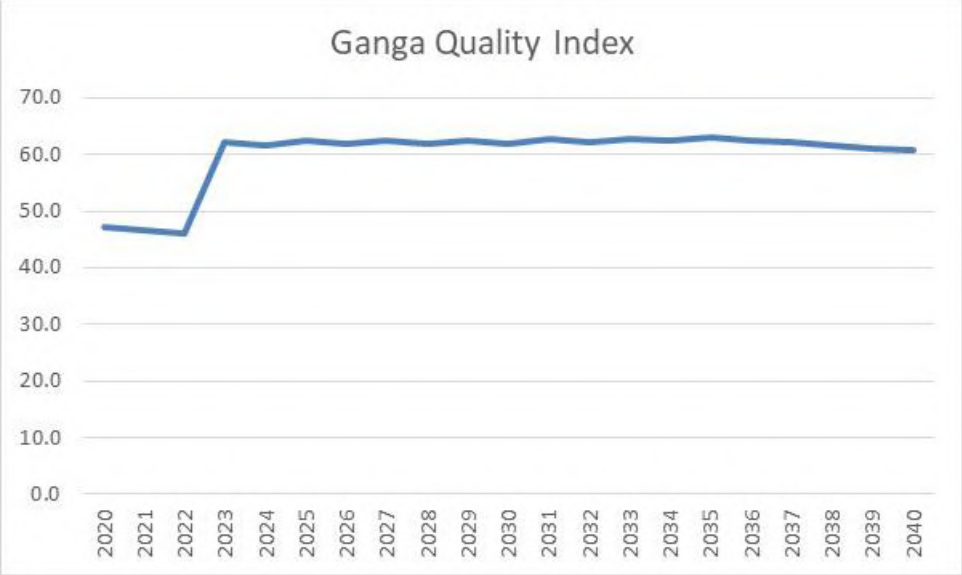


Table 6: NPV of Benefits of the Proposed Program (US$Mn.)

Base Case Income Elasticities of WTP			Higher Income Elasticities of WTP		
Non-User	User	Total	Non-User	User	Total
4,368	645	5,013	11,729	5,382	17,111

On the cost side the program involves 152 projects with a capital cost of Rs15,069 Crores (US$2.2 billion) and annual operating costs of RS832 Crores (US$119 million) when operating at full capacity. Construction under the current program in 2020 and units will start to be operations in 2023. Further details can be found in NMCG website.

A comparison of the costs and benefits is given in Table 7 for the two elasticities of benefits with respect to income. The detailed spreadsheet is included as an annex. The data show that benefits are well in excess of costs in both cases, particularly so in the case of the higher income elasticities. The benefit to cost ratio is 2.5 in the base case and 8.5 in the high elasticity case and the internal rates of return (i.e. the rates of discount at which the net benefits would be zero) are 32% and 90% for the two elasticities.

Given the uncertainties associated with the calculations it is important to conduct some sensitivity analysis. The following are considered:

A. A delay in completion of the projects, so the benefits do not start until 2025.
B. An increase in the capex cost and opex costs.
C. The operations of the STPs are not able to operate at desired capacity due to financial constraints. In that case how would the benefits change is they could only operate at less than planned capacity

Table 7: Net Benefits of the Current Program

	Base Case Income Elasticities of WTP	Higher Income Elasticities of WTP
NPV of Costs US$Mn.	2,006	2,006
NPV Benefits US$Mn.	5,013	17,111
NPV Net Benefits US$Mn.	3,190	15,288
Benefit Cost Ratio	2.5	8.5
IRR	32%	90%

In the case of a delay of two years, from 2023 to 2025, the benefit cost ratios fall to 2.0 (from 2.5) and to 6.8 (from 8.5). If capex costs rise by 25%, this would still only lower the base case benefit cost ratio from 2.5 to 2. A doubling of the opex costs would also only lower the benefit cost ratio from 2.5 to 2.2. The biggest impact is from STP plants operating at under capacity. If they operate at 75% capacity the base case benefit cost ratio falls from 2.5 to 1.58. The plants have to operate at least at 60% of capacity to give a base case benefit cost ratio of greater than 1.

VI. Further work

Further work is needed in the following areas (in order of importance):

a. Improved understanding of water quality, flows and distribution of pollution sources. The water quality index is a function of data on BOD concentrations at 52 monitoring stations. When loadings change the concentrations will change depending on where the STP plants are located, and characteristics of river flow, climate etc. This should be modelled to make a better estimate of the change in quality than has been done here.

b. Better understanding of which characteristics of river quality people will be willing to pay for. The fact that the major share of the benefits (60%) relate to non-use benefit, highlight the need to understand precisely what characteristics people value. This is in particular important since different projects (with similar impact on BOD) may impact these characteristics very differently. Given the study is still based on updating primary data that is more than 25 years old, it would be worth undertaking a new set of WTP surveys.

c. Estimates of possible benefits from health and agriculture.

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Appendix 1

BENEFIT COST ANALYSIS WITH LOWER ELASTICITIES FOR BENEFIT ESTIMATION																
NEW PROGRAM								1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Construction of Reduction in Loading				**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2040**
Population Projection				**100**	**101.1**	**102.3**	**103.4**	**104.6**	**105.8**	**107.0**	**108.2**	**109.4**	**110.7**	**111.9**	**123.1**
MLD				9114.00	9217.38	9321.94	9427.68	9534.62	9642.78	9752.16	9862.78	9974.66	10087.81	10202.24	11222.46
Removal	4857			0.00	0.00	0.00	3399.90	3399.90	3642.75	3642.75	3885.60	3885.60	4128.45	4128.45	4857.00
Percentage				0.00%	-1.13%	-2.28%	33.86%	32.69%	34.17%	32.97%	34.42%	33.19%	34.61%	33.36%	30.16%
E-Rate INR to USD	**70**															
							0.7	0.7	0.75	0.75	0.8	0.8	0.85	0.85	1
Year				**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2040**
COSTS DATA IN 2019 US$																
Volume Waste		Ml/day		9,114	9,217	9,322	6,028	6,135	6,000	6,109	5,977	6,089	5,959	6,074	6,365
Capital Costs	NPV	US$ Mn.	$1,784.49		$717.57	$717.57	$717.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O&M Costs	NPV	US$ Mn.	$221.15	-	-	-	$27.45	$27.45	$29.41	$29.41	$31.37	$31.37	$33.33	$33.33	$39.22
Total Costs	NPV	US$ Mn.	$2,005.65	-	717.6	717.6	745.0	27.5	29.4	29.4	31.4	31.4	33.3	33.3	39.2
BENEFITS in 2019 US$Mn.																
CPCB Data																
Non-use	NPV	US$ Mn.	$4,368.28	0.00	-19.57	-39.69	625.61	617.49	660.00	651.72	695.24	686.64	731.24	722.06	801.52
Use	NPV	US$ Mn.	$644.70	0.00	-2.84	-5.74	92.98	91.60	97.90	96.49	102.92	101.45	108.02	106.46	116.62
Total	NPV	US$ Mn.	$5,012.98	0.00	-22.40	-45.43	718.59	709.09	757.90	748.20	798.16	788.09	839.26	828.52	918.15
NET BENEFITS in 2019 US$Mn.																
	NPV	US$ Mn.	$3,189.66	0.00	-739.97	-763.01	-26.43	681.64	728.49	718.79	766.78	756.72	805.93	795.19	878.93
	BCR		2.50													
	IRR	32%														

ANNEX 5: Financial Management

This Annex describes the financial management (FM) and disbursement arrangements for the proposed Project.

1. The FM arrangements for proposed SNGRBP are based on the implementation experience of the ongoing NGRBP.

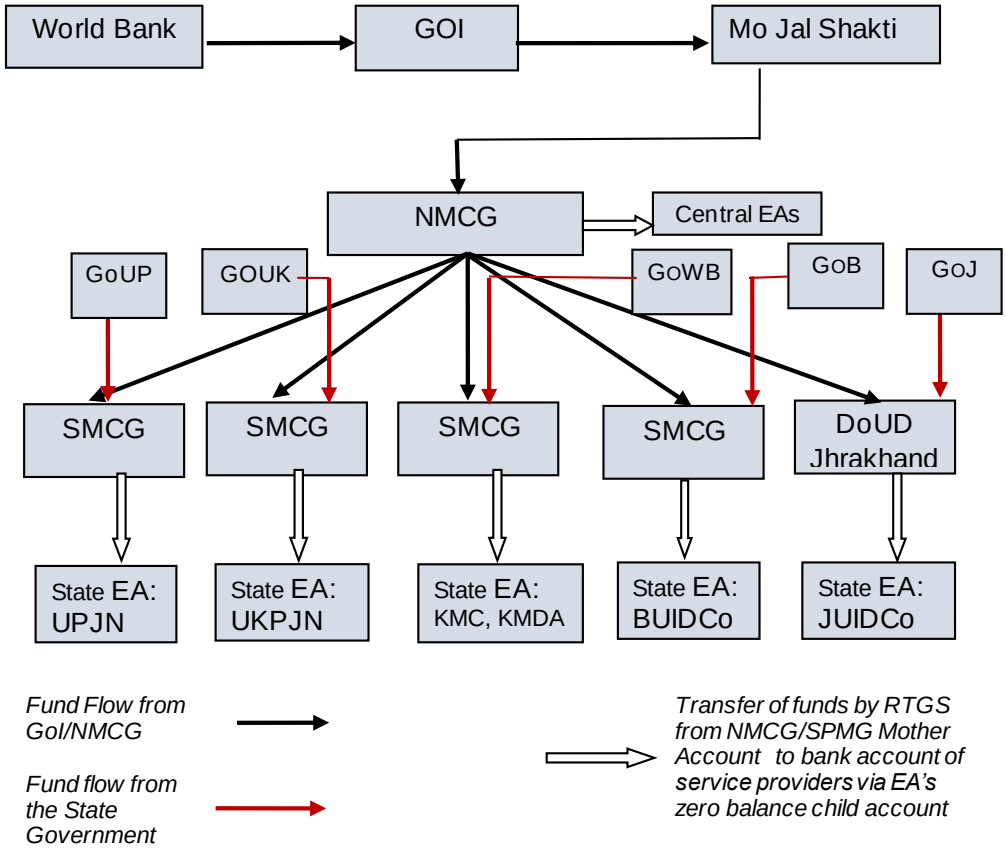
2. **FM Manual:** An FM Manual was prepared for the NGRBP which laid down the detailed financial management processes of the Project including budgeting, funds flow, internal control framework, accounting, financial reporting and audit. The Manual has been revised during the Project preparation of the proposed SNGRBP to incorporate necessary changes and improvements in the processes.

3. **Fund Flow Arrangements:** NMCG, which is registered as a Society, will receive Project funds in an earmarked Project bank account from the budget of DoWR, under the Ministry of Jal Shakti. NMCG will transfer funds quarterly to each SMCG based on demand for funds submitted by respective SMCGs. The NMCG will release installment to each SMCG only on receipt of expenditure statements for previous release and after adjustment of unspent balance. The State Government will release its share of funds to the SMCG within two months of the receipt of the installment from the NMCG.

4. In order to streamline fund-flow arrangements, each SMCG, will have a Project bank account (the "mother account") where funds received from the NMCG along with the State contribution, if any, will be held. Each EA in a State will have Project-specific zero balance bank account (the "child account"), in the same bank as the SMCG. The EA will have the authority to issue instructions to pay contractors/ suppliers' invoices approved by EA for undertaking Project activities within the scope of the approved investments. As soon as a payment instruction is issued by the EA, SMCG will advise its banker to transfer the amount payable to the EA child account which will then be transferred to the supplier/contractor's account on the same day. This transfer of funds from the SMCG account to the supplier/contractor/service provider account will happen through Real Time Gross Settlement (RTGS)[62]. Thus, at the end of any given day, the EA child account will always have a zero balance. The above-mentioned fund flow arrangements will mitigate the risks of delay in releasing payments to contractors once the invoices are approved as well as diversion of funds to other schemes.

[62] RTGS is a funds transfer system where money is moved from one bank to another in 'real-time', and on gross basis. When using the banking method, RTGS is the fastest possible way to transfer money. 'Real-time' means that the payment transaction isn't subject to any waiting period. The transaction will be completed as soon as the processing is done, and gross settlement means that the money transfer is completed on a one to one basis without clustering with another transaction.

Figure 4.1: Fund Flow Diagram



5. As required by GoI, NMCG has switched over to Public Financial Management System (PFMS) in 2017, which is a standard system of fund flow and primary book-keeping designed for centrally sponsored schemes like the *Namami Gange* Program. Under the ongoing NGRBP, all project bank accounts of NMCG, SMCGs and EAs are registered with PFMS and payments at all levels are happening through the PFMS system.

6. **Interim Unaudited Financial Reports (IUFRs):** Each SMCG will submit quarterly IUFRs to the NMCG in agreed formats. The NMCG will consolidate the IUFRs received from the SMCGs along with its own and submit a quarterly consolidated IUFR to the World Bank within 45 days from the end of each quarter.

7. **External Audit:** Annual External audit of NMCG and SMCGs will be conducted by the C&AG and State AGs respectively under Standard Terms of Reference agreed between the C&AG, DEA and the World Bank for audit of Bank financed projects. The annual audited Project financial statements of the NMCG and SMCGs will need to be submitted to the Bank within 9 months from the end of each Financial Year, namely by December 31 each year. The following table presents the audit reports which will be tracked in the Bank's system.

Audit Reports to be tracked in Bank's system

Entity	Responsibility	Due Date
NMCG	C&AG	December 31
SMCG Bihar	State AG	December 31
SMCG Jharkhand	State AG	December 31
SMCG UP	State AG	December 31
SMCG UK	State AG	December 31
SMCG West Bengal	State AG	December 31

8. Pursuant to the World Bank Policy on Access to Information, Bank will require that the NMCG discloses the audited financial statements on the Project website. Upon formal receipt of these statements from the borrower, the Bank will make them available to the public in accordance with the World Bank Policy on Access to Information. The Bank normally makes these statements available to the public through its external website.

9. **Internal Audit:** The NMCG and each SMCG will also have internal audits to assess effectiveness of internal controls and to provide independent assurance on the adequacy of internal controls. Internal audit will also assess compliance with Bank procurement guidelines. Internal auditors will work in close coordination with technical supervision or quality assurance consultants for investments to obtain assurance that the contracts are managed prudently as per the terms of the contracts. In the ongoing NGRBP, internal auditors were appointed very late in the Project although internal audit was a requirement according to the Financing Agreement and the Program FM Manual. Also, in the ongoing NGRBP, a few SMCGs appointed their respective Internal Auditors. In the proposed SNGRBP, the appointment of Internal auditors of all SMCGs will be appointed by NMCG which will ensure independence of auditor. The scope of internal auditors will be extended to EAs, which will help improve quality of internal audits.

10. **Due diligence of EAs:** The EAs of the proposed SNGRBP are the same parastatals as those of the ongoing NGRBP. The EAs have adequate accounting and reporting systems to account for project resources and expenditures.

11. **Disbursements and Eligible Expenditures:** The total Project cost is US$1,119 million. The IBRD Loan will finance 100 percent of the Central share of eligible Project expenditures up to US$381 million. The method to be used for disbursement of funds by the Bank will be "Reimbursement".

12. Expenditures of SMCGs under the Project Management Support (Sub-component 4.2) will be shared by GoI and the States using a 70:30 cost sharing ratio. This cost sharing ratio will also be used for three infrastructure investments under Sub-component 2.2, namely Buxar, Begusarai and Munger in the State of Bihar, which are being carried forward from the ongoing NGRBP. For all activities under other Project components and sub-components, the Central Government (GoI) will bear 100 percent of the costs. In particular, this will be the case for the HAM PPP contracts under Sub-component 2.1 and for the two HAM PPP contracts to be carried forward from the ongoing NGRBP under Sub-component 2.2. The Bank will finance 100% of the GoI share for all components/sub-components subject to a maximum limit

for IBRD financing for each sub-component as laid down in the Table "Project Cost by Component" in Annex 3. Under Sub-component 2, the Bank will finance 100 percent of the GoI's share of eligible expenditures excluding land acquisition and rehabilitation/resettlement (R/R) costs.

13. The sanctioned amount for each infrastructure investment will include the estimated costs of works, goods and services required for that investment including actual costs for preparing FR, DPR, RAP, and other incremental operating and contingency costs[63] of the EA for executing that particular investment.

14. Under Component 2, no infrastructure investment can be undertaken unless sanctioned by the NMCG. All variations in contracts awarded by EAs under the Project will have to be approved by the NMCG. In case of prior review contracts variation orders are also required to be approved by the World Bank as per the Bank's Procurement guidelines. These controls will improve accountability in contract management.

[63] Subject to a maximum of 4% of project cost for preparation activities and another 4% for project supervision

ANNEX 6: Procurement

1. **Project Procurement Strategy for Development (PPSD):** Extensive market analysis has been carried out for different packages of procurement and based on the findings, decision on packages (HAM/DBOT) is finalized for I&D, STP and Sewerage works to ensure adequate participation of bidders. The HAM for sewage infrastructure under SNGRBP is based on key principles of PPP which aims to allocate risks and responsibilities to parties which are best capable to handle and have the highest incentive to perform so that the Project is implemented and operated at high standards.

2. In the HAM PPP approach, Works are partly financed by the private sector. Under the HAM model, the contractor has to design, build and operate & maintain for 15 years. NMCG would contribute about 40 percent of construction cost while the remaining 60 percent of the construction cost would be contributed by private sector through debt and equity. NMCG would pay the private sector quarterly annuity over an O&M period of 15 years. More details of this contracting model are available at Section III: Technical Analysis.

3. Consultancy contracts are also framed based on market research, and packaging of the same in terms of scope of services and period are decided. Based on risk and market analysis, the Procurement Plan for the first 18 months of Project implementation has been prepared to set out the selection methods to be followed by the borrower for procurement of goods, works, and consulting services financed by the World Bank.

4. **Procurement Plan:** The Project shall use the Bank's online procurement planning and tracking tools (viz. STEP) to record all procurement actions under IPF operations, including preparing, updating and clearing its Procurement Plan, and seeking and receiving the Bank's review and No-objection to procurement actions as required. The NMCG staff have been trained by the World Bank in use of STEP. The NMCG has so far identified following three discrete HAM investments to be taken up under SNGRBP (refer Project Components description)

5. **Procurement Types, Method and Prior Review Threshold**

Type of Procurement	Method Threshold (US$, millions)	Prior Review Threshold
Works (including Turnkey, Supply & Installation of Plant and equipment, and PPP)	Open International > 40 Open National < 40 National Request for Quotation < 0.1	All contracts more than US$15 million equivalent
Goods, Information technology and Non-Consulting Services	Open International > 3 Open National < 3 National Request for Quotation < 0.1	All contracts more than US$4 million equivalent

Consulting firms	Selection Based on Consultants' Qualifications < 0.3 Least Cost Selection and Fixed Budget Selection - in justified cases Quality- and Cost-based Selection and Quality-based Selection - in all other packages National market approach (As per paragraph 7.25 of the Procurement Regulations) < 0.8	All contracts more than US$2 million equivalent
Consulting - individuals	No threshold	All contracts more than US$400,000 equivalent
Direct selection	No threshold	With prior agreement based on justification • For goods/works/non-consulting services: As per paragraphs 6.8–6.10 of the Procurement Regulations. • For consultants: As per paragraphs 7.13–7.15 of the Procurement Regulations.

The above thresholds are for the initial 18-month implementation period. Based on the procurement performance of the Project, these thresholds may be subsequently modified. Even for post review cases, the inputs of World Bank on TORs / Technical Specifications will be obtained by the Project.

6. **Complaint handling mechanism.** To address procurement complaints received by the proposed Project, the borrower will implement a complaint handling mechanism. The NMCG is required to ensure recording of procurement-related complaints in the STEP system. Both the World Bank and borrowers will use STEP to track complaints. The borrower will be responsible for performing the following actions in STEP: (a) promptly record all complaints relating to procurement process in IPF operations; (b) for procurement process complaints received on contracts subject to the World Bank's prior review, submit the borrower's proposed response to each complaint before issuing it to the complainant(s); (c) record the borrower's response to the procurement process complaints upon issuance to the complainant(s); and (d) promptly register requests for debriefings and update STEP with the record of the debriefings to interested parties.

7. **Oversight and monitoring by the World Bank.** All contracts not covered under prior review by the World Bank will be subject to post review during ISMs and/or special post review missions, including missions by consultants hired by the World Bank. To avoid doubts, the World Bank may conduct, at any time, independent procurement reviews of all the contracts financed under the loan.

8. **National Procurement Procedures**: National competition for the procurement of goods, works and non-consulting services according to the established thresholds will be conducted in accordance with paragraphs 5.3 – 5.6 of Section V of the Regulations and the following provisions:

1. Only the model bidding documents for National Competitive Procurement (NCP) agreed with the GOI Task Force (and as amended for time to time), shall be used for bidding.
2. Invitations to bid shall be advertised on a widely used website or electronic portal with free open access at least 30 days prior to the deadline for the submission of bids, unless otherwise agreed in the approved procurement plan.
3. No special preference will be accorded to any bidder either for price or for other terms and conditions when competing with foreign bidders, State-owned enterprises, small-scale enterprises or enterprises from any given State.
4. Except with the prior concurrence of the Bank, there shall be no negotiation of price with the bidders, even with the lowest evaluated bidder.
5. Government e-Marketplace (GeM)* set-up by Ministry of Commerce, Government of India will be acceptable for procurement under Request for Quotations (RFQ) method.
6. At the Borrower's request, the Bank may agree to the Borrower's use, in whole or in part, of its electronic procurement system, provided that the Bank is satisfied with the adequacy of such system.
7. Procurement will be open to eligible firms from any country. This eligibility shall be as defined under Section III of the Procurement Regulations. Accordingly, no bidder or potential bidder shall be declared ineligible for contracts financed by the Bank for reasons other than those provided in Section III of the Procurement Regulations.
8. The request for bids/request for proposals document shall require that Bidders/Proposers submitting Bids/Proposals include a signed acceptance in the bid, to be incorporated in any resulting contracts, confirming application of, and compliance with, the Bank's Anti-Corruption Guidelines, including without limitation the Bank's right to sanction and the Bank's inspection and audit rights.
9. The Borrower shall use an effective complaints mechanism for handling procurement related complaints in a timely manner.
10. Procurement Documents will include provisions, as agreed with the Bank, intended to adequately mitigate against environmental, social (including sexual exploitation and abuse and gender-based violence), health and safety ("ESHS") risks and impacts.

*Use of GeM will be allowed in lieu of RFQ/Shopping as per following details:

- up to INR 50,000 in catalog mode (viz. any available item could be selected by IA without further competition), provided selected Item/Supplier meeting the requisite quality, specification and delivery period.

- up to INR 3 Million from the Supplier having lowest price amongst at least three Suppliers meeting the requisite quality, specification and delivery period. The tools for online bidding and online reverse auction available on GeM may be used by the Purchaser.
- up to INR equivalent of US$100,000 from the Supplier having lowest price and meeting the requisite quality, specification and delivery period after mandatorily obtaining bids from at least three Suppliers, using online bidding or reverse auction tool provided on GeM.

Annex 7: Draft Guarantee Term Sheet

Summary of Indicative Terms and Conditions
of a Proposed IBRD Guarantee with a Letter of Credit
in Support of Governmental Payments

*This term sheet contains a summary of indicative terms and conditions of a proposed guarantee **("Guarantee")** by the International Bank for Reconstruction and Development **("IBRD")** for discussion purposes only and does not constitute an offer to provide a Guarantee. The provision of a Guarantee is subject, inter alia, to satisfactory appraisal by IBRD of the proposed Second National Ganga River Basin Project **("Project")**, compliance with all applicable policies of the World Bank, including those related to environmental and social safeguards, review and acceptance of the ownership, management, and financing structure (including in connection with shareholders, suppliers, equipment, and Project design, and contracts proposed by the winning bidder), review and acceptance of project / transaction documentation by IBRD, and the approval of the management and Executive Directors of IBRD in their sole discretion. Without limiting the generality of the foregoing, IBRD is highly selective with regard to the clients and beneficiaries it works with and is diligent on Know-Your-Customer requirements for all project participants (equity investors, ultimate shareholders, lenders, contractors, advisors) and will undertake an appraisal of the Project and the Project Company, including an assessment along these parameters.*

If the Guarantee-related legal agreements are not signed within twenty-four (24) months following approval of the Guarantee by the Board of Executive Directors of IBRD, IBRD may withdraw the offer of the Guarantee.

IBRD-Guaranteed Letter of Credit ("L/C")	
L/C Applicant:	National Mission for Clean Ganga (NMCG)[64], a Government of India ("GOI") agency, as Purchaser under selected Hybrid-Annuity Model (HAM) Public-Private Partnership (PPP) Agreements[65] for priority investment subprojects under GOI's *Namami Gange* (Homage to Ganga) Program[66] ("Concession Agreements").
L/C Beneficiaries:	Escrow Banks selected by the L/C Applicant (Purchaser), acceptable to IBRD [and _____], and concluding Escrow Agreements with the L/C Applicant (Purchaser), the relevant State Missions for Clean Ganga (SMCGs)[67], [the relevant Executive Agencies[68]], [the relevant Urban Local Bodies[69]], and the relevant Concessionaires, the latter being privately-owned special-purpose-vehicle companies selected by [the relevant Executive Agencies] to implement subprojects following a competitive process.[70]

[64] Registered as a society under the Societies Registration Act, 1860, operating under the Ministry of Jal Shakti (Water Resources)), and charged with implementation of the Homage to Ganga Program.
[65] NMCG has identified three wastewater treatment HAM-PPP investments, in the cities of Agra, Meerut, and Saharanpur, all in the State of Uttar Pradesh, to be eligible to benefit from the Guarantee.
[66] A program of actions whose objective is, inter alia, to stop the discharge of untreated municipal sewage or industrial effluents into the main stem of the Ganga River.
[67] State-level arms of the NMCG, charged with implementation of the Homage to Ganga Program in their respective states.
[68] State-level government agencies charged with implementation of priority investment subprojects under the Homage to Ganga Program in their respective states.
[69] Local / municipal governments, registered as societies under the Registered Societies Act, 1860, and whose mandate includes pollution-source prioritization and wastewater service delivery.
[70] While the Escrow Banks are the immediate beneficiaries of the L/C, the Concessionaires are the second-order beneficiaries, and NMCG / GOI is the ultimate beneficiary.

L/C Issuing Bank[71]:	A commercial bank acceptable to IBRD (as Guarantor under the Guarantee Agreement), the L/C Applicant (Purchaser)[, and the L/C Beneficiaries (Escrow Banks)]. An acceptable L/C Issuing Bank will be selected by the L/C Applicant (Purchaser), GOI, and IBRD following a competitive process.
Maximum L/C Amount:	The maximum amount available for draw under the L/C shall not exceed USD [19] million[72]. This amount may be reduced from time to time in accordance with the terms of the L/C and the Guarantee Agreement.
L/C Effective Date:	[Effective Date of Concession Agreement that is first to become effective / Date of financial close under Concession Agreement that is first to reach financial close]
L/C Validity Period:	Up to the term of the respective Concession Agreement(s), plus some additional months to cover any post-termination payment obligations.
L/C Features:	Revolving standby irrevocable L/C issued in favor of the L/C Beneficiary(ies) (Escrow Bank(s)) by the L/C Issuing Bank at the request of the L/C Applicant (Purchaser) to backstop the quarterly payment obligations of the L/C Applicant (Purchaser) under the Escrow Agreement(s), following the occurrence of a Guaranteed Event (as defined below). Any amounts drawn by the L/C Beneficiary(ies) (Escrow Bank(s)) under the L/C that are repaid by the L/C Applicant (Purchaser) to the L/C Issuing Bank within the L/C Reimbursement Period (as defined below) would be reinstated. The obligation of the L/C Applicant (Purchaser) to repay the L/C Issuing Bank amounts drawn under the L/C would be guaranteed by IBRD up to the Maximum Guaranteed Amount. Any amounts drawn by the L/C Beneficiary(ies) (Escrow Bank(s)) under the L/C that are subsequently repaid by IBRD (as Guarantor under the Guarantee Agreement) to the L/C Issuing Bank under the Guarantee would not be reinstated. That is, any principal amount repaid by IBRD would be deducted from the Maximum L/C Amount.
Permitted Drawdown under L/C (Guaranteed Event):	Failure by the L/C Applicant (Purchaser) to pay any amount due and payable to the L/C Beneficiary(ies) (Escrow Bank(s)) pursuant to the respective Escrow Agreement(s) for purposes of paying any undisputed amount due and payable to the respective Concessionaire(s) pursuant to a quarterly invoice according to the terms of the respective Concession Agreement(s).
L/C Fees:	To be payable by the L/C Applicant (Purchaser) to the L/C Issuing Bank. Level of L/C Fees must be acceptable to the L/C Applicant (Purchaser) and IBRD.
L/C Reimbursement and Credit Agreement (RCA)	

[71] While there will be multiple L/C Beneficiaries, there will be a single L/C Issuing Bank and a single state-wide L/C.

[72] This amount represents two (2) rolling quarters of annuity payments for each of the three (3) selected priority investment subprojects during the fifteen (15) years of operation and maintenance of those subprojects.

Borrower (of the L/C loans):	L/C Applicant (NMCG, as Purchaser under the Concession Agreement(s))
Lender (of the L/C loans):	L/C Issuing Bank, as guaranteed lender
L/C Reimbursement Period:	Following a draw under the L/C by an L/C Beneficiary (Escrow Bank) following the occurrence of a Guaranteed Event, the amount drawn becomes a loan from the Lender (L/C Issuing Bank) to the Borrower (Purchaser). The Borrower would be obligated to repay the Lender (L/C Issuing Bank) such L/C loan, together with accrued interest thereon, within a period of twelve (12) months **(the "L/C Reimbursement Period")** from the date of each draw (L/C loan), pursuant to the RCA. In the event of a timely repayment of the L/C loan, the L/C will be reinstated by the amount of such repayment. In the event of non-payment of the L/C loan by the due date, the L/C Issuing Bank would have the right to call on the Guarantee for principal amounts plus accrued interest due by the L/C Applicant (Purchaser) under the RCA.
Principal amount of the L/C loans:	Amounts drawn down under the L/C not to exceed the Maximum L/C Amount.
Interest Rate Charged on the L/C loans:	An appropriate spread above [LIBOR] acceptable to the L/C Issuing Bank, the L/C Applicant (Purchaser), and GOI, and agreed by IBRD (as Guarantor under the Guarantee Agreement). The maturity of the selected [LIBOR] base rate should ideally be one (1) month.
IBRD Guarantee Agreement	
Guarantor:	IBRD
Guarantee Beneficiary:	L/C Issuing Bank, as guaranteed lender
Guarantee Face Value:	USD 19 million
Guarantee Support (Scope):	IBRD (as Guarantor under the Guarantee Agreement) will backstop the payment obligations of the L/C Applicant (Purchaser) under the RCA to the extent that (i) the said obligations result from a Permitted Drawdown under the L/C, and (ii) the L/C Applicant (Purchaser) has failed to repay the L/C Issuing Bank in accordance with the RCA. That is, if the amount remains unpaid after the expiry of the L/C Reimbursement Period, the L/C Issuing Bank would have the right to call on the Guarantee for the principal amount (equal to the amount drawn under the L/C) plus accrued interest due from the L/C Applicant (Purchaser).
Maximum Guaranteed Amount:	Maximum Guaranteed Principal plus accrued interest thereon in accordance with the RCA. IBRD (as Guarantor under the Guarantee Agreement) may cover compound interest, but will not cover penalty interest, default interest, or charges of a similar nature.
Maximum Guaranteed Principal:	Guarantee Face Value, i.e., USD 19 million Any principal amount paid by IBRD (as Guarantor under the Guarantee Agreement) to the L/C Issuing Bank under the IBRD Guarantee would be

	deducted from the Maximum Guaranteed Principal, and that amount would not be reinstated.
Maximum Guarantee Period:	L/C Validity Period plus fourteen (14) months.
IBRD Financial Exposure Limits:	The Maximum Guarantee Period will not exceed twenty (20) years. The financial exposure of IBRD (as Guarantor) under the Guarantee will start on the L/C Effective Date.
Signing:	If the Guarantee-related legal agreements are not signed within twenty-four (24) months following approval by the Board of Executive Directors of IBRD, IBRD (as Guarantor under the Guarantee Agreement) may withdraw the offer of the Guarantee.
Exclusions, Withholding, Limitation / Suspension, and Termination Events:	Standard exclusion, withholding, limitation / suspension, and termination events for transactions of this nature.
Substitution of Guarantee:	If IBRD (as Guarantor under the Guarantee Agreement) exercises remedies against the L/C Issuing Bank under the Guarantee Agreement for reasons attributable to the L/C Issuing Bank, then IBRD may enter into a new Guarantee Agreement with a substitute L/C Issuing Bank on substantially the same terms and conditions as the Guarantee Agreement and for the remaining term of the Maximum Guarantee Period.
Conditions Precedent to Effectiveness of the IBRD Guarantee:	Usual and customary conditions for financing of this type, including but not limited to the following: (i) firm commitment for sufficient financing, including satisfactory contribution of equity, to complete construction of the subprojects for which Concession Agreements have been concluded; (ii) execution, delivery, and effectiveness of all Project and financing agreements, in form and substance satisfactory to IBRD, in relation to all subprojects for which Concession Agreements have been concluded, and including the Indemnity Agreement and the Loan Agreement; (iii) delivery of all relevant host-country environmental approvals required for the operation of the Project, and compliance with all applicable World Bank requirements relating to Sanctionable Practices[73] and environmental and social safeguards; (iv) effectiveness of all required insurance (to include IBRD as an additional insured on third-party liability insurance); (v) satisfaction of all conditions precedent for first disbursement under the

[73] "Sanctionable Practices" means corrupt, fraudulent, collusive, coercive, or obstructive practices, as defined in IBRD's Anti-Corruption Guidelines.

	financing documents for all subprojects for which Concession Agreements have been concluded, save for any condition that requires the effectiveness of the Guarantee Agreement to have occurred; (vi) provision of satisfactory legal opinions; (vii) payment in full of the Initiation Fee, Processing Fee, Front-end Fee, the first installments of the Standby Fee and the Guarantee Fee (as applicable) and reimbursement of expenses of any IBRD's external legal counsel; and (viii) satisfactory integrity due diligence of the Escrow Bank(s), the Concessionaire(s) (and related parties), and guaranteed parties.
Subrogation:	If and to the extent IBRD (as Guarantor under the Guarantee Agreement) makes any payment under the Guarantee, IBRD (as Guarantor under the Guarantee Agreement) will have an immediate and automatic right of subrogation to the extent of such unreimbursed payment to the L/C Issuing Bank's rights under the RCA.
Governing law:	English law or New York Law

Indemnity Agreement	
Parties:	IBRD and Republic of India **("Member Country")**
Indemnity:	The Member Country will reimburse and indemnify IBRD on demand, or as IBRD may otherwise direct, for all payments under the Guarantee and all losses, damages, costs, and expenses incurred by IBRD relating to or arising from the Guarantee.
Covenants:	Usual and customary covenants included in agreements between member countries and IBRD. Any specific covenants will be determined during the Guarantee documentation phase.
Remedies:	If the Member Country breaches any of its obligations under the Indemnity Agreement, IBRD may suspend or cancel, in whole or in part, the rights of the Member Country to make withdrawals under any other loan, credit, or grant agreement with IBRD or IDA, or any IBRD loan or IDA credit to a third party guaranteed by the Member Country, and may declare the outstanding principal and interest of any such loan or credit to be due and payable immediately. A breach by the Member Country under the Indemnity Agreement will not, however, discharge any guarantee obligations of IBRD under the Guarantee.
Governing Law:	The Indemnity Agreement will follow the usual legal regime and include dispute settlement provisions customary for agreements between member countries and IBRD.
Project Agreement	
Parties:	IBRD and the L/C Applicant (NMCG, as Purchaser under the Concession Agreement(s))
Representations and Warranties:	The L/C Applicant (Purchaser) will represent, among other standard and Project-specific provisions, as of the effective date, that: (i) it is in compliance with applicable environmental laws and the applicable World Bank guidelines and environmental and social safeguards requirements; and (ii) neither it (nor any person or organization directly or indirectly responsible for controlling or administering all or part of its activities, and any other relevant Project participants, as determined by IBRD), nor any of its affiliates has engaged in any Sanctionable Practices in connection with the Project.
Covenants:	The L/C Applicant (Purchaser) will covenant, and will cause the Concessionaires to covenant, that it / they will, among other things: (i) comply with applicable laws, including environmental laws, and the applicable World Bank environmental and social safeguards requirements; (ii) provide annual audited financial statements and other reports; (iii) provide certain notices and other information to IBRD;

	(iv) provide access to the Project; (v) not engage in (or authorize or permit any affiliate or any other Person acting on its behalf to engage in) any Sanctionable Practices in connection with the Project; (vi) comply with World Bank requirements relating to Sanctionable Practices regarding individuals or firms included in the World Bank Group list of firms debarred from World Bank Group-financed contracts; and (vii) obtain IBRD's consent prior to agreeing to any change to any transaction document which would affect the rights or obligations of IBRD under the Guarantee Agreement or any other Guarantee-related agreement.
Payment of Fees to IBRD:	Payment of fees due to IBRD is the obligation of the L/C Applicant (Purchaser). However, if the L/C Applicant (Purchaser) fails to pay any installment of such fees in full or when due, [a Concessionaire / another party][74] can elect to pay the unpaid amount of the fees corresponding to its portion of the Maximum L/C Amount and seek reimbursement from the L/C Applicant.
Initiation Fee:	15 bps of the Guarantee Face Value (but not less than USD 100,000)
Processing Fee:	50 bps of the Guarantee Face Value[75]
Front-end Fee:	25 bps of the Guarantee Face Value
Standby Fee:	25 bps per annum, charged periodically and applied to that portion of the guaranteed amount that IBRD has contractually committed and for which IBRD does not yet have financial exposure under the Guarantee. The Standby Fee is normally charged semi-annually and accrues sixty (60) days after the date of signing of the agreement providing for the Guarantee. The Standby Fee must be paid in advance on regular payment dates.
Guarantee Fee:	[50-100] bps per annum (depending on the Guarantee average life resulting from the proposal of the bidders under the Concession Agreements; refer to the pricing schedule below*). The Guarantee Fee is charged on that portion of the guaranteed amount that IBRD has contractually committed and for which IBRD has financial exposure under the Guarantee (Maximum Guaranteed Principal). The Guarantee Fee must be paid in advance semi-annually on regular payment dates. Where the Guarantee Fee is payable in installments, IBRD will have the right to terminate [the relevant portion of] the Guarantee in the event of nonpayment of any installment of the Guarantee Fee or Standby Fee in full when due. *The guarantee fee level is determined by the Maximum Guarantee Period: 50 bps up to 8 years, 60 bps from 8 to 10 years, 70 bps from 10 to 12 years, 80 bps from 12 to 15 years, 90 bps from 15 to 18 years and 100 bps from 18

[74] A bidder under a Concession Agreement may propose another party, subject to acceptance by GOI and IBRD (as Guarantor under the Guarantee Agreement).
[75] In exceptional cases, projects can be charged over 50 bps of the guarantee amount.

	to 20 years.
External Legal Costs:	Reimbursement of any IBRD external legal counsel expenses by the L/C Applicant (Purchaser).
Cooperation Agreement	
Parties:	IBRD and the L/C Applicant (Purchaser)
Cooperation Agreement:[76]	The L/C Applicant (Purchaser) will covenant, among other things, that it will: (i) comply with all its obligations under the transaction documents; (ii) obtain IBRD's consent prior to agreeing to any change to any transaction document which would materially affect the rights or obligations of IBRD under the Guarantee Agreement or any other transaction document; (iii) provide certain notices to IBRD; (iv) take all action necessary on its part, in accordance with and as required by the terms of the Project-related agreements to which it is a party, to enable the L/C Beneficiaries (Escrow Banks) to perform all of the L/C Beneficiaries' obligations under the Concession Agreements and other relevant transaction documents; and (v) cooperate with IBRD and furnish to IBRD all such information related to such matters as IBRD shall reasonably request; and promptly inform IBRD of any condition which interferes with, or threatens to interfere with, such matters.

[76] Either a Project Agreement or a Cooperation Agreement will be concluded.

Water

Interception and diversion-based wastewater management can conserve Indian rivers and lakes

Intercepting sewage before it reaches rivers or waterbodies could be an intermediate way to reduce pollution

India's drains carry a mix of domestic sewage, industrial effluents and solid waste which makes wastewater management more complex. Photograph: iStock

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Jyoti Parsad

Published on: 17 Mar 2025, 5:42 pm

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industrialisation, and population growth have led to severe pollution, threatening both ecosystems and human health. Major rivers like the Ganga, Yamuna and Brahmaputra, along with numerous lakes, are heavily contaminated by untreated sewage and industrial effluents.

In urban areas, centralised sewerage systems are designed to transport and treat wastewater, but in reality, a large portion of sewage including septic tank overflows never reaches treatment plants.

Instead, it flows into open drains, streams and lakes, further degrading water quality. India's drains carry a mix of domestic sewage, industrial effluents and solid waste which makes wastewater management more complex.

The challenge is even greater during monsoons when overflowing drains worsen contamination which happens because of improper calculation of organic and hydraulic volume.

As per the inventory maintained by Central Pollution Control Board (CPCB), by 2021, the total generation of sewage is 72,368 million litres per day (MLD) but the actual treatment is of only 20,236 MLD which demonstrates a huge gap in the wastewater management.

To address this gap, Swachh Bharat Mission (SBM) 2.0 is promoting I&D based wastewater management, particularly in cities where sewer networks are inadequate or nonexistent. Integrating I&D systems with existing wastewater management approaches enhances treatment efficiency and curbs pollution by diverting untreated

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successful implementation of an I&D project.

1. **Mapping and Monitoring Drains** – Identifying critical drain outfalls and assessing pollution loads.
2. **Interception Structures** – Constructing weirs or collection chambers to capture wastewater before it enters rivers.
3. **Diversion Systems** – Installing pipelines or channels to transport captured wastewater to treatment plants.
4. **Treatment and Reuse** – Ensuring wastewater is treated to acceptable standards and, where possible, reused for agriculture, industry, or landscaping.

A game changing approach

Intercepting sewage before it reaches rivers or waterbodies could be an intermediate way to reduce pollution. Projects like Namami Gange have seen improved water quality in key river sections. This approach is an intermediate and immediate solution which can be quickly implementable. This serves the purpose where a centralised underground sewerage network is not feasible.

Additionally, I&D solutions are highly adaptable, fitting both small towns with basic systems and large cities with advanced treatment facilities. Beyond economic and logistical benefits, cleaner rivers support aquatic life, sustain fisheries, and enhance biodiversity.

Diverting wastewater also helps prevent waterborne diseases, improving overall public health.

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improper planning and design as well as inadequate treatment infrastructure - many cities simply lack the capacity to treat diverted wastewater. In many cases, sewage treatment plants effectively treat wastewater, only to release it back into the same polluted channels, undermining the cost and effort of cleaning.

Financial constraints also pose a barrier, especially for smaller municipalities that may struggle to fund basic infrastructures.

Successful implementation requires strong coordination among government agencies, industries, and local communities, ensuring that all stakeholders work together toward a common goal. Additionally, regular maintenance is essential to keep the system functioning efficiently and prevent failures.

Shining examples

Ahmedabad's Sabarmati Riverfront Development Project has significantly improved the river's water quality through the implementation of comprehensive interception and diversion structures. A key component of this initiative is the installation of interceptor sewers along both banks of the river, designed to capture sewage from 38 discharge points.

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These interceptor lines collect untreated sewage and, with the aid of newly constructed pumping stations on the reclaimed riverbanks, redirect it to augmented sewage treatment plants located south of the Vasna Barrage. This

Also, the eight Lakes Restoration Project in Coimbatore is also noteworthy.

This initiative incorporated a multi-faceted approach using advanced screening systems, diversion channels, and natural wetlands to manage and treat wastewater before it reaches local water bodies. Advanced screening systems intercept large debris and particulate matter, ensuring that only finer pollutants enter the diversion channels.

These channels then redirect the water to treatment facilities or natural wetlands, where tertiary treatment processes take place.

Diversion channels ensure that treated water flows safely without overloading treatment plants, while natural wetlands serve as biofilters, utilising plants and microorganisms to further purify the water, removing excess nutrients and pollutants.

This combination revitalises local ecosystems, improving water quality and supporting biodiversity, as seen in projects around the Yamuna River, where such integrated methods have led to cleaner water and healthier habitats.

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Source: CDD Society

Interception and diversion project at Mahadevpura Lake, Bengaluru

The Mahadevapura Lake interception and diversion (I&D) project employs hydraulic diversion structures to capture wastewater before it enters the lake, redirecting it to a 1 MLD Decentralized Wastewater Treatment System (DEWATS). The system includes screened intake structures to remove solid waste, followed by diversion channels and culverts that transport the wastewater to sedimentation and balancing tanks.

From there, the flow is regulated and processed through an Anaerobic Baffled Reactor (ABR) and Anaerobic Filter for organic load reduction. Planted Gravel Filters (PGFs) and floating wetlands provide tertiary treatment before the treated water is released back into the lake. Box culverts and silt basins at inlet points help manage hydraulic loads and prevent sedimentation, ensuring effective pollution control while supporting ecosystem restoration.

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Source: CDD Society

Interception and diversion project at Assi river, Varanasi

The Assi River interception and diversion (I&D) project in Varanasi utilises screening mechanisms, diversion channels, and interceptor pipelines to capture wastewater before it enters the river, redirecting it to treatment facilities.

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Source: CSE

Fifty MLD of sewage is diverted to the Ramana Sewage Treatment Plant (STP), while the remaining 30 MLD undergoes ozonation-based advanced oxidation treatment to break down pollutants. Interceptor drains and sedimentation structures regulate flow and prevent untreated discharges, while pilot bioremediation initiatives using bacterial cultures enhance organic matter degradation. These interventions ensure wastewater is

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Source: CSE

Namami Gange

The Namami Gange Program has made remarkable strides in pollution control through Interception & Diversion (I&D) projects, significantly improving water quality in key stretches of the Ganga. In Uttar Pradesh state, a total of 154 drains have been intercepted and diverted, reducing the direct discharge of untreated sewage into the river.

Notable projects include the Sisamau Nala interception in Kanpur, which diverts 140 MLD of sewage to treatment plants, and the Sultanpur I&D initiative, which includes the construction of a 7 MLD STP and the upgrade of an existing 5 MLD waste stabilisation pond into a 10 MLD aerated lagoon STP to treat wastewater from six drains.

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Building on these efforts, 2023-24 saw the inauguration of major I&D projects across multiple states. On March 1, 2023, the Prime Minister inaugurated three key projects in West Bengal, including STPs in Bally (40 MLD), Kamarhati & Baranagar (60 MLD), and Howrah (65 MLD).

Shortly after, on March 2, 2024, twelve projects worth Rs 2,189 crore were launched in Bihar, with major interventions in Patna, Bhagalpur, and Saran. The momentum continued on March 10, 2024, when I&D networks were integrated into sewage treatment projects in Prayagraj (72 MLD), Jaunpur (30 MLD), and Etawah (45 MLD), Uttar Pradesh.

Further strengthening the program, the Union Minister of Jal Shakti laid the foundation stone for a 220 MLD I&D project in Meerut on January 18, 2024, with an estimated cost of Rs 370 crore. These initiatives highlight the government's commitment to restoring the Ganga's health through comprehensive wastewater management.

The road ahead

To fully harness the benefits of interception and diversion, India must take a comprehensive approach to wastewater management. Expanding treatment infrastructure is essential, requiring significant investment in modern, high-capacity plants across the country.

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Technology can play a transformative role, with Artificial Intelligence (AI) and Geographic Information System (GIS) enabling real-time monitoring of drains and pollution levels. Collaboration between the public and private

Lastly, true progress depends on community engagement. Educating and involving local populations will ensure long-term success, fostering a collective responsibility for cleaner rivers and lakes.

In conclusion

Interception and diversion (I&D) of drains offer a scalable solution to reduce river and lake pollution in India by preventing untreated wastewater discharge. This approach enhances water quality and supports sustainable water management.

However, when drains carry industrial waste and contaminated runoff, treatment becomes complex, often leaving residues that limit safe reuse.

Overloaded plants may struggle to remove all pollutants, compromising water quality. Effective I&D requires stricter pollution control and advanced treatment to ensure safe and sustainable water reuse.

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Summary

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- *New WaterAid–Tree Aid study finds 45% of people in Ghana, Niger and Nigeria face high water risk.*

— 20 million more than five years ago.

- *Niger faces the worst crisis, with 99.5% of freshwater at risk of sedimentation and poor quality.*
- *Experts urge governments to integrate forest and water priorities into climate and adaptation plans.*

A growing water crisis is unfolding across West Africa, putting millions of lives at risk, according to a new study by WaterAid and Tree Aid.

The report, *From Roots to Rivers: How Deforestation Impacts Freshwater Access*, finds that 45 per cent of people — more than 122 million across Ghana, Niger and Nigeria — are now exposed to unsafe drinking water, an increase of 20 million in just five years. The study links this alarming trend directly to deforestation and the loss of vegetation cover that sustains freshwater systems.

Forests and vegetation, the report explains, play a crucial role in protecting freshwater resources by stabilising soils, filtering pollutants and regulating rainfall. Their destruction is disrupting these natural processes and threatening the reliability of water supplies used for drinking, food production and health.

Drawing on 12 years of Earth Observation data from satellites between 2013 and 2025, the study examined vegetation, rainfall and water coverage across the three countries — chosen for their diverse ecological and climatic conditions within West Africa. For the first time, the analysis provides clear evidence of a correlation between deforestation and freshwater decline.

In Niger and Nigeria, every 1,000 hectares of forest loss corresponds to an average of 9.25 hectares of surface water loss. In Nigeria, the figure

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Reduced access to clean, safe water due to ongoing deforestation is further compounded by climate change, the study warns. Intense rainfall, without vegetation to filter it or stabilise soil, leads to sediment and pollutants entering rivers, lakes and reservoirs. Over time, this not only reduces available drinking water through diminished groundwater absorption and evapotranspiration, but also lowers the quality of what remains.

The scale of the problem is most severe in Niger, where 99.5 per cent of available surface freshwater is now considered at risk of sedimentation and poor quality. In Nigeria, around 85.6 million people live in areas highly vulnerable to surface water loss from deforestation.

In Ghana, contamination remains the central concern, with forest loss directly linked to worsening surface water quality. Between 2013 and 2025, the country lost around 298,000 hectares of vegetation, which is roughly equivalent to losing an area the size of Edinburgh each year. Nigeria recorded vegetation loss of 324,000 hectares, comparable to an area the size of Birmingham annually.

Niger, however, showed modest improvement, managing to increase its vegetation cover by 101,000 hectares.

The study underscored that water security in West Africa cannot be separated from forest management. WaterAid and Tree Aid are calling on policymakers to integrate forest and water priorities into climate plans, financing frameworks and adaptation strategies, particularly through investment in strengthened, climate-resilient and equitable water services that prioritise vulnerable communities and promote universal access to safe water.

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Science & Technology

India's digital thirst: What data centre giants aren't saying about their water use

Tech giants promise sustainability through new cooling systems, recycling and offsetting, but DTE finds little transparency, no standard reporting, and growing water stress around their sites

AdaniConneX data centre in Noida. Rohini Krishnamurthy / DTE

Rohini Krishnamurthy

Published on: 10 Nov 2025, 3:27 pm

Summary

- *Down To Earth analyses ESG reports of India's top data centre operators — from AdaniConneX to Sify — and finds glaring gaps in water-use transparency.*
- *Firms promise "water-neutral" and "AI-ready" facilities but offer little evidence to back their claims.*
- *Key metrics like Water Usage Effectiveness (WUE) remain inconsistently reported and poorly standardised.*
- *Companies tout offsetting and recycling projects while communities near their sites still face*

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In the first three parts of this series, *Down To Earth* (*DTE*) traced India's rapidly expanding data centre industry, a pillar of the country's digital and artificial ambitions (AI) ambitions, in regions like Greater Noida and Bengaluru where local communities are already struggling for access to clean water.

In this final part, *DTE* examines the other side of the story: how the industry's biggest players report (and often obscure) their water use, the technologies they claim will make them "water neutral", and why experts say those promises don't always hold water.

DTE reviewed the Environmental, Social, and Governance (ESG) reports of India's top data centre operators — Nxtra by Airtel, AdaniConneX, STT, NTT, CtrlS, and Sify — and found a consistent and troubling pattern: A pervasive lack of transparency in how these firms report their water use.

As demand for digital infrastructure soars, fuelled by the explosive growth of generative AI platforms such as ChatGPT and Gemini (*read Part 1 of this series*) — data centres are expanding at breakneck speed across India. But despite their vast water requirements, companies are revealing little about how much they consume, where it comes from, or what impact it has on local water resources.

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Local and International data center players in India

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Indian data center operators	CtrlS, Pi Datacenters, BSNL (Nextgen Infinite), Web Werks, Airtel (Nxtra Data Centers), AdaniConnex, and Sify Technologies
New announcements	Google (collaboration with AdaniConnex), Tata Consultancy Services and Reliance Enterprises

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Absent water consumption figures

ESG reports from the companies use two key terms, water consumption and water withdrawal, which sound similar but mean different things. Consumption refers to water lost during operations, usually through evaporation in cooling systems, while withdrawal refers to water drawn from natural or municipal sources (surface, underground, reclaimed or treated potable water) that may later be returned to them.

Nxtra by Airtel operates 15 hyperscale data centers across eight Indian cities — facilities that typically span over 10,000 square feet. In its 2025 ESG report, the company disclosed a total water consumption of 216,357 kilolitres (KL), including 9,876 KL drawn from groundwater and 191,152 KL purchased from third-party sources, with no reported use of surface water. However, Nxtra did not release consumption figures for 2023 or 2024, leaving a crucial gap that makes it impossible to track changes or assess whether its water use has risen over time.

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water withdrawals across all its business operations — mining, airports, solar manufacturing, wind, copper, roads, data centres, defence and digital labs — at 4,390 million litres in 2025, a 59 per cent increase from 2022. The report does not disclose how much of this was used for data centres, even though 2022 was the year AdaniConneX began operations in Chennai.

STT GDC India, a subsidiary of the Singapore-headquartered ST Telemedia Global Data Centres, operates 30 facilities across India. Its 2024 ESG report shows a total water withdrawal of 1,149,020 KL, up 8.5 per cent from 2023 (1,059,011 KL). While no country-specific data is available for 2024, its 2023 report revealed that 419,204 KL of water was withdrawn from India, 40 per cent of its global total and up 17 per cent from the previous year.

Headquartered in England, NTT operates in 20 countries and regions across the Americas, Asia Pacific, Europe, the Middle East, Africa, and India, where it runs 15 facilities. According to its 2024 Sustainability Report, the company withdrew 413,779 kilolitres (KL) of water in 2023, consuming 203,297 KL of it. However, its 2025 report omits any mention of water withdrawal or consumption, raising questions about the company's transparency and year-on-year reporting consistency.

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Sify Technologies, which runs 14 AI-ready data centres with a combined IT capacity of roughly 200 MW, reported withdrawing 6,132,323 KL of water in 2023-24, up 5 per

consumption of 409,037 KL in 2023-24, down from 468,330 KL the previous year.

None of these reports provide data centre-level details, and apart from STT's 2024 report, no global operators disclose country-level figures.

Imperfect technologies

How much water a data centre uses depends largely on its cooling technology. The most common is evaporative cooling, which uses water to remove heat but requires constant replenishment, especially in hot or dry climates. The alternative is air-cooled chillers, which dissipate heat using fans and consume little or no water, though they demand far more electricity.

The trade-off is that evaporative systems are generally more energy-efficient but less water-efficient, Shaolei Ren, associate professor of electrical and computer engineering at the University of California, Riverside, told *DTE*. Water-cooling systems are often cheaper but can strain water resources in areas where the resource is less abundant, for example, Bengaluru or Noida.

"Air-based cooling systems don't use water directly but still have an indirect water footprint through the electricity required to power them, explained Melissa Scanlan, Lynde [illegible]. Uihlein Endowed Chair in Water Policy, professor and director of the Center for Water Policy at the University of Wisconsin–Milwaukee. If the electricity source is fossil fuel-based, the environmental burden remains high.

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the State Level Environment Impact Assessment Authority to replace gas generators with diesel generators since the Data Centre Building will host critical information and data of Government and Defence and hence continuous operation is extremely critical. The committee set a condition that the installed diesel generator should use low sulphur diesel type and conform to Environment (Protection) Rules prescribed for air and noise emission standards. Low sulphur fuel reduces air pollutants like small particulate and black carbon emission and does not directly reduce carbon dioxide emissions.

About 78 per cent of India's power generation in 2024 was fossil-fuel based.

Further, traditional air cooling can no longer efficiently mitigate the escalating heat produced by the ever-increasing power densities of modern processors used for AI workload. Liquid cooling technologies like liquid immersion cooling, which involves bathing servers, chips, and other components in a specialised dielectric (or non-conductive) fluid, which absorbs the heat from the chips and transfers it to a heat exchanger, where it is cooled down before flowing back into the tank.

However, the technology has higher upfront costs than conventional direct liquid cooling, but provides significant energy savings and significantly less water than other approaches, according to an article by Environmental and Energy Study Institute, a US-based nonprofit.

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immersion "where feasible", Sify claims to have saved "billions of gallons" through water-free cooling but provides no data to support the claim; and CtrlS reports reducing its water footprint by 119,662 KL annually by switching from water- to air-cooled systems, without specifying how many facilities adopted the change.

All the sustainability reports are unclear on how many data center facilities have switched to newer technologies and how the switch has impacted their water and energy consumption.

Yotta Data Services Pvt Ltd believes that liquid cooling is central to the future of AI data centres. "The industry's real direction is water-neutral data centres: air-cooled + liquid-cooled + closed-loop systems, not water-cooled towers," the company stated.

But as companies make ambitious claims about "water-neutral" or "water-positive" facilities, researchers warn that transparency remains weak, and independent verification is almost non-existent. Even global tech firms are reluctant to open their sustainability claims to scrutiny. Microsoft, for example, says its pilot cooling technology at one data centre reduced water use by more than 124.9 million litres, without opening it for review by independent academic researchers.

Water usage effectiveness

Many ESG reports reviewed by *DTE* refer to water usage effectiveness (WUE), which is a metric developed by The Green Grid, an nonprofit industry consortium, to measure

uses over the same period. A score of zero represents ideal efficiency.

"WUE is a useful starting point for quantifying water consumption," said Ren. "But it doesn't capture everything. The typical WUE value is reported on an annual basis, which does not reflect peak water demand. Those peaks can be particularly problematic for local water infrastructure."

Ren also said that WUE also does not account for local water stress levels, which are critical for understanding real impacts. But there is no single standardised method of calculating WUE. This, he said, can create confusion and make comparisons difficult. "More consistent reporting methods would be helpful."

Not every company discloses its WUE, and those that do offer little context (see table). "Modern hyperscale DCs — including ours [Yotta, which does not publicly mention WUE] — are built to operate at extremely low WUE and avoid reliance on freshwater entirely," Yotta told *DTE*.

Published Water Use Effectiveness (WUE) of major data center operators

Company	WUE in (l/kwh) or %
Nxtra	No published data
AdaniConnex	No published data
CtrlS	No published data
STT	0.73 in 2024

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Sify 1

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Reusing water and offsetting claims

Recycling and reusing water is often presented as the most sustainable solution, but the reality is more complex. Water quality is critical. Reclaimed or treated water, if improperly managed, can cause corrosion, scaling and microbial growth in cooling equipment. “Recycling water helps but in the Indian context, the water quality standards need to be improved to ensure the right chemical parameters are met,” Shashank Palur, manager and hydrologist with the Urban Water programme at WELL Labs, Bengaluru, told *DTE*.

Yotta Data Services Pvt Ltd also calls for standarsdiations. “We expect the national Data Centre Policy to set clear standards for non-potable water usage, wastewater recycling, and cooling efficiency, ensuring that capacity growth does not come at the cost of community water security,” Yotta told *DTE*.

Nxtra says it recycled 15,329 KL of water in 2025 through advanced sewage treatment systems and aims for 100 per cent recycling in its hyperscale data centres to become “water neutral”. It does not specify whether the recycled water is used for cooling. AdaniConneX mentions using treated water and rainwater harvesting, without providing any clarity. STT said its Pune facility reuses high Total Dissolved Solids water “multiple times before replacement” but does not define limits. CtrlS claims “water positivity” through innovative recycling and sustainable operational

"water offsetting", which is compensating for water use in one location by replenishing or restoring water elsewhere. Microsoft and Amazon are leading advocates, pledging to become water positive by 2030 and 2027 respectively, meaning they will return more water to communities than they consume.

Microsoft has invested in at least eight projects in India, partnering with nongovernmental organisations to either restore lakes or enhance availability of groundwater, according to the company's water replenishment portfolio.

Amazon has announced similar commitments. In 2024, it pledged to return more water to Indian communities than it uses by 2027. The company has invested in restoration projects at Yamare Lake near Bengaluru and Sai Reddy Lake near Hyderabad — both once vital local water sources that gradually vanished. Since early 2025, work has involved desilting, rebuilding bunds, and repairing inlet and outlet structures. The two projects are expected to replenish over 570 million litres of water annually, 270 million to Yamare and nearly 300 million to Sai Reddy.

During a visit to Yamare Lake, *DTE* found restoration work ongoing. "We supply groundwater to homes in eight villages, including Yamare, but levels are falling. Water is now available only at 100 feet," says Praveen Kumar, Panchayat Development Officer. "The lake's revival could help improve groundwater recharge."

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Yamare Lake rejuvenation. Rohini Krishnamurthy / DTE

Issues with offsetting, however, remain unaddressed. "Although companies are raising water levels in some water-scarce areas, these efforts don't address localised depletion where their data centres operate," said Labanya Prakash Jena, consultant on sustainable finance at the Institute for Energy Economics and Financial Analysis (IEEFA). "If a data centre causes depletion in Whitefield, that cannot be offset by restoring a lake elsewhere. It's an ineffective approach."

For residents, the debate over technology and offsetting feels distant. In Tusiana Village, Greater Noida — home to Yotta's 20-acre data centre park — retired resident Rattu Singh puts it simply: "If there's no water in our village

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three.

This story was produced with support from Internews' Earth Journalism Network.

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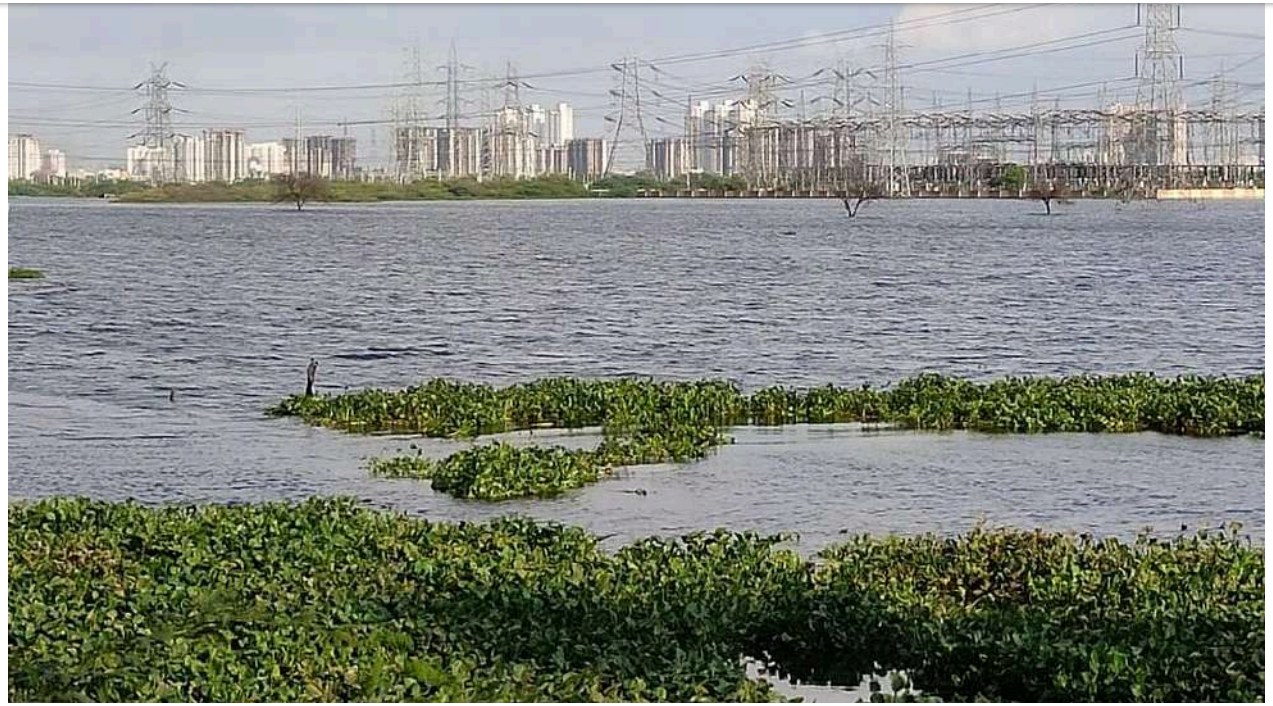
Water

Rethinking Gurugram's waterlogging fix: Let the city absorb, not divert



The Najafgarh Jheel. Photo: Author provided.

Ritu Rao

Published on: 08 Nov 2025, 9:12 am

Gurugram experienced two bouts of heavy rainfall this year — the first between July 9 and 10, when about 133 mm of rain fell within 12 hours, and the second on September 1, which saw over 100 mm of rainfall in just four hours. Both downpours led to severe waterlogging, power outages, and hours-long traffic jams stretching for kilometers along major highways such as NH-48, prompting authorities to issue work-from-home advisories.

Public frustration quickly spilled onto social media, with countless posts blaming the government for the city's poor infrastructure. In October, Union Minister for Power, Housing and Urban Affairs, M L

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thereby addressing the city's persistent monsoon waterlogging issues.

Experts, however, have voiced serious doubts about the project's feasibility. They point out that Gurugram's natural drainage system flows northwest toward the Najafgarh Jheel and the Sahibi river (Najafgarh Drain), and that diverting this flow southward against the natural gradient would necessitate massive pumping, making the project both economically unviable and environmentally damaging.

Assessment of Gurugram's topography reveals that a natural ridge formed by the Aravalli hills runs through the district, creating a clear drainage divide that defines the city's hydrology. Historically, runoff from the Aravalli slopes and adjoining urban areas has drained northwest into the Najafgarh Jheel and Sahibi river, which eventually joins the Yamuna in Delhi. This basin has functioned as a vital natural stormwater reservoir, absorbing seasonal rainfall from Gurugram and its surrounding catchments.

Government and technical studies further note an elevation difference of roughly 60-80 meters between the Aravalli foothills and the Najafgarh Jheel. This natural gradient reinforces Gurugram's north-westerly drainage pattern and explains why any attempt to divert runoff southward towards Palwal and ultimately the Yamuna basin would entail major infrastructural interventions and large-scale pumping operations.

Given that the proposed alignment of the project extends from Gurugram to Palwal via Sohna and Nuh, and that a detailed project report (DPR) is yet to be prepared, a preliminary, back-of-the-envelope assessment was undertaken to gauge its feasibility. For this purpose, the area under the Gurugram Municipal Corporation (GMC) was considered to estimate stormwater runoff under different monsoon rainfall scenarios.

According to a study based on Sentinel-2 data of 2022, the Gurugram Municipal Corporation (GMC) area covered a total of 306.9 sq km (excluding water bodies), comprising 203.5 sq km of built-up land and 103.4 sq km of non-built-up area, which includes trees, bare ground, rangeland, and cropland. For runoff estimation, runoff coefficients of 0.8 for built-up areas and 0.2 for open areas were assumed.

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exceeding 100 mm this year, and with climate change projected to increase the frequency of high-intensity, short-duration rainfall, such extreme events are expected to become more frequent in the future.

Based on the above assumptions, the estimated runoff generation from the GMC area is approximately 9 million cubic metres (MCM) per day for 50 mm/day rainfall, 18 MCM per day for 100 mm/day, and about 29 MCM per day for 160 mm/day rainfall. Experts have observed that the proposed stormwater drain's alignment would run counter to the natural drainage gradient, necessitating a deep drain at a depth of approximately 18 metres to cut through the ridge in the initial stretches. At this depth, the drain's cross-sectional area is estimated to be around 12 square metres, with a natural flow velocity of about 1 metre per second. Under these conditions, the drain's discharge capacity would be approximately 12 cubic metres per second.

If pumping mechanisms were introduced to double the discharge rate, the flow could potentially reach 24 cubic metres per second, translating to a total discharge volume of about 2 MCM per day. Achieving such capacity, however, would demand substantial energy inputs, complex engineering, and extensive infrastructure investment, making the project highly resource-intensive and costly. According to expert estimates, the overall project cost—including land acquisition—is expected to be around Rs 1,500 crore.

While the discharge capacity of the proposed drain has been estimated, actual on-site conditions may result in a considerably lower capacity due to a smaller effective cross-sectional area or reduced flow velocity.

After estimating the runoff volumes generated under various rainfall scenarios and the discharge capacity of the proposed drain, along with the substantial energy inputs and infrastructure costs involved, the feasibility of the project appears questionable.

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First, even with heavy pumping, the proposed stormwater drain has a maximum discharge capacity of approximately 2 MCM per day. This capacity is inadequate to manage the 9 MCM of runoff generated by a 50 mm/day rainfall event—let alone the 18 MCM and 29 MCM expected under 100 mm/day and 160 mm/day rainfall scenarios, respectively. Such volumes would easily overwhelm the proposed drain, rendering it ineffective. Moreover, this assessment is based on daily capacity; when shorter,

1 MCM in 12 hours and just 0.33 MCM in four hours—far below the required capacity to handle these extreme events.

Second, the project cost estimated by experts—including land acquisition—cannot be justified for a system that would operate at full capacity only during 3-4 heavy rainfall events, amounting to roughly 10 days in a year. For the remainder of the year, the drain would remain unutilised, particularly the heavy pumping infrastructure, which would be prone to disrepair and may not function effectively when required during those few monsoon days.

Third, Gurugram already possesses a natural stormwater reservoir in the form of the Najafgarh Jheel wetland, the natural drainage sink toward which most of the city's runoff flows. On the Haryana side, the Jheel has a storage capacity of around 32 MCM, and at the 211-metre contour, it spans over 5,000 acres. This wetland can effectively store runoff from even the heaviest rainfall events, providing not only waterlogging mitigation during the monsoon but also a valuable water resource for groundwater recharge and use during the dry season.

Fourth, Gurugram has been declared a 'dark zone' by the Central Ground Water Authority (CGWA) due to over-extraction of groundwater. In 2024, the city drew 212 per cent of its permissible annual groundwater limit, more than double the sustainable threshold, as reported in the National Compilation on Dynamic Groundwater Resources of India. This over-extraction threatens agricultural productivity, health of waterbodies, and is already contributing to land subsidence—with structural damage being reported in parts of the city. In this context, the proposal to divert stormwater out of the city towards Palwal, rather than using it to recharge local aquifers, reflects a troubling lack of foresight.

Finally, Gurugram's real challenge lies not in where its stormwater drains, but how it drains. The city's inadequate internal drainage system prevents effective runoff dispersion, causing waterlogging during even moderate rainfall. A more sustainable approach would focus on strengthening local drainage networks, creating distributed storage systems, enhancing soil permeability, and integrating pumping and recharge infrastructure—turning stormwater from a liability into a resource.

The analysis above clearly indicates that the proposed project would be a white elephant. To truly improve Gurugram's drainage and waterlogging resilience, the city must adopt low impact

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revival of traditional water bodies, wetlands, and ponds across the city will make Gurugram far more permeable and climate-resilient. This nature-based approach not only mitigates local waterlogging but also advances progress toward Sustainable Development Goals (SDGs) 11 and 13—fostering inclusive, safe, resilient, and sustainable cities while promoting urgent action against climate change and its impacts.

Instead of diverting monsoon stormwater outside the city, Gurugram must learn to absorb and manage it within its boundaries, allowing excess runoff to flow naturally into the Najafgarh Jheel wetland. This wetland can act as a buffer and storage basin, recharging groundwater and gradually releasing surplus water into the Yamuna in Delhi. By embracing such nature-based, sustainable solutions, Gurugram can transform its waterlogging problem into an opportunity for water security and ecological restoration.

Ritu Rao works with Indian National Trust for Art and Cultural Heritage (INTACH) on various natural heritage projects

Views expressed are the author's own and don't necessarily reflect those of Down To Earth

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Water

'The poorer you are, the more expensive water is'

Preetha Banerjee

Published on: 08 Nov 2025, 9:12 am

Preetha Banerjee (PB): How does the politics around water access impact the development of communities?

Abhijit Banerjee (AB): With water we have this kind of rhetorical move that complicates the issues around its access, which is that it is supposed to be free. But in fact, the poorer you are, the more expensive it is in time, quality and every dimension.

Because we pretend partly that it is free, then of course we have to ration it, and when you ration it, you ration it to the poor. And we have very complicated mechanisms for doing that. And then the fact that we ration it means other mechanisms like the common pool get drained. This is especially the case with drinking water.

PB: How do you link ecological degradation with development?

AB: One of the challenges of development, and I think it is a challenge that very few countries have managed well, is that there are things that seem invisible. I think a lot of the shared resources tend to look invisible, and then by the time we wake up, we have lost a lot of them. And that is a general pattern.

It is the same with overtourism in Europe, and it is the same with overuse of water in India—the logic is very similar. And then the problem is that once you are in a place where there is a crisis, then things get worse, resources get privatised. And when things get privatised, the people who cannot afford them get hurt.

PB: Why did you choose the medium of short films to communicate your message or research?

AB: I tend to think that economics is placed in the wrong place—it is seen as being a technical discipline, one that is for experts. Then the experts come and often, you know, do a snow job on us. Everybody should be understanding economics. So, I was interested in creating conversations which would be participatory. I do not think the ideas are that hard, but I think the rhetoric and the

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This interview was originally published in the November 1-15, 2025 print edition of Down To Earth

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Water

India's digital thirst: A booming data centre corridor in Uttar Pradesh's GB Nagar is running on empty wells

As gleaming data hubs rise across the state, residents struggle for drinking water and officials have no answers on how much these facilities consume

Groundwater levels in Khora Colony in sector 62, Noida, are fast depleting. A data centre is being built a kilometre away. Rohini Krishnamurthy / DTE

Rohini Krishnamurthy

Published on: 07 Nov 2025, 5:31 pm

Summary

- *Down To Earth investigates how Gautam Buddha Nagar's rapid data centre expansion is deepening groundwater stress.*
- *Residents of industrial colonies near Adani and Sify facilities pay for tanker water as borewells plunge to 600 feet.*

scarce regions — and locals are paying the price

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from.

- *Experts warn that the state's digital dreams could collapse if its aquifers continue to dry up.*

In the first part of this series, *Down To Earth* (DTE) explored what data centres are, why they require vast quantities of water to operate, and their rapid expansion into water-stressed regions such as Greater Noida where local communities already struggle for access to clean water. The second part travelled south to Karnataka, India's Silicon Valley, to examine how the same pattern is unfolding in and around Bengaluru.

This third part returns to Uttar Pradesh's Gautam Buddha Nagar (GB Nagar), now emerging as one of India's biggest data centre corridors, to uncover how the promise of "24x7 water supply" for billion-dollar digital parks coexists with neighbourhoods where residents pay for every drop they drink.

Khora Colony is every city dweller's worst nightmare. Located in Sector 62 of GB Nagar, the area is a hub for heavy industry. However, the living conditions here are dire. A massive open drain runs through the neighbourhood, roads are broken, and residents live amid a stench that never quite leaves the air. Yet, these visible hardships mask a graver problem — the steady, alarming fall of groundwater levels.

Just 1.2 kilometres away stands the construction site of AdaniConneX, a 50:50 joint venture between India's Adani Group and the United States-based global data centre operator EdgeConneX. The company's mission is to build what it calls "an environmentally and socially conscious 1 gigawatt (GW) data centre infrastructure platform by 2030."

Residents of Khora Colony, however, have never heard of it. Ram Chauhan, a vegetable vendor who has lived here for 15 years, said he was fed up with the situation. "We don't get any government water supply. We depend entirely on groundwater, which is fast depleting," he said.

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Another resident, Yogita Chauhan, explains how the crisis is hurting their finances. "Our submersible pumps fail again and again as water levels drop. Repairs cost a lot. We also call for tankers every two or three days, paying Rs 1,500 ($16.89) for just 500 litres," she says.

Construction at AdaniConneX's site is ongoing and tightly guarded. According to company data, the facility will have an IT load capacity of 150 MW, which would require roughly 3.9 billion litres of water annually if traditional cooling towers were used. These towers rely on water to dissipate heat from servers into the atmosphere. However, AdaniConneX claims to use air-cooled chillers instead of the more water-intensive, water-cooled systems.

"If a data centre uses dry coolers, it doesn't consume much water, although its energy use rises," Shaolei Ren, associate professor of electrical and computer engineering at the University of California, Riverside, told *DTE*.

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Yogita Chauhan of Khora Colony says the current water crisis has increased their expenditure. Rohini Krishnamurthy / DTE

Nearby, in Sector 132, Sify Technologies operates two data centres. According to the company's environmental, social, and governance report, all its data centres use freshwater for all operations,

centre consumes 26 million litres of water annually, Sify's two centres combined could be using around 3.64 billion litres of freshwater every year.

Residents of Galli No. 25, a cramped street opposite the Sify facilities, receive piped water from the government and rely less on borewells. But awareness of the data centres' existence is low. "I've seen the building, but I don't know what a data centre is," says food vendor Rohit Rathore. "These companies haven't done anything for us. The educated get jobs, but what about the rest of us?"

Sectors 62 and 132 fall under the jurisdiction of the New Okhla Industrial Development Authority (NOIDA), created under the UP Industrial Development Act, 1976, to oversee planned industrial growth. GB Nagar district comprises four development blocks, Bisrakh, Dadri, Dankaur and Jewar. Groundwater levels in Bisrakh, which includes Noida and much of Greater Noida, are already classified as overexploited.

In fact, things do not look good for all of GB Nagar. The stage of groundwater extraction in GB Nagar is 104.79 per cent, the *Dynamic Ground Water Resources of India 2023* report by the Central Ground Water Board showed. This means more water is being extracted than can be naturally replenished each year.

Policy action

GB Nagar has become one of India's busiest data centre corridors, now home to 17 operational or upcoming facilities, including those by AdaniConneX, Yotta Data Services Pvt Ltd, Nxtra, CtrlS, and STT, according to visual directory Data Center Map.

But the state's ambitions run high. In 2021, the UP government unveiled the Uttar Pradesh Data Center Policy 2021, a five-year framework to attract Rs 30,000 crore ($3.4 billion) in investments and develop a 900 MW data centre industry across the state. The policy also aims to establish at least eight private data centre parks — large campuses housing multiple facilities.

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The momentum is already visible. In 2023, data service provider STT GDC India signed a memorandum of understanding with the state government to invest about Rs 4,100 crore in new centres, describing Noida as "a promising and emerging" hub. The company's two major parks, planned

As of June 2025, the total proposed capacity for data centres in the state has reached 644 MW, drawing investments worth Rs 21,342.9 crore, according to government data. Of this, 99 MW has already been commercialised, including projects by Yotta, NTT Global Data Centres, Adani Enterprises Ltd, and STT Global Data Centre.

Like Karnataka, the Uttar Pradesh government has introduced a dedicated single-window clearance system to fast-track industrial projects, including data centres. The Department of IT and Electronics has set up a project management unit (PMU), staffed by outsourced professionals and consultants, to help implement the policy, oversee investment proposals, and recommend the disbursement of incentives. The PMU reports to an empowered committee, which clears projects worth over Rs 200 crore before they go to the state cabinet for final approval.

Businesses are pleased. "Greater Noida's strong policy and administrative ecosystem through the UP government's Data Center Policy, and the facilitative approach of the Noida Authority, create a business-friendly environment that streamlines approvals and makes it a preferred data centre destination," Yotta told *DTE*.

But, as in Karnataka, the Uttar Pradesh Data Center Policy 2021 is largely silent on water. It merely states that industrial area development authorities such as NOIDA and Greater Noida Industrial Development Authority (GNIDA) will ensure "24x7 uninterrupted water supply" to data centre units operating in their jurisdictions.

Yotta, which is based in Mumbai, told *DTE* that UP has explicit clauses requiring data centres to use treated, non-potable water, build on-site recycling systems, and avoid drawing from drinking water reserves." The company further asserted that "UP's policy mandates park-level water treatment and prohibits groundwater extraction." The policy only mentions that data centre parks shall set up water treatment plants.

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Government apathy

When *DTE* visited the offices of NOIDA, officials gave this reporter an incomplete list of data centres in their records, which they acknowledged was not comprehensive. They could not confirm the source of water for these facilities, though some mentioned the source for industries is recycled water. They

A senior official from Jal Nigam, the state agency responsible for providing drinking water and sewerage facilities, spoke to *DTE* on condition of anonymity. "NOIDA forwards requests from companies to us, detailing their water requirements. We supply water based on per capita calculations. If there's a shortfall, we ask industries to meet their needs independently or obtain permission from the groundwater department," the official explained. Jal Nigam, he added, also provides treated water to industries at Rs 5 per kilolitre (KL), typically for construction purposes.

At the Ground Water Department office, Executive Engineer Vishwajeet Singh confirmed that most of GB Nagar is a notified area, meaning groundwater extraction is restricted due to overexploitation. "We have a district groundwater council, comprising officials from the pollution control board and environment department, which issues permissions. We grant no-objection certificates only if companies commit to recharging two litres of groundwater for every one litre extracted," Singh said.

He added that industries must install rainwater harvesting systems or ponds, use flow meters to track usage, and submit weekly data to the department. "Groundwater is not a big problem in UP," he claimed. "We charge Rs 1.2 for every KL extracted."

DTE shared a list of data centres in UP with Singh, requesting information on which facilities had permits for groundwater extraction and how much they were drawing. Despite following up, there was no response.

Unlike in Bengaluru, GB Nagar's official records contain no publicly available data on water use by data centres. Environmental clearances reviewed by *DTE* include only a vague clause: "If the proposed project is situated in notified area of ground water extraction, where creation of new wells for ground water extraction is not allowed, requirement of fresh water shall be met from alternate water sources other than ground water or legally valid source and permission from the competent authority shall be obtained to use it."

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DTE also filed Right to Information requests with NOIDA, GNIDA, and the Ground Water Authority in UP's capital, Lucknow. As of publication, no replies have been received.

This is part three of a four-part series. Part four will examine how major data centre companies report, and obscure, their water consumption data. Read parts one, two and four of the series.

Groundwater | water crisis | Uttar Pradesh | Adani | Greater Noida | Noida authority | Noida | Noida real estate | Greater Noida Industrial Development Authority (GNIDA) | data centres | Yotta Data Centre Park | Sify

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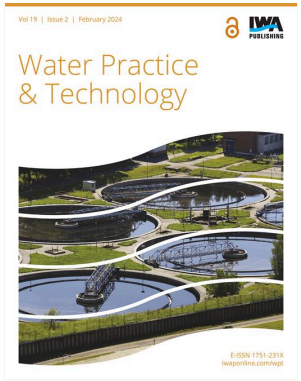

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RESEARCH ARTICLE | JANUARY 16 2024

Interceptor sewer for abatement of pollution in surface water

Radhey Shyam Tyagi; S. K. Singh; P. K. Goyal

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https://doi.org/10.2166/wpt.2024.005 **Article history**

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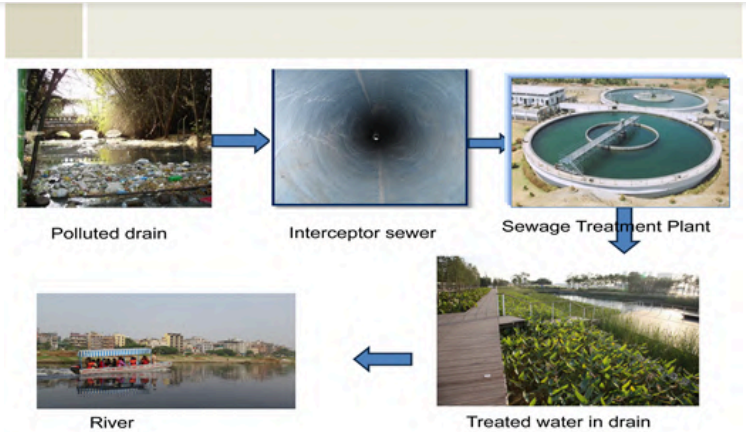

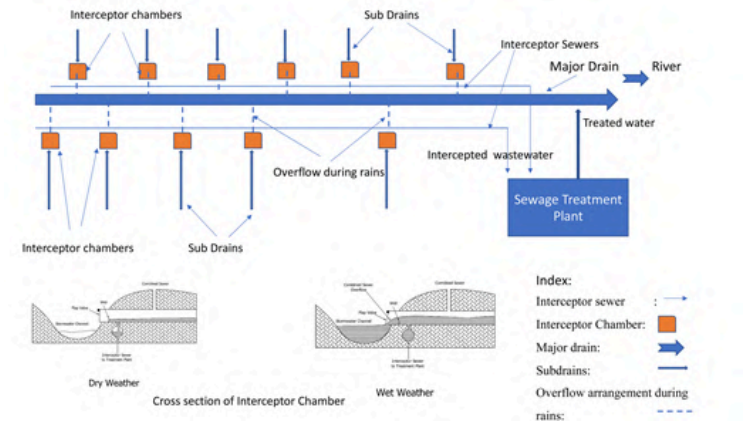

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Unplanned population growth in urban cities has largely caused unplanned habitations called slums. Due to various complexities, service providers are unable to provide basic amenities, i.e., water, roads, sanitation, and sewerage in these slums. Water, being the basic need for human survival, is either managed by these residents by extracting groundwater or the minimum required water is provided by the government through water tankers or tube wells. In the absence of sewerage facilities, sewage is discharged directly into stormwater drains, rivers, ponds, lakes, etc. It contaminates the freshwater of these water bodies. The Yamuna River (22 km stretch) from the Wazirabad Barrage to the Okhla Barrage, and about 600 lakes in Delhi, India, are highly polluted. To avoid such severe events of contamination of water resources, it is necessary to develop a system to intercept wastewater at the source, transfer it to the nearest sewage treatment plant, and treat it to the required discharge

ZHU Xiaojie, Journal of Sichuan Normal University (Natural Science), 2022

Load Flux of Nitrogen in Pollution Source and Remediation Measures of the Suohuangcang National Wetland Park
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an interceptor sewer along three major drains (Najafgarh, Supplementary, and Shahadra) for the abatement of pollution in river Yamuna, Delhi.

HIGHLIGHTS

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- The interceptor sewer project will reduce the organic and pathogenic pollution in river Yamuna.
- An interceptor sewer will trap wastewater at the source and convey it to STPs.
- Success of an interceptor sewer depends on the lateral coordination and cooperation of various stakeholders.
- CPCB and DPCC must monitor river water quality regularly and instruct the concerned authorities.

Keywords: Delhi, pollution abatement, sewer interception, water bodies, Yamuna River

INTRODUCTION

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River Yamuna starts from the Yamunotri Glacier, at an elevation of 6,320 m above the mean sea level, and after flowing 200 km, it is barraged at Tajewala. Around one-third of stored water is diverted into the Eastern Yamuna Canal for the water supply demand of U.P. and two-thirds of water into the Western Yamuna Canals for the water demands of Haryana and Delhi (Figure 1). After traversing around 1,376 km through the states of Himachal Pradesh, Haryana, Uttar Pradesh (U.P.), Uttarakhand, Delhi, Rajasthan, and Madhya Pradesh, it confluences with River Ganga at Allahabad called the Triveni Sangam. River Yamuna enters Delhi on the upstream side of Palla village, and after traveling through Delhi for around 48 km, it enters U.P. near the Okhla Barrage. River water quality in the stretch between Wazirabad and Okhla Barrages is horrible because of receiving massive wastewater discharge from 23 drains (Table 1) in the Delhi National Capital Region (NCR). These 23 stormwater drains carry untreated wastewater from unsewered colonies and discharge it into the river. The Najafgarh drain and supplementary drains confluence at the downstream side of the Wazirabad Barrage, and finally, release wastewater into the river. These two drains are the main polluting contributors that have wastewater discharge varying from 1,360 to 1,800 million liters per day (MLD) and 60% of the total pollution load. The total biological oxygen demand (BOD) load from these drains in the

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coliforms/100 ml (CPCB 2004). Septic conditions and sewage input enhance coliform growth and make water highly harmful for human consumption (Upadhyay *et al.* 2011). Due to the mixing of a considerable amount of solid waste and municipal and industrial effluents with river water, the microbial activity of the aquatic system results in the substantial depletion of dissolved oxygen (DO). At the downstream of Jaitpur (Delhi), the river also receives the discharge of Hindon cut river that carries wastewater from U.P. Hence, the river looks like a sewage canal between the Wazirabad Barrage and the Okhla Barrage, especially during dry weather. Nonavailability of fresh water on the downstream of the Wazirabad Barrage for dilution is also one of the major reasons for the poor water quality in river Yamuna (Paliwal *et al.* 2007; Sharma & Singh 2009). In the year 1994, the Hon'ble Supreme Court took Suo moto on an article 'Quiet Flows Maily Yamuna' published in the newspaper 'The Hindustan Times' about the pathetic/unhealthy condition of the river Yamuna, and issued notices to the Union of India and CPCB. This case became famous with the name 'Maily Yamuna Case' vide WP(C)/725/1994 and continued to be heard by the Apex Court of a five-judge Bench chaired by the Hon'ble Chief Justice of India. Other related central and state government departments became the party, such as the Ministry of Environment and Forest, GOI; Ministry of Urban Development, Government Of India (GOI), CPCB, Delhi Pollution Control Committee (DPCC), Department of Irrigation and Flood Control, GNCTD, Delhi Jal Board (Formerly Delhi Water Supply and Sewage Disposal Undertaking under Municipal Corporation of Delhi); Delhi Development Authority, Haryana and U.P. Govt.; MCD and Central Water Commission, etc.; responsible for the ecological flow in Yamuna, prevention of solid waste dumping, collection and treatment of 100% sewage generated in the city, river front development, quality monitoring of river water, treatment of industrial waste flowing into the river and regulations related to maintaining river water quality.

Table 1 List of stormwater drains, their discharge, and current status of trapping of discharge

S. no.	Name of drain (2)	Discharge of wastewater (3)			% Contribution of pol
		m^3/s	Cusecs	MLD	
1.	Najafgarh i/c Supplementary Drain	23.6375	834.7504	2,042.28	52.22
2.	Shahadra Drain	5.948	210.0634	513.93	13.14

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S. no.	Name of drain (2)	Discharge of wastewater (3)			% Contribution of pol
		m^3/s	Cusecs	MLD	
4.	Old Agra Canal at Okhla	2.788	98.463	240.90	6.16
5.	Barapulla drain	1.577	55.708	136.30	3.49
6.	Tuglakabad Drain	1.028	36.315	88.85	2.27
7.	Powerhouse Drain	0.981	34.667	84.82	2.17
8.	Dr Sen Nursing Home	0.748	26.338	64.44	1.65
9.	AbuFazal Drain	0.589	20.806	50.90	1.30
10.	ISBT/Morigate/Quadia Drains	0.523	18.481	45.22	1.16
11.	Saritavihar Drain	0.472	16.686	40.82	1.04
12.	Maharani Bagh Drain	0.306	10.829	26.50	0.68
13.	Jaitpur Drain	0.192	6.768	16.56	0.42
14.	Molahad Band Drain	0.162	5.709	13.97	0.36
15.	Kailashnagar Drain	0.137	4.847	11.86	0.30
16.	Tonga Stand Drain	0.132	4.655	11.39	0.29
17.	Shastri Park Drain	0.088	3.119	7.63	0.20
18.	Drain No.14	0.085	3.002	7.34	0.19
19	Metcalf House Drain	0.070	2.472	6.05	0.15

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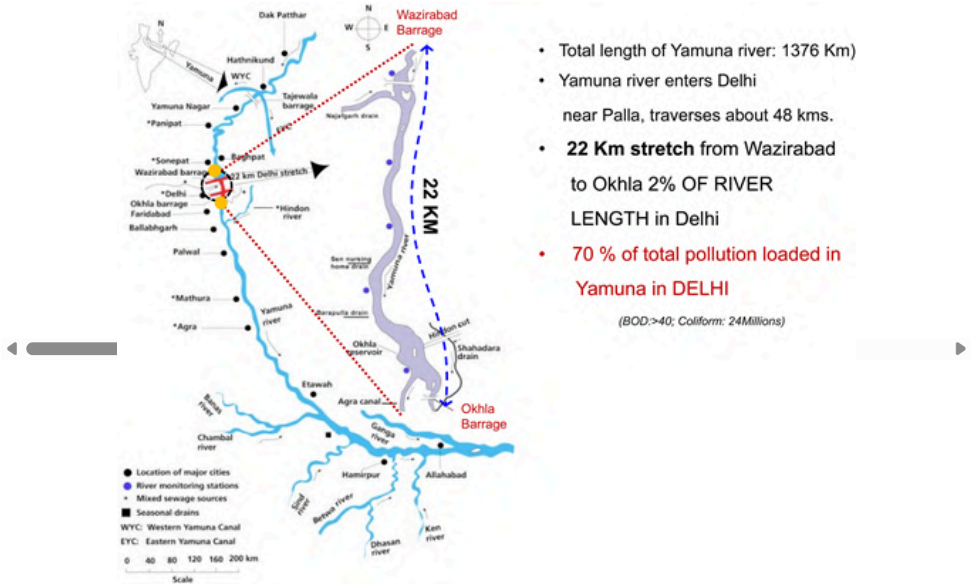
S. no.	Name of drain (2)	Discharge of wastewater (3)			% Contribution of pol
		m^3/s	Cusecs	MLD	
20.	Civil Mill Drain	0.072	2.560	6.26	0.16
21.	Magazine Road Drain	0.081	2.884	7.06	0.18
22.	Sweepers Colony Drain	0.069	2.442	5.98	0.15
23.	Khyberpass Drain	0.015	0.530	1.30	0.03
	Total Flow MLD			**3,910.68**	

Source: CPCB and Delhi Jal Board, March 2023.



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STUDY OF MAJOR SOURCES OF WATER POLLUTION

Rapid urbanization, unsewered areas, and slum settlements along water bodies

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Due to rapid urbanization and the inflow of migrants to the urban areas for earning their livelihood, environmental problems are increasingly severe across Asia, especially in India. It is attributed to the rising human population, urbanization, and economic activities. Unplanned population growth and poor wastewater management resulted in reduced water resources in a country like India ((Nallathiga 2008) and completely outpaced the augmentation of civic infrastructure. Physical and financial constraints in providing civic infrastructure like water, power supply sanitation, sewage treatment, housing, etc., at the same pace at which growth and in-migration occur, resulted in the discharge of wastewater in the nearby water bodies, i.e., ponds, drains, rivers, etc.

One of the major factors contributing to the pollution in water bodies and low capacity utilization of sewerage treatment plants is the absence of a sewerage network in large unplanned colonies of cities. For example, in Delhi, around 55% population lives in slum areas and is deprived of sewerage facilities. Providing sewerage infrastructures in these congested areas, which have developed in an unplanned manner over a period of time, is also highly complicated and difficult in terms of feasibility, legality, and time-consuming. Hence, wastewater generated in these colonies is discharged untreated into nearby waterbodies through drains. The population of Yamuna basins' towns and cities was estimated to be 118.34 million in the year 2018. It resulted in huge concretization, reduction in green areas, size and the number of water bodies, which were the source of water to meet the demand of the urban population (Chandramouli & GR 2011; Kumar *et al.* 2020) Along the banks of rivers, there are many illegal colonies within floodplains that discharge untreated waste and fecal residues causing pollution in river water (Supplementary material, Figure S1a, b). The embankments of all smaller and major drains have also been encroached upon, wherein habitats discharge their domestic waste directly into drains. Most of the households have constructed their toilets on the banks of these drains and are directly discharging their soil wastes into the drain, thus increasing fecal coliform in drain water.

Synchronization of sewage treatment capacity, aging of sewerage system, and poor functioning of STPs

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better environment. Like in Delhi, sewage generation is around 4,000 MLD, against which, the total treatment capacity in Delhi is hardly 2,815 MLD. But, only 1,937 MLD of sewage is being treated (CPCB 2021). Hence, around 878.67 MLD of wastewater is discharged into waterbodies untreated (Hima Jwala *et al.* 2020). This is the same conditions in other metro and urban cities. In many cities, the sewer pipe material is reinforced cement concrete which is more than 40–50 years old against its intended life of 30 years. Due to the aging factor and formation of hydrogen sulfide gas inside the sewer pipe line, the material, especially reinforcement, gets rusted and sewer pipes come to highly dilapidated conditions. In many places, the crown of pipes is broken due to rusting and it falls inside the sewer pipe resulting in settlement and chocking of the sewer which blocks the flow of sewage. Over the period, the silt deposited in the sewers becomes hard, which makes it difficult to clean the sewer (Supplementary material, Figure S2). The problem is aggravated during desilting, which further damages the sewer due to abrasion caused by silt removal equipment (Kumar & McMasters 2017). Refurbishment, rehabilitation, and upgrading old sewer lines are challenging and time-consuming in congested areas. Thus, without a proper and inadequate carriage system, sewage is not conveyed to the respective sewage treatment plants (STPs) and these plants are underutilized. The authorities responsible for sewerage management in cities are required to treat sewage as per the standard published vide notification no. GRS 1265 (E): Environment (Protection) Amendment Rules, 2017 (Supplementary material, Table S1). However, they have failed to maintain those quality standards due to many reasons**.** As per the CPCB report 2013, only 51% of sewage in metro cities, 32% in class-I cites, and 8% in class-II cities is being treated. Whereas, 10% STPs are functioning good, 36% satisfactory, 33% poor, and 21% very poor (Figure 2) (CPCB 2013).

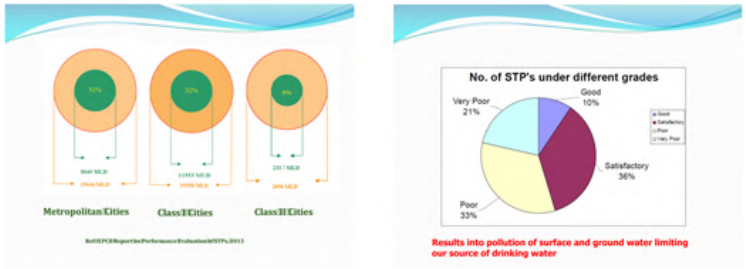

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Figure 2 Status of sewage generation, treatment, and functioning of STPs in India.

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Storm water drains are meant for carrying rainwater only. But, in the absence of sewerage facilities in slums, wastewater is discharged into these drains that ultimately outfalls into waterbodies and contaminates the available fresh water, reducing the water resources. In Delhi, 23 drains carrying wastewater of planned and unplanned colonies discharge into river Yamuna. According to CPCB, the river water quality standard of river Yamuna in the Delhi stretch have become class C. This classification is done according to the best use designated to the surface water (Sharma & Singh 2009). River water must have acceptable quality for the survival of aquatic life, flora, and fauna. As water for processing and drinking is available in abundance, there are substantial industrial activities in those cities situated along the banks of rivers, i.e., manufacture of sugar, distilleries, textile, leader, pulp and paper, food processing, chemicals, pharmaceuticals, oil refineries, thermal power, etc. resulting into the massive discharge of industrial waste (Sharma *et al.* 2020). The statewise list of industrial cities, their percentage contribution of pollution, and the total industrial discharge generated (Table 2). Despite government regulations for setting up effluent treatment plants at the outlets of such industries, the industrial effluent is bypassed and discharged into nearby drains untreated, which ultimately contaminates river water and further ground water, when it percolates into the ground.

Table 2 State-wise industrial estates along the Yamuna Riverbank, percentage contribution, and the total industrial discharge generated

S. No.	Name of state/Cities along bank
1.	Uttar Pradesh/Yamuna Nagar, Panipat, Sonipat, Bagpat, Delhi, Gautambudh Nagar, Ghaziabad, Mathura, Agı
2.	NCT of Delhi
3.	Haryana
4.	Madhya Pradesh

A large amount of solid waste is thrown by the residents into and on the banks of drains, rivers, and ponds. In Delhi, solid waste generation was estimated to be 17,000–25,000 TPD for an

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large area of landfills (MoEF GOI 2001). Hence, there will be a lot of pressure on the municipal bodies to manage even the residue of municipal waste in the future. Without an adequate solid waste management infrastructure in Delhi and less awareness programs, the residents throw their domestic waste in nearby water bodies, i.e., drains and rivers, ultimately increasing the pollution in water bodies.

Lack of dilution in rivers

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Since the entire quantity of raw water of river Yamuna is divided into Eastern and Western Yamuna Canals on the upstream side of the Tajewala Barrage, there is hardly any release of fresh water for ecological flow and dilution of pollutants in river Yamuna, on the downstream side of the Tajewala Barrage. On the intervention of the Hon'ble Supreme Court, and later NGT in 2017, the Haryana Government was directed to release 10 Cumec freshwater from the Tajewala Barrage as the ecological flow for the river. However, this quantity of water was so low that it percolated into the ground after traveling some distance, and no adequate freshwater was left to maintain the ecological flow up to the Delhi stretch. The surface and groundwater quality in the river basin has deteriorated alarmingly (Kumar *et al.* 2020). Whatever freshwater is seen in the Delhi stretch from Palla to Wazirabad Barrage is the quantity of fresh water released by Haryana for the drinking needs of Delhi, as per the memorandum of understanding signed among the basin states of river Yamuna, which is lifted at the Wazirabad Barrage for treatment at Chandrawal, Wazirabad, and Okhla water treatment plants. Hence, there is no freshwater left to be released downstream of the Wazirabad Barrage for further dilution of polluted river water. In the absence of adequate freshwater on the downstream of the Wazirabad Barrage, the quality of river water cannot be improved to the bathing standard quality (Supplementary material, Table S2), despite making all efforts to reduce pollution in the river Yamuna. This is the condition of most of the river basins in India.

ACTION PLAN FOR IMPROVEMENT OF WATER QUALITY IN WATER BODIES AND GROUNDWATER IN DELHI

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On the recommendation of the High-Power Technical Committee in the year 2006, constituted by the Hon'ble Supreme Court comprising of the senior representatives of the Central Water Commission, Central Pollution Control Board, Central Ground Water Board, CPHEEO under the Ministry of Urban Development, GOI, and CEO, Delhi Jal Board being the Convener, the Hon'ble

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drains, i.e., Najafgarh, Supplementary, and Shahdara, for the abatement of pollution in river Yamuna'. The objective of this concept was to intercept sewage flowing in small subsidiary drains before it enters the major drain and the intercepted sewage to be conveyed to the nearest STPs for proper treatment to ensure that only treated sewage is discharged into these drains and ultimately into rivers. The overall concept was to lay deep and large sized diameter sewer pipes along the major drains (Najafgarh, Supplementary, and Shahdara) to trap wastewater of sub drains at sources; augmentation of the existing capacity of 10-MLD STP at the mouth of the Delhi Gate drain (constructed as a pilot project under the Yamuna Action Plan (YAP)-I) up to 77 MLD; interception of remaining drains into Bela Road, Ring Road, and other nearby trunk sewers which were rehabilitated under the YAP-II, collected wastewater to be pumped to the Okhla STP. If required, additional STPs will be constructed after utilization of the full capacity of the existing plants. Interceptor sewer system concepts were conceived to reduce the environmental impacts on receiving waters by diverting the combined sewer flow from the original sewer outfalls to Wastewater Treatment Works (WwTWs). Interceptor sewer systems comprised large pipes, and pumping stations to pump wastewater into STPs. This concept was earlier tried in the Liverpool area as part of the Mersey Estuary Pollution Alleviation Scheme (MEPAS), which significantly improved the quality of River Mersey, resulting in the comeback of flora and fauna (Thomas *et al.* 2000, 2004).

SALIENT FEATURES OF INTERCEPTOR SEWER CONCEPT

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The key features of the interceptor sewer concept include trapping untreated sewage from around 190 sub drains of three major drains (Najafgarh, Supplementary, and Shahadra) into a 59 km long interceptor sewer to be laid along these three major drains through the micro tunneling method for the ease of construction, less inconvenience to the nearby people, and no damage to adjacent properties.

The interceptor chambers will be constructed in such a manner that during dry weather flow, the entire wastewater is trapped in the interceptor sewer. But during rain, excess wastewater beyond the capacity of the interceptor sewer is overflown into the major drains directly. It also involves the construction of trash racks to trap floating materials and screens at the intercepting chambers.

Seven lift stations are proposed to collect and pump the trapped sewage to the nearest STPs so that only treated effluent will be allowed to flow in the major drains (Figure 3). The capacity of the existing STPs at Pappankalan and Nilothi needs to be augmented. The entire unsewered

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Delhi Sewerage Master Plan (DSMP) 2031 (Delhi Jal Board 2015). The diameter and the depth of the interceptor sewer have been selected in such a manner that the interceptor sewer will act as a trunk sewer in the ultimate setup of the sewerage system and will be able to cater to the sewage discharge of the entire unsewered colonies in their command as per the proposed DSMP-2031 (Delhi Jal Board 2015). Hence, interceptor sewers would be completely independent and neutral to the time frame within which unauthorized colonies will be provided sewerage.

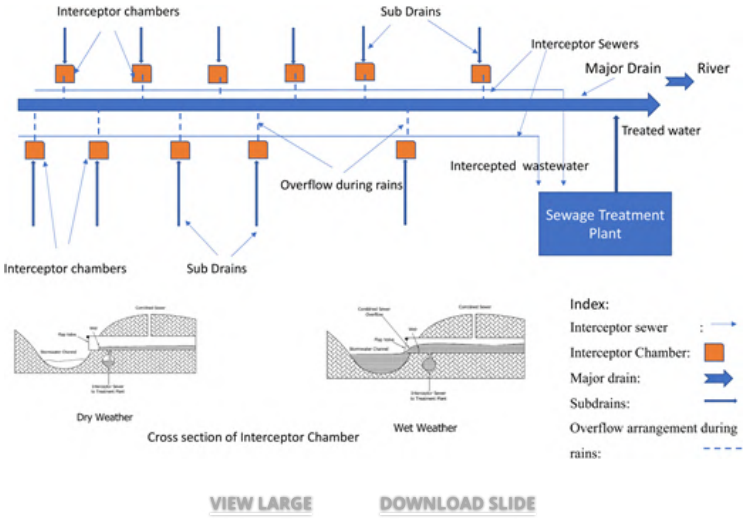

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Figure 3 Wastewater flow arrangement of the interceptor sewer.

The optimization of the design of interceptor sewer systems was adopted as per the design mentioned in (Karovic & Mays 2014). Being a combined sewer system, which carries wastewater and some rainwater from drains, the overflow chamber and its modeling is followed from (Xue *et al.* 2013). Details on the effectiveness of the best management practices are being followed as given in the study by Kaini *et al.* (2012). The best management practices are measures that contribute to improve or safeguard the condition of the receiving sub drains (Rathnayake & Tanyimboh 2015). In addition, simplified hydraulic models as in other studies (Meirlaen *et al.* 2002; Gernaey *et al.* 2006) are used, which are accurate and are computationally very demanding (Tavakol-Davani *et al.* 2016).

Pre-feasibility report

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(IS) along the portion of the major drains to intercept the sub drains and to convey trapped sewage into the nearest STP; A topographical survey along the proposed alignment of the interceptor sewer and up to 1 km of each sub drain; Soil investigation to find the water table, soil profile, and bearing capacities up to 50 m depth of the average ground level; proposed L-section of the interceptor sewer alongside drains; Locations of intercepting chambers and manholes; Measurement of dry weather flow in all the sub drains proposed to be trapped into the interceptor sewer; Collection of wastewater samples from the sub drains and major drains to find out the water quality, and subsequently, decide the best sewage treatment technologies; Encroachment observation, if any, along and across the alignment of the entire interceptor sewer; and Title and ownership of the land coming across the proposed alignment of the interceptor sewer along the major drains.

Methodology of construction and monitoring mechanism

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The methodology adopted in the construction of this entire project was the state-of-art. Modern technology, i.e., micro tunneling has been adopted in laying the sewer line and in the construction of lift stations and interceptor sewer chambers (Supplementary material, Figure S3). The entire length of the interceptor sewer has been laid through the micro tunneling method, causing minimum nuisance to the public and nearby structures. In fact, the micro tunneling method is costlier, but it is a better option in terms of social and environmental conditions, which cannot be worked out in terms of money, as it does not obstruct the movement of traffic and prevent environmental pollution. It also saves the cost of cutting of roads and their restoration. All the lift stations were constructed from top to bottom, which eliminated wider excavation and collapse of trenches. The big interception chamber has been provided with mechanical screening and scrapers to remove the floating material to avoid the chocking of sewer lines. Since most of the construction work of the interception chambers was carried out within the bed of drains, balloon types of cofferdams were used for the diversion of the flow of drains.

To ascertain the timely construction of this project, there was a three-tier monitoring mechanism, i.e., Project Monitoring Committee headed by a member (technical) to monitor the monthly progress as per the bar chart and coordination among various departments, the Project Monitoring Unit headed by the Chief Executive Officer, Delhi Jal Board to ascertain the smooth flow of funds as required, to complete the project in time, and the Apex Committee headed by the Chief Secretary, Delhi, once in 3 months, to monitor the progress and resolve the

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Works awards in six packages for fast completion of work

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The entire work was divided into six packages with the following scope of work as summarized in Table 3. Thus, the work on all the segments could be started simultaneously and completed as early as possible in a time-bound manner. The packages were divided in such a manner that every package was linked with a particular sewage treatment plant (Supplementary material, Figure S4).

Table 3 Package-wise length of interceptor sewer, number of intercepting chambers, and names of the associated STPs

Pack No.	Package description STP	Intercepting chamber no.	Interceptor sewers Dia, mm	Tota
1	Dwarka	3	900–1,600	2,25
2	Nilothi/Keshopur	40	900–1,600–2,000–2,400	23,4
3	Coronation Pillar	35	900–1,600–2,000–2,400	11,8
4	Rohini/Rithala	19	900–1,600	4,88
5	Yamuna Vihar	16	900–1,600–2,000	6,02
6	Kondli	19	900–1,600–2,000–2,400	11,7

Interception of remaining drains

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Apart from the above three major drains, the Delhi Jal Board took the initiative to trap the following drains into the nearby sewerage systems or set up STP at the mouth of drains: Magazine Road Drain, Sweepers Colony Drain, and Khyber Pass drains. These three drains have been trapped at the Arunanagar sewage pumping station, and sewage is pumped to the Oklha STP through the Nigam Bodh SPS and the Ring Road Trunk sewer. Metcalf House Drain: The connection of the drain to the Bela Road Sewer was not technically feasible. Hence, a small

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connection to the Bela Road sewer. Mori Gate Drain: The Delhi Jal Board has proposed an STP of 45 MLD capacity at the outfall point and asked the Delhi Development Authority to allot the land. Tonga Stand Drain: Partially trapped into the Nigam Bodh pumping station. Civil Mill Drain: Very low discharge, and the drain has been connected to the Ring Road sewer. Delhi Gate Drain: An additional STP of 68 MLD was constructed and commissioned in 2015, in addition to the existing 10-MLD capacity STP to treat the entire discharge of the drain. The Sen Nursing Home Nalah + Nalab 12A: 10 MLD is being treated at STP at its mouth and remaining trapped in the Ring Road sewer. Drain No. 14: The drain has been trapped in the Ring Road sewer. Barapula Drain: Barapula Drain is also one of the big drains which starts from Meharoli Badarpur road and, after traversing the entire south Delhi and receiving the discharge of hundreds of sewered and unsewered colonies, meets with Yamuna near Sarai Kalekhan. The Delhi Jal Board ultimately has proposed setting up 180 MLD STP at the mouth of this drain to treat wastewater of the Barapula Drain. Maharani Bagh Drain: Partially trapped in the existing sewer. Kalkaji Drain: Trapped in the existing sewer. Tehkhand Nalah: Not feasible for trapping. Tughlakabad Drain: Trapped.

Advantages and anticipated outcome of interceptor sewer concept

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After completion of this project, no untreated wastewater will enter the waterbodies, i.e., drains and rivers. The sewage coming from unsewered colonies, slums, etc., will be trapped at the source and diverted to the nearest STPs. Hence, only treated effluent will be allowed to flow into the drains that are out falling into the river at present; thus there is a reduction in the pollution of river water. New STPs would be constructed only after utilizing the existing unutilized STPs, which will reduce the project costs. It was anticipated that hardly new STPs of 318 MLD capacities would be required after successfully commissioning the interceptor sewer. The interceptor sewer has been designed to cater to the dry weather flow of the sub drains and a maximum of up to 80% of water supplied at 272 LPCD (sewage generation as per CPHEEO norms) of the total population under the catchment of the drain. The provisions of overflow structure of surplus discharge during rains shall be made in such a manner that excess water during rains will flow directly into the major drains instead of going to the interceptor sewer. It will avoid the overburden of sewage at all respective STPs during rains. During the conceptualization of the interceptor sewer project and allied works, river quality modeling was conducted, and it predicted the improvement in the quality of river water as in Figure 4.

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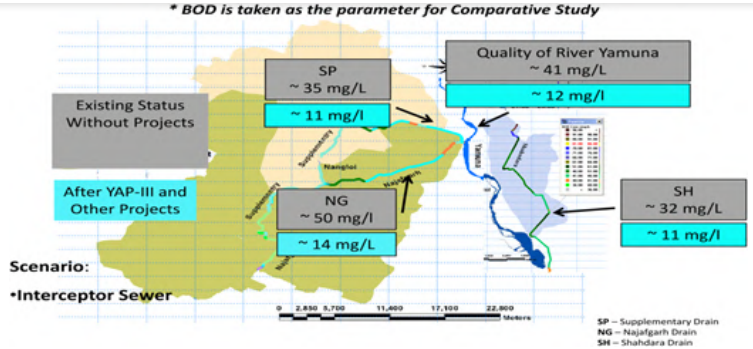

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Figure 4 Anticipated quality of river Yamuna after the implementation of the interceptor project.

Since the interceptor sewer has been completed to the extent of 99%, the quality of water in river Yamuna has been improved as per the CPCB report 2020–21(CPCB 2021) (Table 4). River water quality at the Nizamuddin bridge was most critical from 2008 onward, i.e., more than 40 ppm, which was found to be 26 ppm (Average) in September 2021, after the completion of the interceptor sewer. Near the Okhla Bridge, the BOD was reduced from 32 ppm (In 2008) to 11 PPM in 2021 which is close to the forecast in 2008. River water quality could be much improved with the release of adequate freshwater from the Wazirabad Barrage for dilution. These efforts are not adequate until various stakeholders continue to work jointly together to prevent pollution in the Yamuna River by treating sewage and industrial waste as per the new quality standards, proper solid waste management, and discharge of ecological flow in the river round the year (Figure 5).

Table 4 Quality of river water in September 2021, after commissioning of the interceptor sewer

Location parameters	Wazirabad (u/s)	ITO	Nizamuddin bridge	Okhla barrage
pH	7.7	7.2	7.2	7.4
Dissolved oxygen (mg/l)	8.0	Nil	Nil	5.6
Conductivity (μohm/cm)	483	1,070	1,069	967
Chemical oxygen demand (mg/l)	27	45	52	37

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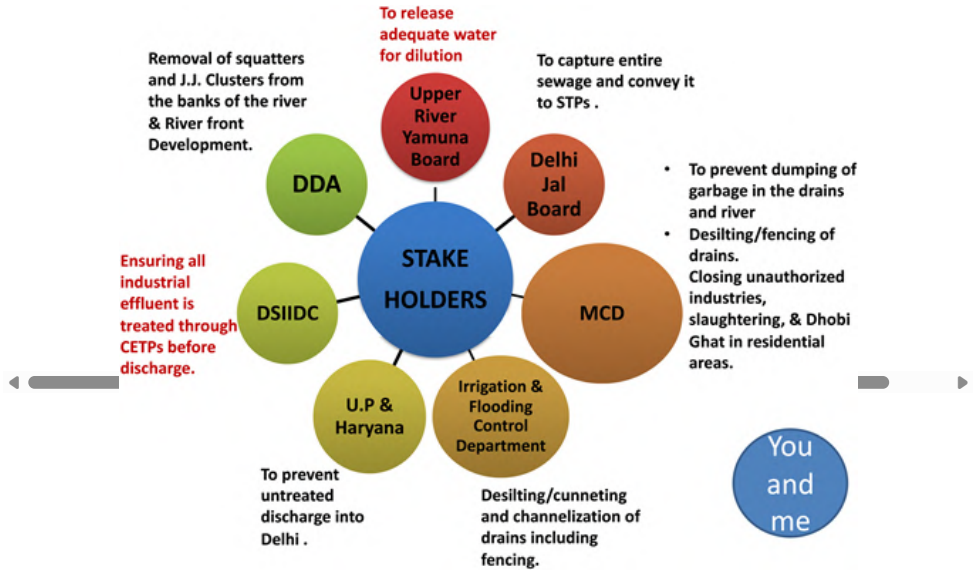
Location parameters	Wazirabad (u/s)	ITO	Nizamuddin bridge	Okhla barrage
Biological oxygen demand (mg/l)	4.9	12	15	11
Chloride (mg/l)	53	155	157	132
PO_4-P (mg/l)	BDL	0.4	0.4	0.8
Anionic surfactant-MBA (mg/l)	BDL	1.28	1.23	1.37
Ammonical nitrogen-N (mg/l) (mg/l)	2.6	4.6	9.7	9.8
Total coliform (MPN/100 ml)	13×10^2	54×10^5	24×10^5	14×10^5
Fecal coliform (MPN/100 ml)	45	33×10^4	41×10^4	26×10^4



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DISCUSSION

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DO is necessary for aquatic life which is largely sensitive to changes in the BOD load. The larger the BOD, the lower will be the DO, which results in an anaerobic reaction and production of obnoxious gases. The data of CPCB shows that a higher BOD and a lower DO are present between Wazirabad and Okhla Barrages. Even if Delhi has 100% treatment capacity with treatment standards of BOD < 30 PPM at all STPs, the BOD in the above stretch is more than 12 PPM (Singh *et al.* 2019). The trend of river water quality for the last 12 years shows that the river water quality in terms of BOD reduced in 2012–13, but it started to rise again thereafter till 2018, and reached up to 60 ppm, but the minimum BOD remained constant. The BOD in river water again reduced for one year in 2019, but it started rising again. From 2020 onward, the interceptor sewer was commissioned in phases. Consequently, the maximum BOD in river water started to reduce and reached up to 26 PPM (Figure 6). However, bathing quality in rivers requiring BOD < 3 mg/L and DO > 4 mg/L can only be achieved after dilution with adequate fresh water if released from upper storage dams of river Yamuna and upgradation of all STPs as per the standard prescribed by CPCB for sewage treatment standards. The quantity of freshwater to be released into the downstream of the Wazirabad Barrage to attain the bathing water quality in river Yamuna is still to be worked out. It is also not clear whether all the basin states will agree to spare their shared water to be released into the river compromising their drinking, agricultural, and industrial water demands. The Hon'ble National Green Tribunal (NGT) has ordered the release of only 10 m^3 per second of freshwater at the downstream of the Tajewala Barrage, which is insufficient even for the ecological flow of the river.

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Figure 6 Trend of BOD for the last 12 years in the Yamuna River near the Nizamuddin bridge, Delhi.

The interceptor sewer has been designed to take care of the wastewater of the drains within the territory of NCT Delhi. But a huge quantity of wastewater is also coming from the neighboring states, i.e., Haryana and U.P. The Badshapur Drain from Gurugram carries around 400–450 MLD of wastewater and discharges into the Najafgarh drain. Similarly, drain No. 6 coming from the industrial areas of Samalkhan, Haryana also carries around 45–50 MLD of wastewater and discharges into the supplementary drain in Delhi. Khureji Khas, Loni Road, and Sahibabad drains carry approximately 270–320 MLD of wastewater from U.P. and discharge into the Shahdara Drain. The respective states must treat the wastewater from these drains before discharging it into Delhi's drains to further improve the quality of river water.

Interceptor sewers will take care of only 75% of the total pollution load in river Yamuna, i.e., North, West, and East Delhi's drains. Delhi must prepare a separate plan for trapping wastewater discharges from the remaining drains and finally implement the DSMP 2031, which is the ultimate solution to prevent sewage flow into water bodies.

It is also observed that the interceptor sewer project has been completed to the extent of 99%. Around 1,080 MLD of wastewater has been intercepted and around 500 MLD of greywater still flow into rivers through drains due to unsewered areas in South Delhi. Besides, the residents have not connected their greywater disposal arrangement with the Delhi Jal Board sewer. Hence, greywater also flow into the drains and finally into rivers. Three STPs, i.e., Kondli (205 MLD), Rithala (182 MLD), and Okhla (563 MLD) are being rehabilitated and ungraded. By the time these STPs are commissioned, the sewage trapped in these plants cannot be treated. After commissioning of these plants, the quality of river water will further improve. Delhi must upgrade all remaining STPs to the treatment standard as prescribed by CPCB to achieve the desired river water quality standards.

Sewage reaching STPs is not purely domestic sewage. It is mixed with industrial waste coming from non-conforming industries illegally set up in residential areas. Hence, many times, the treatment process of sewage is affected, and the results do not meet the desired/designed standards. The disposal of sludge from STPs is also a major challenge. The Delhi Municipal Corporation does not allow sludge at their Sanitary Land Fills (SLFs), as they have exhausted their capacities at all SLFs. Hence, digested sludge is stacked either at STPs itself or disposed of as per the goodwill of the contractors engaged in disposing of silt/sludge, which also affects the treatment process.

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CONCLUSION

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The interceptor sewer project is one of the robust solutions to reduce the organic (BOD) and pathogenic (coliforms) pollution in the river Yamuna. Around 1,080 MLD of wastewater has been trapped from interceptor sewers against the targeted 1,100 MLD and is being treated at the respective STPs, which has improved the quality of river water to some extent, as anticipated. If dilution is not possible, the quality of the treated effluent will have to be of tertiary standards. Thereafter, the quality of river water will further improve by a natural self-cleaning process while traveling in the drains and rivers for miles together. After improvement of water flowing in the drains and rivers, groundwater quality will also improve, thus adding a source of groundwater in the future. However, the success of the interceptor sewer depends on the lateral coordination and cooperation of various stakeholders. All the above departments, being under different authorities and governments must come under one umbrella to monitor the progress of the projects undertaken by the respective departments and to direct the respective authorities appropriately. The regulating authorities, i.e., CPCB and DPCC, must monitor river water quality at regular intervals and pass the instructions to the concerned authorities appropriately. Thus, this concept can be replicated anywhere globally. However, the quantity of freshwater availability for dilution will ensure whether the bathing quality of river water can be achieved or not. After cleaning river water to bathing quality, the same can be utilized as raw water at water treatment plants. This study is not limited to the NCT of Delhi, but can be replicated elsewhere in India and abroad, for the abatement of pollution in surface water. The concept and methodology may little bit differ for different towns or cities, depending on their geographical and hydrological conditions.

DATA AVAILABILITY STATEMENT

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All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

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The authors declare there is no conflict.

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Supplementary data

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GUIDELINES

FOR PREPARATION OF PROJECT REPORTS

UNDER

NATIONAL RIVER CONSERVATION PLAN
AND
NATIONAL GANGA RIVER BASIN AUTHORITY

गंगा सेवा भारत सेवा

जहाँ है हरियाली ।
वहाँ है खुशहाली ।।

Ministry of Environment & Forests
National River Conservation Directorate
New Delhi

December, 2010

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FOR PREPARATION OF

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Ministry of Environment & Forests
National River Conservation Directorate
New Delhi

Prepared by
Alternate Hydro Energy Centre
Indian Institute of Technology, Roorkee

December, 2010

ACKNOWLEDGEMENT

These guidelines are based on the developments that have taken place and the experience gained in implementing the schemes under NRCP and NGRBA of the Ministry of Environment and Forest since the earlier guidelines were issued in the year 2002. These guidelines have drawn considerably from the publications and internal documents of NRCD, CPHEEO, JNNRUM, CPCB and New Delhi office of the World Bank.

Interaction with the officials of NRCD/MoEF has helped in crystallizing and finalizing the guidelines. We are especially grateful to the group of officials of the NRCD/MoEF led by Shri Rajiv Gauba, Joint Secretary and including Shri B Sikka, Director, Dr (Mrs.) R Dalwani, Director, Shri Rajiv Sinha, Director, Dr. K. C. Rathore, Director, Shri Lalit Kapoor, Director, Shri B. B. Barman, Additional Director, Shri Lalit Bokolia, Joint Director, Shri S. K. Srivastava, Deputy Director, Shri Ajay Raghav, Deputy Director, Shri S. K. Singh, Deputy Director and Shri A Raju, Deputy Director for their very valuable contributions. Consultation with officials of the CPCB and NGRBA states has been useful. Suggestions received from Prof KJ Nath and Dr Vinod Tare is thankfully acknowledged.

Shri Vinay Shankar, Shri RP Sharma, Shri V. K. Gupta and Dr. A. Sinvhal were other members of the team that prepared the guidelines. Their contributions are thankfully acknowledged.

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ABBREVIATIONS

ADP	:	Area Development Plan
ASP	:	Activated Sludge Plant
BGL	:	Below Ground Level
BHP	:	Break Horse Power
BOD	:	Biological Oxygen Demand
CDM	:	Clean Development Mechanism
CER	:	Certified Emission Reduction
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board
CPHEEO	:	Central Public Health Environmental Engineering Organisation
CSP	:	City Sanitation Plan
CTC	:	Community Toilet Complex
CW	:	Civil Works
CWC	:	Central Water Commission
DA	:	Drainage Area
DBO	:	Design, Build & Operate
DG	:	Diesel Generator
DO	:	Dissolved Oxygen
DPR	:	Detailed Project Report
EM	:	Electrical and Mechanical Works
FAB	:	Fluidized Aerated Bed
FR	:	Feasibility Report
GAP	:	Ganga Action Plan
GIS	:	Geographical Information System
GL	:	Ground Level
GoI	:	Government of India
GRP / DI	:	Glass Reinforced Plastic / Ductile Iron
HRD	:	Human Resource Development
HUDCO	:	Housing and Urban Development Corporation Ltd.
IPS	:	Intermediate Pumping Station
IWBC	:	Integrated Wood Based Crematoria
JNNURM	:	Jawahar Lal Nehru National Urban Renewable Mission
LCC	:	Life Cycle Cost
LCS	:	Low Cost Sanitation
MLD	:	Million Litres Per Day
MoA	:	Memorandum of Agreement
MoEF	:	Ministry of Environment and Forests, Govt. of India
MNRE	:	Ministry of New and Renewable Energy Sources, Govt. of India
MoUD	:	Ministry of Urban Development, Govt. of India
MPS	:	Main Pumping Station
MSW	:	Municipal Solid Waste

NGRBA	:	National Ganga River Basin Authority
NIT	:	Notice Inviting Tender
NRCD	:	National River Conservation Directorate
NRCP	:	National River Conservation Plan
O&M	:	Operation and Maintenance
PERT / CPM	:	Programe Evaluation Review Technique/ Ciritical Path Method
PHED	:	Public Health Engineering Department
PMU	:	Project Management Unit
PS	:	Pumping Station
SBR	:	Sequential Batch Reactor
SOR	:	Schedule of Rates
SPCB	:	State Pollution Control Board
SPMU	:	State Project Management Unit
SPS	:	Sewage Pumping Station
SS	:	Suspended Solids
STP	:	Sewerage Treatment Plant
SWM	:	Solid Waste Management
SWM	:	Sewerage Water Management
TF	:	Trickling Filter
TPI	:	Third Party Inspection
TSS	:	Total Suspended Solids
UASB	:	Upflow Anaerobic Sludge Blanket
UFW	:	Unaccounted for Water
UIDSSMT	:	Urban Infrastructure Development Scheme for small and Medium Towns
ULB	:	Urban Local Bodies

SALIENT FEATURES OF GUIDELINES FOR PREPARATION OF REPORTS UNDER THE NGRBA/ NRCP

1. City Sanitation Plan (CSP) shall be the basis for planning and formulating projects. Therefore, preparation of city sanitation plans, wherever it doesn't exist, will be the first step. However, CSP shall be prepared on the basis of City Development Plan (CDP), if so drawn and finalized for the city.
2. Holistic approach and provision of integrated sewer network up to house-property line in place of drain interception and diversion. This will ensure full coverage of the town and thereby transportation of entire sewage to treatment plants for optimal utilization.
3. Dovetailing with projects under JNNURM/UIDSSMT/ State Plan is compulsory. This will ensure optimal utilization of resources on priority basis.
4. Design, Build & Operate (DBO) model for efficient operation and maintenance (O & M) of River Conservation schemes.
5. First 5 years O & M cost to be in-built in the project cost. This will ensure unhindered O & M of assets which is necessary for achieving the river cleaning objectives. Next 10 years O & M cost to be also worked out with revenue generation plan. The O & M responsibility beyond 5th year will rest with the State Government/ ULB.
6. Stakeholder consultation at the stage of formulation and implementation of the project. This is to ensure active involvement of various stakeholders and the civil society to generate support and encourage ownership.
7. Signing of tripartite MoA among Government of India, State Government and ULB is mandatory. This will bind these three tiers of Government to ensure fulfillment of respective commitments in terms of release of funds, timely completion of projects, ensuring house connection to sewer and operation & maintenance of assets, etc.
8. Active association of ULBs in project formulation and siting of important infrastructures such as STP, PSs etc. This will ensure their co-operation in getting land in time which is crucial for timely completion of projects.
9. Dedicated Cell in States for implementation of projects. This will ensure fulltime deployment of adequate number of skilled technical personnel by the States which is critical for proper supervision, quality control, adherence to completion schedule and project cost control.
10. Appraisal of project proposals by independent Institution/Experts. This will enhance quality of DPR in addition to cost optimization. Any short comings in the planning and designing of the project will also be addressed through such appraisal.
11. Third Party Inspection (TPI) for implementation of projects is required. This will strengthen State Government agencies in maintaining the desired quality of work. Generally, States are not in a position to deploy adequate technical personnel for round the clock supervision of works and hence this will be an effective mechanism to ensure progress and quality of works.

12. Emphasis on recycling and reuse of treated sewage. Agricultural and industrial demand on fresh is laid water is very high. On the other hand, drawling of fresh water from rivers for these purposes may also contribute to pollution as dilution reduces. Therefore, there should be an endeavor to maximize the use of treated sewage.
13. Degree of treatment linked to availability of fresh water in river. Instead of uniform level of treatment, the approach of varying level to be followed as water quality is directly linked with availability of fresh water in a particular stretch of river.
14. Use of digital maps, other 'information – communication technology' (ICT) tools and software for project planning and design. In order to improve scientific and engineering design and planning, good quality maps and computer aided design are necessary.
15. Coverage of schemes for management of Municipal Solid Waste affecting river water quality. Different types of solids and solid waste also contribute to river pollution significantly. Therefore, this activity will be taken up selectively under the program.
16. Priority to undertake River Conservation Projects for City/ Towns polluting river stretches identified by CPCB. The list of polluted stretches published by CPCB from time to time will primarily be the basis for selecting rivers and towns to be included under the program.
17. Adoption of innovative and best technology options for treatment of sewage. Technology selection is critical to technical and financial sustainability of assets created. Detailed and careful exercise may be undertaken for selection of the best option on a case to case basis. For this, life cycle study of technology options along with detailed analysis in respect of performance will be mandatory at FR stage.
18. DPR preparation to be preceded by Feasibility Report (FR). This will focus on option exploration and selection of locations for major infrastructure. This will also help reduce uncertainty in land acquisition and pre-emptively resolve other local issues, thus contributing to timely execution of project.

In addition, the following good practices will be promoted under the revised guidelines:

19. Incorporation of Rain water harvesting in community sanitation schemes.
20. Promotion of solar energy for community sanitation schemes.
21. Improved sanitation scheme based on higher user charges where applicable.
22. Up gradation of existing community sanitation and sewerageinfrastructure.
23. Thrust on innovative River Front Development (RFD) Projects.
24. Introduction of “river festival” and “river runs” under the public participation, Information, Education & Communication (IEC) activities.
25. Design parameters of STP to be considered based on actual measurement and analysis.

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

i. The Ministry of Environment and Forests (MoEF) has been implementing an ambitious programme of pollution abatement of rivers in India. It started in 1985 with the Ganga Action Plan (GAP) and gradually extended to other polluted rivers through National River Conservation Plan (NRCP). The current programmes covered under NRCP include works in 172 towns along polluted stretches of various rivers spread over 20 states. To give a fresh impetus to pollution abatement of River Ganga and its tributaries, a major initiative under the National Ganga River Basin Authority (NGRBA) has been started in 2010. The National River Conservation Plan Scheme is given as Annexure 1. The objectives, approach and functions of NGRBA are given as Annexure-2.

ii. Given the size and scope covered under these programmes that involve a large number of agencies and individuals all over the country, it is necessary that proposals are prepared by the implementing agencies in the States to address the specific wastewater management problems to achieve the objectives of the programmes. This established the necessity of comprehensive guidelines that would not only help in addressing the various issues concerning the river pollution but also in expediting the decision making process.

iii. The guidelines for preparation of DPRs, presently in force, were issued by NRCD in 2002. However, since then a number of developments have taken place and lessons have been learnt that necessitate the revision of guidelines on preparing the DPRs. The guidelines will help state agencies in preparing quality proposals to address river pollution problems in a holistic manner.

1.2 CHANGES OCCURRING SINCE THE GUIDELINES WERE ISSUED

Significant developments that have taken place are mentioned below.

1.2.1 National Ganga River Basin Authority (NGRBA)

The Central Government has given Ganga the status of a 'National River' and has constituted a 'National Ganga River Basin Authority' (NGRBA) as an empowered planning, financing, monitoring and coordinating authority for the Ganga River with new institutional structures. The objective is to have the river basin as the unit of planning, a shift from town centric to river basin approach and to have a comprehensive response covering water quality and flow, sustainable access, environment management, prevention and control of pollution and food and energy security, in the form of a national mission. The World Bank is considering supporting a major investment under NGRBA.

1.2.2 Identification of Polluted Stretches by CPCB

The Central Pollution Control Board (CPCB) has identified nearly 150 polluted stretches of rivers in the country that require pollution abatement programmes and the list is likely to be expanded, given the pace at which the country is growing. Once a town is selected for inclusion under the programme based on the CPCB criteria, DPRs are prepared town-wise. The selected towns are divided into various sewerage districts according to topography and slopes. DPRs of

various districts may be prepared and presented in different volumes. Similarly, DPRs of non-sewerage components like low cost sanitation, crematoria, river front development, for a town may again be prepared in different volumes. The underlying need is that a comprehensive DPR should conform to a city level sanitation plan that would help reduce the pollution of river to the desired level.

1.2.2 Innovative Initiatives of NRCD

Several initiatives have been taken by NRCD such as public consultation, signing of MoAs with states and urban local bodies (ULBs), inclusion of O&M expenditure for 5 years in the project cost etc.

1.2.3 Introduction and Coverage of JNNURM

The Ministry of Urban Development (MoUD) launched a new programme in the current Plan known as Jawaharlal Nehru National Urban Renewal Mission (JNNURM), which has many similar components but with divergent objectives. Also, MoUD has an ongoing programme of 'Urban Infrastructural Development Scheme in Small & Medium Towns (UIDSSMT) under which many schemes covered under the NRCP, such as the schemes of wastewater management and solid waste management, are eligible for funding. These schemes need integration and synchronisation with the programmes of MoEF aimed at improving the quality of waters of rivers.

1.2.4 International Funding

International Funding Institutions such as the World Bank have pledged supporting the NGRBA programme.

1.2.5 Review of pollution abatement projects in the Ganga Basin

The World Bank, in a study to review pollution abatement projects in the Ganga Basin, has identified deficiencies needing attention and corrective action. AHEC in IIT Roorkee has also been examining DPRs received by the NRCD for funding and found areas where improvements are needed. A gist of the deficiencies is given below:

i. Identification and understanding of problems and their causes is often inadequate.
ii. In the DPRs, targets are expressed as physical outputs or assets to be created. The outcome should conform to performance and bench marking of assets through O&M.
iii. Several factors such as capital cost, technology, cost of O&M and its recovery, ability and capacity to execute the project, social and environmental consequences need to be kept in consideration while selecting the most appropriate and maintainable option out of a number of possible solutions.
iv. The DPR often does not contain detailed information and analysis of existing assets and their condition, options considered, justification of the proposed solution.
v. Survey and investigation done, based on which the DPRs are prepared, need improvement.
vi. A number of aspects such as implementation of projects, their management and O&M arrangements, financial strength of the Urban Local Bodies or of the State Government,

infrastructure available such as availability of electricity to run the facilities created and desirable institutional actions required are not reflected properly.

vii. Involvement of stake holders and civil society in the projects needs to be emphasised.

viii. Often, the quality of survey and investigation is poor.

ix. The DPRs stress more on cost estimates than being a document that would emphasise and analyse the problem with clarity, come out with solutions and then select the most cost effective option to achieve the desired outcome, keeping in view the capacities of the institutions and social and financial concerns and interests of other stake holders.

x. The Urban Local Bodies are generally not regarded as the primary stake holder.

xi. The team that is entrusted with the preparation of the DPR consists mainly of engineers. Professionals with expertise in financial, economic and social matters are also to be associated. Since the pollution abatement project affects every resident of the town and, indeed of the basin, it is necessary to ensure that there is consensus about and involvement with the pollution abatement projects and the project addresses the felt needs of the plural society that we have in our towns. Activities such as social surveys, programmes to secure stakeholder participation have to be undertaken. Likewise, economic informationa technology and financial issues are of concern to every resident. To deal with these aspects it is desirable to associate persons who specialise in social sciences with the team that prepares the project.

xii. Preparation of the DPR is generally done by lower level of engineering staff and is not properly supervised.

xiii. In cases where Consultants are appointed to prepare DPRs, they are not necessarily highly skilled. Too much independence is given, their work is unsupervised and often quality checks are not undertaken.

xiv. In cost estimates, a provision to encourage innovation and flexibility to the bidder to quote alternative items may be provided.

xv. House connections to ensure flows in the sewer system may have to be provided.

xvi. As the mission Clean Ganga stipulates that no untreated sewage and industrial waste water would be allowed to be discharged into the river Ganga beyond 2020, the DPRs of projects in the Ganga basin are to be proposed, based on comprehensive planning of a city, including isolated clusters.

1.2.6 Preparation of Project Reports

Presently the DPRs are submitted without any CSP and Feasibility Reports. This practice has several disadvantages as mentioned below:

i. Absence of Integrated Approach

The Schemes proposed are independent and disparate and do not get integrated into a plan of area development. Many components Schemes of Pollution Abatement of Rivers will fit into such a plan. For example, river front development, setting up crematoria, plantation and community toilet complexes can smoothly merge in a river bank area development plan.

ii. Exploration of Options

Direct preparation of DPR may result in not properly exploring options to find solutions for the identified problem in a cost effective and sustainable manner and ignoring socio-economic and

institutional factors.

iii. Identification of Agencies for Schemes

In the absence of a feasibility report identification of agencies that are best suited to handle a particular scheme was not necessarily well thought out and reasoned giving rise to the possibility of mismatch.

1.3 REVISION OF GUIDELINES – SALIENT FEATURES

In light of the above background and developments, a need for revision of guidelines of 2002 has arisen and accordingly guidelines have been revised.

While many provisions of the earlier guidelines are still valid there is a need for change in others. Salient features of the revised guidelines are given below.

1.3.1 Adoption of Holistic Approach

So far the focus was on interception and diversion of drains and installation of STPs. It did not ensure that all the wastewater generated was taken to and treated in the STPs. A holistic approach in preparing pollution abatement projects is now to be adopted. It will include river basin approach and provision of an integrated sewer network up to the house property line. Slums and individual houses having no space for House Hold (HH) installation of toilets shall be covered through community toilets. The new approach will ensure full coverage of the city and thereby transportation of entire sewage to STPs for optimal treatment and utilisation.

1.3.2 Identification of Polluted Stretches

The Central Pollution Control Board (CPCB) has identified nearly 150 polluted stretches of rivers in the country that require pollution abatement programmes and the list is likely to be expanded, given the pace at which the country is growing. Towns that need to be covered under the NRCP are to be identified on the basis of these polluted stretches.

1.3.3 Multi Stage Preparation of Project for the Selected Town

i. For the selected town it will be helpful if a plan was prepared in which all sources of pollution in the town were identified to achieve the outcome of improved water quality of rivers and environmental improvement. It should include all needed schemes - both that are funded by the NRCD and others that are not funded by it but are eligible for funding under the Schemes of other Ministries / Departments. This plan is called the City Sanitation Plan, which will form the bedrock of planning and formulating projects. Its preparation has been included as a necessary first stage.

ii. For sewerage schemes that offer a number of options and whose cost is high, it will be mandatory to prepare a feasibility report in which all available options are evaluated and the optimal option is selected. For the selected option the DPR would be prepared. For non-sewerage schemes DPRs are to be prepared straight away based on the city sanitation plan.

iii. Thus, these guidelines provide for a three stage preparation of projects relating to sewerage schemes and two stage preparation projects for non-sewerage schemes for pollution abatement of the river
   a) City sanitation plan
   b) Feasibility report and
   c) Detailed project report.

In order to save time, effort and expenditure, for preparing the city sanitation plan and the feasibility report, secondary data – data that is already available - should be used. However, if it is felt that it is necessary to have some data for preparing these reports and it is not available, it should be generated.

1.3.4 Dovetailing and Synchronisation with projects under JNNURM/ UIDSSMT/State Plan

It has been made obligatory that projects proposed or approved under schemes such as JNNURM, UIDSSMT or state plan are dovetailed and synchronized with the projects proposed under NRCP/NGRBA. It will ensure optimal utilization of resources on priority basis.

1.3.5 Institutional Arrangements and Implementation Mechanism

A number of activities, some of which are mentioned below, need to be undertaken and for each there should be an institutional arrangement from the State Government, down to the ULB, to discharge responsibility for the component schemes.

i. Identifying polluted stretches of the river and sources of pollution in the state.
ii. Identifying causes of pollution and towns that are responsible for pollution in the river.
iii. Awareness generation and involve stake holders at various levels.
iv. Preparation of projects
v. Implementation and third party inspection
vi. Supervision, guidance, quality control, adherence to completion schedule and project cost control
vii. O&M
viii. Monitoring and evaluation

To ensure that the above functions are performed efficiently and effectively, dedicated cells are necessary in the states. Accordingly, a State Project Management Unit (SPMU) has been suggested in the state government with representation of the concerned departments. In states within the Ganga basin SPMU may be appointed by the State Ganga River Conservation Authority. In other states, the government in the department of Urban Administration may appoint the SPMU. The executive arm will be the state implementing agency, the organization which deals with projects related to water and waste water in urban areas.

At the level of the district or the town where actual projects are implemented there is a PMU with the DM/DC/Collector or the President of the District Planning Committee or the Mayor/President of the ULB as its chief and representatives of the ULB and departments who are to handle the schemes under the NRCP.

It is necessary to secure active association of the ULB in project formulation, siting of and

getting land for important infrastructure such as sewage pumping stations and STPs, which is crucial for timely completion of projects and their O&M.

1.3.6 Inclusion of Tributaries in NRCP

Tributaries may have a significant impact on the quality and quantity of water and on aquatic life. If tributaries render the river water polluted, pollution abatement works for these rivers can be proposed.

1.3.7 Revision of Standards of Treated Wastewater

In critical stretches of Ganga river standards of STP effluents have been revised.

1.3.8 Inclusion of branch and lateral sewers and house connections up to the property line

Under NRCP branch and lateral sewers and house connections up to the property line are not eligible for financial assistance from the NRCD. However, NGRBA guidelines provide for the Ganga basin that apart from conveying sewers, pumping stations and STPs, these items should also be included in projects in unsewered areas to make the city fully sewered.

1.3.9 Renovation, up gradation and modernization of existing projects.

Some components of existing projects have outlived their design periods. On the one hand, their performance, mainly that of STPs would have deteriorated and, on the other, specifications of treated effluents have been raised. Therefore, there is a need to provide for renovation, up gradation and modernization of such projects.

1.3.10 Projects needed in view of emergence of new colonies and expansion of old towns/cities

In several towns haphazard growth has taken place without any matching arrangements for disposal of wastewater. New projects of sewage management are required for such areas.

1.3.11 Community Toilet Complexes

Rainwater harvesting and promotion of solar energy are to be incorporated in the community toilet complexes. At commercial locations toilet complexes may be set up with higher specifications for high end users on higher user charges basis. The up gradation of existing CTCs is to be explored and provision to be made for the same.

1.3.12 Catchment Area Treatment to check the flow of silt and nutrients

For a river, the quantity and quality of its discharge is a function of rainfall and land use in the catchment. Silt, nutrients and agricultural runoff are its major pollutants. Both for securing flow in the river system and for maintaining quality, proper land use and measures to protect the catchment are necessary.

1.3.13 Works to secure environmental flow

It is well known that aquatic life in river systems cannot be sustained unless flows unique to biodiversity in sections of rivers are maintained, especially in periods of low flow. Several

measures may need to be taken to achieve this objective, including the following

i. Reducing abstraction of water from the river
ii. Reuse and recycling of wastewater including discharge back to the river
iii. Increasing efficiency of use of water in irrigation, domestic consumption and industry
iv. Catchment area treatment, to increase base flow and check the flow of silt and nutrients to the river
v. Augmenting flow in the river
vi. Rain Water harvesting for ground water recharge

1.3.14 Recycle and Reuse of Wastewater

Agricultural, industrial and domestic demand of fresh water is very high. On the other hand, drawl of fresh water from the river for these purposes reduces availability of water in the river for dilution. Recycling and reuse should either be for non-domestic municipal uses or for specific irrigation and industrial purpose. Therefore, innovativeness in design of STPs should be encouraged so that the treated sewage can be used to meet such demand on case to case basis.

Presently under the NRCP, schemes for catchment area treatment, works to secure environmental flow are not eligible for funding. However, there are schemes of other ministries under which these schemes could qualify for funding. Hence preparation of such schemes will help in taking advantage of programmes of other ministries and their agencies. However, a judicious view on discharging back to river or for reuse may have to be taken depending upon river flow.

1.3.15 Degrees of Treatment Linked to Availability of Fresh Water in the River

The ŘŜƎƦŜŜ of treatment and the quality of effluent of the STP should be determined, taking inű2 account the quantity and quality of fresh water available in the river and the assimilative capacity of the same for dilution so that after mixing of effluent the quality of river water satisfies the prescribed standards for the best designated use. Therefore, instead of a uniform level of treatment the approach of varying level should be followed. There should also be emphasis on augmenting flow in the river.

1.3.16 Preparation of FRs and DPRs

The state project management unit may identify the specific agency that will deal with a particular source of pollution. A suggestive list of agencies that may deal with different types of schemes is provided in the chapter on project management and institutional issues. These agencies will prepare FRs and DPRs of schemes assigned to them. Their FRs and DPRs should be put together into an integrated project. Since they may be examined by different officers, they need to be in different volumes – one volume for one scheme.

In order to improve scientific and engineering designs and planning the following are necessary:

i. Good quality digital maps on GIS platform
ii. Softwares for project planning and design.
iii. Suitably educated, trained and experienced manpower with necessary professional expertise.

1.3.16.1 Sewer System

The sewer districts should be so configured that long trunk mains and number of pumping stations are reduced to the minimum. For this purpose options of centralised and decentralised systems should be worked out and evaluated.

1.3.16.2 Sewage Treatment Plants

The NRCD has published a document in 2009 “Compendium of Sewage Treatment Technologies” in which the technologies have been evaluated on

i. Performance,
ii. Energy requirement,
iii. Resource requirements and associated costs,
iv. Land requirements.
v. Annualised cost also has been worked out.

Depending on the desired water quality of the effluent of the STP, land requirement, availability of electricity and funds available, the technology that appears feasible should be selected using the matrix given in Compendium of Technologies. New technologies like 'In Situ Sewage Treatment through Bioremediation' not covered in the compendium may also be examined.

The STPs are to be designed on the basis of actual measurements of the waste water flows in the drains and projecting the same as per the design period of the component.

1.3.16.3 Appraisal of Projects

Projects submitted for financial assistance to the NRCD/NGRBA or other funding agencies are liable to be appraised by independent institutes/experts. This will enhance quality of DPRs in addition to cost optimisation. Any likely loopholes in planning and designing of projects will also be plugged through such appraisals.

1.3.17 Flow Chart

A flow chart has been introduced in the guidelines which mention processes involved in the preparation of the DPR and the time expected to be taken in each. In other words it mentions the main activities of the agencies/institutions involved in the preparation of the project reports and the time likely to be taken in each activity. The Flow Chart is attached as Figure 1 in chapter 22.

1.3.18 Public Awareness and Public Participation

Stakeholder consultation at the stage of formulation of CSP and of Feasibility Report of the project has been provided to ensure active involvement of various stake holders and the civil society to generate support as well as belongingness and ownership of assets. Much greater involvement of stakeholders and their ownership of the project is called for. The revised guidelines deal with this issue. Introduction of “river festivals” and “river runs”, under public participation activities, have also been included. DPRs of component schemes do not have provision for this item. For each component scheme, a plan of public awareness and public participation should be made, expenditure of which should be met from this allocation.

1.3.19 HRD and Capacity Building

Emphasis has been laid on education in various domains of knowledge, the required training experience, and capacity building in all organisations associated with the river conservation programme.

Particular attention should be given to capacity building and HRD in ULBs to enhance their technical and financial capability in the implementation and O&M of projects, as they are to finally take over the assets. So, their capacity building will boost the success of the programme.

DPRs of component schemes do not have provision for this item. For each component scheme, a plan of HRD and capacity building should be made, expenditure of which should be met from this allocation.

1.3.20 Operation and Maintenance

Funds required for operation and maintenance for the first 5 years is required to be inbuilt in the project cost to overcome initial hindrances likely to be faced by ULBs/ States. It will ensure unhindered O&M of assets, which is necessary for achieving the improvement in the river water quality.

1.3.21 Memorandum of Agreement (MoA)

There is to be a tripartite MoA among ULB, State Government and the MoEF that provides a framework of commitments by all stake holders for successful implementation of the programme and proper O&M of assets. A copy of the MoA is given as Annexure 4.

1.3.22 Monitoring and Evaluation:

Provision for third party inspection has been made to strengthen capacity of the state government and state implementing agency to monitor the physical progress of projects during preconstruction, construction, commissioning and trial run and post construction. A copy of the relevant notification is attached as Annexure 5.

The DPRs of component schemes do not have provision for this item. For each component scheme, a plan of monitoring and evaluation should be made, expenditure of which should be met from this allocation.

1.3.23 Flexibility in the methodology of preparation of CSP, FR AND DPRs

These guidelines provide a broad frame work of and the methodology of preparing the city sanitation plan, feasibility report and the DPR. Circumstances may vary from place to place and for a given river and a source of pollution. Therefore, various activities contained in these guidelines should be carried out in a manner that is best suited to the local conditions within the broad framework of these guidelines.

1.3.24 Inclusion of Schemes for Management of Municipal Solid Waste affecting river water quality

Different types of solids and solid waste may also contribute directly to river pollution in a significant manner. Therefore, one of the component schemes should include measures for dealing with that part of solid waste that directly contributes to river pollution.

1.4 CENTAGE ON PROJECT COST

According to the present practice, a centage of 8% of the project cost is admissible. This issue has been examined with reference to the practice followed by CPWD (Reference of CPWD Works Manual 2007 http://cpwd.gov.in/newsitem/latestnewspdf/Final-WorksManual.pdf). It is proposed to revise the centage as given in the table below:

Table 1.1: Table showing details of Centage

S. No.	Item	Provision by NRCD/MOEF	Provisions in CPWD manual	Recommended percentage+
1	2	3	4	5
I	**Preliminary (Enabling Works)**			
	Preliminary work :- surveys, investigations, report preparation, tender documents, hiring specialist, training, education, capacity building, computer software & hardware, computer consumables	3.00	charged as a separate item	3.00
II	**Establishment & Supervision**	**-**	**6.50**	**6.75**
III	**Special T&P**	**1.00**	***0.50**	**1.00**
IV	**Audit & account Charges**	1.00	0.25	0.25
V	**Contingency**	3.00	Charged directly to works under each item of works and is 3%	3.00
	Total	**8.00**		**14.00+**

***The indicated rates of tools and plants are exclusive of the cost of special tools and plants, the cost of which will be charged to the estimates of the works.**

+ Subject to the approval of NRCD

1.5 ADDITIONAL FEATURES

River Ganga has been given the status of National River and the National Ganga River Basin Authority has been constituted. The Authority has both regulatory and development functions. The Authority is to take measures for effective abatement of pollution and conservation of the river Ganga in keeping with sustainable development needs including activities such as development of a river basin management plan, maintenance of minimum ecological flows in the river Ganga, among others.

Basin management plan of River Ganga is currently being developed. Specific features of projects that will come up in the basin, as distinct from those under the NRCP, will be known only after the Basin Management Plan has been prepared, has been considered by the NGRBA and new guidelines are issued. Till then these guidelines will apply to projects in the Ganga basin also.

Based on Ganga River Basin Management Plan, certain additional features may have to be adopted in these guidelines in due course.

CHAPTER 2
COLLECTION OF DATA

2.1 INTRODUCTION

As stated in Introduction, preparation of Detailed Project Report for pollution abatement is a three step process, namely, City Sanitation Plan (CSP), Feasibility Report (FR), followed by the Detailed Project Report (DPR). This chapter deals with collection of data required for preparing all these reports. Some states have already started preparing CSPs. Where available, these CSPs should be used. If necessary, they may be updated and if there are any gaps in relation to the river pollution abatement works, these should be filled up.

Preparation of CSP is to precede the FR and is to be the basis for preparing the DPR. It follows, therefore, that it should be prepared on the basis of available data (Primary / Secondary Data) that has been generated by the concerned agencies and primary data may also be required. Feasibility Report will identify the problem of pollution, develop and evaluate the various options and select the best that is cost effective and sustainable and produces the intended outcome.

After selection of a city on the basis of data collection, it is necessary to prepare a CSP, FR of sewerage schemes and then a DPR. The DPRs of non-sewerage schemes can be prepared straight after the preparation of CSP. For preparing the DPR, additional data may be needed, which may have to be generated by undertaking suitable survey and investigation (primary data).

In this chapter, the guidelines deal with collection of primary and secondary data.

2.2 DATA REQUIRED AT DIFFERENT LEVELS

The data needs to be gathered at several levels as below:

i. Drainage basin of the river, in which polluted stretches have been identified and in respect of which the pollution abatement project is to be prepared. This will help to identify the priority for taking up pollution abatement works to improve the river water quality.
ii. The town which is causing pollution of the river and for which an integrated project is to be prepared for abatement of pollution from waste water and solid waste. A town may have to be divided into a number of sewerage districts for getting optimal results and data gathered should meet this need. In case some data mentioned below is not available, it may be stated at the appropriate place. However, DPR should integrate all the data provided by agencies concerned for pollution abatement.

2.3 DATA RELATED TO DRAINAGE BASIN

It is beneficial for the planner to have an understanding of the river basin as every activity undertaken at any point in the basin has implications for the river as a whole, though more often on the downstream side. It is, therefore, necessary to identify activities and their impact on the river. Relevant data must be collected and analysed so as to assign priority to towns for taking up pollution abatement works. Data that needs to be collected is mentioned below.

While information on catchment may be beneficial to assess the overall pollution load, the DPR may focus on information pertaining to the area with in the municipal boundary of the town.

2.3.1 Drainage Basin Map

A map of the basin on 1:50,000 scale SOI topographical sheet showing the following features:

a) Drainage map marking the catchments of
   i. Tributaries,
   ii. Main stem and
   iii. Existing water bodies

b) Cities / Town in the basin with
   i. River water quality being below the desired level
   ii. Cities with cultural, social and tourism importance

c) Recent Land Use, if available, from State Remote Sensing Centre
   i. Agriculture,
   ii. Forests,
   iii. Mining
   iv. Industrial areas

d) Sites from where samples for testing water quality were drawn by the CPCB/SPCB.
e) Sites of abstraction of water - dams and diversion works
f) River gauging sites
g) Flood plain
h) Identified river fronts needing development and management and removal of encroachment.

2.3.2 Geography

i. Latitude, Longitude of the town
ii. Physical features and natural resources
iii. General topography
iv. Any other important information

2.3.3 Climate

i. Rainfall:
   Average annual rain fall
   Average rainfall during monsoon
   Maximum rainfall in a day
   Number of rainy days

ii. Temperature:
Maximum and minimum in
   Summer
   Monsoon,

Winter.

2.3.4 Population

It should include towns

i. With significant population causing pollution
ii. Where river water quality is below that prescribed for the best designated use.
iii. With cultural, social and tourism importance

Information may be presented in the table below

Table 2.1: Table showing population of Towns in the River Basin

Town	Male	Female	Total
Urban			
Town 1			
Town 2			
Town 'n'			
Rural			

2.3.5 Cultural and religious significance of the river, its basin and cities located on its bank

Briefly describe significance of the river, the basin and cities on its bank so as to bring out the importance of conservation of the river and reasons why it should be protected from the pollution caused by the waste water of major cities.

2.3.6 Hydrological

Hydrological data as below

i. Discharge figures of river, tributaries and streams.
ii. Average dry weather flow in the river. These may be obtained either from CWC or Irrigation Departments. Where such data is not available, efforts may be made to assess the flow on the basis of river cross-section/ wetted perimeter, depth, velocity etc.
iii. Storage capacity of dams, barrages, etc. if any
iv. Discharge capacity of diversion works
v. Quantity of water abstracted at various sites for irrigation, industry, human consumption, particularly up stream of the town concerned.
vi. Morphology and hydrology of the river.
vii. Quantity of ground water abstracted within the town.
viii. Ground water levels in different blocks.

2.3.7 Industrial Waste

Information about industrial effluent may be provided in the following table

Table 2.2: Information about Industrial Effluents

Areas	Quantity of water used mld	Effluent Generated mld	Industrial effluent satisfies standards Yes/ No	Proper Industrial SWM –Yes/No
*Industrial Area				
*Major Industrial Units				
*Grossly polluting units				
*Mining Areas				
Others				
Total				

*In case of more than one area/unit give information in additional rows unit wise

2.3.8 Sampling Locations for River Water Quality

Water quality data at following locations may be obtained

i. At confluence of major tributaries, upstream and down stream, as is available with SPCB / CPCB
ii. At points where industrial effluent is discharged in to the river or streams in the basin
iii. At each city –upstream and downstream of the city, and
iv. At other important locations of the river such as bathing ghats.

2.3.9 Polluted stretches of rivers in the States/NGRBA:

List of polluted stretches published by the CPCB may form the basis for selection of town / river (Annexure 6).

In case CPCB data is not available in respect of any city but it is felt that the river water quality is unacceptable, water quality may be tested and if found unsatisfactory, pollution abatement project may be prepared in accordance with these guidelines.

Table 2.3 Designated-Best-Use Class of water Criteria

Source: CPCB

Designated Best Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	**A**	1. Total coliforms organism MPN/ 100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved oxygen 6mg/l or more 4. Biochemical oxygen demand 5 days 20°C 2mg/l or less
Out door bathing	**B**	*1. Total coliforms organism MPN/100 ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved oxygen 5mg/l or more 4. Biochemical oxygen demand 5 days 20°C 3mg/l or less

Designated Best Use	Class of Water	Criteria
Drinking water source after conventional treatment and disinfection	C	1. Total coliforms organism MPN/100 ml shall be 5000 or less 2. pH between 6 to 9 3. Dissolved oxygen 4mg/l or more 4. Biochemical oxygen demand 5 days 20oC 3mg/l or less
Propagation of wild life and fisheries	D	1. pH between 6.5 to 8.5 2. Dissolved oxygen 4mg/l or more 3. Free ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling, controlled waste disposal	E	1. pH between 6.0 to 8.5 2. Electrical conductivity at 25oC micro mhos/cm Max.2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2mg/l

*The NRCD norms are: Fecal coliform< 500 MPN/100ml (desirable), 2500MPN/100ml (max permissible)

2.3.10 Biological Parameters

As far as possible information on biological indicators may be provided.

2.4 TOWN RELATED DATA

2.4.1 Maps Related to City

Digital maps, as may be available, showing the following features on a scale large enough to understand the physical features.

i. Important land marks of the city
ii. Rivers and their flood plains
iii. Other water bodies
iv. River banks where solid waste is dumped
v. Drains, and their respective outfalls and catchments (drainage areas)
vi. Streets and surface / underground utilities
vii. Municipal wards
viii. Open spaces
ix. Residential areas
x. Industrial estates
xi. Industrial units outside industrial estates
xii. Points of discharge of industrial effluents
xiii. Slums
xiv. Water supply system – Including intake points and ground water.
xv. Places used for open defecation
xvi. Community toilets
xvii. Sewers in each drainage area with diameters and invert levels with junctions of sewers, if existing.
xviii. STPs and sewage pumping stations, if existing.
xix. Crematoria

xx. River front (ghats) developed in the past
xxi. Sites on river banks for cattle wallowing, dhobi ghats, washing of motor vehicles and carcasses are dumped
xxii. Garbage dumping sites including land fills
xxiii. Bio-medical waste treatment facilities
xxiv. Ground levels and contours
xxv. Pollution abatement works carried out in the past

2.4.2 Land Use, Contour, Drainage and Other Thematic Maps

The themes related to which the maps should be prepared are mentioned in the previous section. At the stage of preparing FR, the maps of SOI, ULB and State Remote Sensing Agency may be used. However, at the stage of DPR, it may be useful to use most recent satellite imagery, data and maps. Contour maps at appropriate interval will be needed for which survey may have to be done.

2.4.3 Use of State of Art Tools Like Remote Sensing and GIS

If there are easily accessible facilities with the State Remote Sensing Centre or other specialized agencies an attempt should be made to use remote sensing to gather spatial information observable from space and present it and other data mentioned above in Geographical Information System (GIS) format. It gives the ability to prepare maps on different themes as required. For cities with a population of one million or more the data must be presented in GIS format. For other cities it is optional.

Latest preparation tools/software like GIS, CAD, satellite imageries etc. may be used for preparation of maps. As expertise of this kind may not be generally available with the implementing agencies, the work may be done by hiring qualified experts for such purposes from outside. A good map depicting all the above features would help in improving decision making and finalising appropriate sewerage routes without disturbing other civic utilities.

2.4.4 Population of the Town

Population of the town should be provided in the following tables

Table 2.4 Population of the town during the last five decades

Year	No of wards	Area of town	No of houses including slums	Population	Growth rate	Density of population no / sq. km
1971						
1981						
1991						
2001						
2011						

Table 2.5 Ward wise details may be provided in the following table

Ward no		1971	1981	1991	2001	2011
1	Population					
	No of houses					
2	Population					
	No of houses					
n	Population					
	No of houses					

Table 2.6 Slum population and households in each ward Latest census

Ward No	Slum no.	Slum name	Population in the latest census	No of households	Mode of Water supplied Piped, hand pump, none	Toilets or Open defecation	Drain into which waste water flows
1							
n							

2.4.5 Status of Wastewater Management Works Undertaken or Already Implemented in the Past

In the past some works related to pollution abatement and management of waste water may have been implemented, for which the following details may be collected.

i. Year of installation/commissioning
ii. Designed capacity/performance
iii. Present Performance and O&M details
iv. Details of existing sewered areas along with branch, lateral and trunk sewers
v. Sewage Treatment Plants
vi. Year of installation/commissioning
vii. Designed capacity

Unsewered areas housing low-income groups are serviced by 'pit latrines' or septic tanks at individual household/ community levels. Overflows from septic tanks are discharged into the river through open drains. These areas are to be marked on the map. These facilities are to be synchronised / dovetailed with the proposed scheme.

2.4.6 Status of River

i. Purposes for which river water is being used
   a. Drinking
   b. Irrigation
   c. Industry
   d. Navigation

ii. Water Quality

The programme aims at improving the river water quality to the desirable standards. CPCB has

classified all inland waters in five categories according to the designated best use class. The designated best use as well as actual quality of river water should be reported. For actual baseline data, water quality should be analysed at upstream and downstream points of the city as also downstream points of major outfalls. Water quality analysis should take into account all the parameters prescribed by CPCB/SPCB in their formats. This is necessary to assess the current water quality and the extent of improvement that can be achieved through interventions proposed in the DPR. The sampling of water quality should be from completely mixed zone to represent accurate impact

Water quality of the river and drains may be presented in tables such as given below:

Table 2.7: Water quality of River / Drain

Parameters	Result									
	Upstream		Downstream		Out fall 1		Out fall 2		Outfall n	
	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
pH										
SS (mg/l)										
TDS (mg/l)										
BOD (mg/l)										
COD (mg/l)										
Cl (mg/l)										
Total coliform, MPN/100 ml										
Fecal coliform, MPN/100 ml										
*Saprobity index										
#Diversity Index										
@P/R Ratio										
Fish etc										

*Saprobity Index: Numerical estimation of pollution of organic matter, from 0 – 4.
#Diversity Index: Diversity index is a statistic which is intended to measure the biodiversity of an ecosystem.
@P/R Ratio: **production/respiration ratio (P/R ratio)** The relationship between gross production and total community respiration. Where P/R = 1 a steady-state community results. If P/R is persistently greater or less than 1 then organic matter either accumulates or is depleted respectively

2.4.7 Soil Investigations

For laying deep sewers, soil investigation and test bores must be made at suitable intervals along the alignment of sewers to ascertain the type of soil at different depths and behaviour of ground water table and bearing capacity of the soil. For deep sewer laying, wherever required a mechanical system may be proposed as a safety and speedy measure.

2.4.8 General Information

i. Location – Latitude, Longitude
ii. Important features

iii. Climate
iv. Brief history of the city
v. Commercial activities
vi. Industrial activities
vii. Educational activities
viii. Cultural activities
ix. Religious activities
x. Master plan of development of the city, obtain if there is one.
xi. City development plan or city sanitation plan prepared under JNNURM, if it has been prepared, should be obtained.
xii. Project reports of development works in the city executed, under execution and proposed for future in the following sectors should be obtained.
xiii. Slum population and their development/rehabilitation plan.
xiv. Present sewerage management and SWM system.

2.4.9 Discharge carried by drains and Water Quality

A note on the number of drains, state of drains, discharge carried by them, along with the location points of outfall water should be prepared. Discharge in these drains should be measured in dry weather and their water quality (sewerage parameters viz., pH, temperature, colour, odour, TSS, VolatileSS, BOD, COD, Cl, nitrogen, phosphorus fecal coliform and any other parameter considered significant for the city) should be tested in dry weather.

Samples for testing water quality should be composite and flow proportional taken once a week for diurnal variation on hourly basis. Considering a four-week month, three samples are to be taken on weekdays, whereas the fourth sample is to be taken on an off day i.e. Sunday.

Sampling for water quality should be conducted for at least one month during dry weather to assess pollution load quantitatively and qualitatively. Actual present flows should be measured at the point of outfall into the water body, which could be either through open drains or pumping stations.

This information may be provided in the following table

Table 2.8: Discharge Carried by Drains

Drain no.	Drain name	Starting point	Outfall point	Length, km	Measured flow	Population
1						
2						
n						

Table 2.9: Waste water characteristics of Drains.

Parameters	Monitoring Sites of Drains								
	1	2	3	4	5	6	7	8	9
pH									
Temperature									
Colour									
Odour									
TSS (mg/l)									
VolatileSS (mg/l)									
BOD (mg/l)									
COD (mg/l)									
Cl (mg/l)									
Nitrogen mg/l									
Phosphorus mg/l									
Fecal ColiformMPN/100ml									

2.4.10 Water Supply

Sources of present supply of water should be provided in the table below

Table 2.10: Status of Water Supply

i. Present Status

Sources of Water Supply	Quantity				
	Drainage Area 1	Drainage Area 2		Drainage Area n	Future Projection
River (Describe source)					
Tubewells (mention nos. and average depth of tubewells in the area)					
Hand Pumps					
Others (mention)					
Total					
Present population					
Population covered by water supply					
Per capita water supply					
Present hours of water supply					

Ii. Plans for Augmentation of Water Supply

Approved plans, if any, for augmentation of water supply in the future JNNURM or State Plan, should be indicated so that these are appropriately considered for designing Sewerage systems and STPs. The following information may be provided.

Table 2.11 Plans for Augmentation of Water Supply

Drainage Area	Name of project	Date of sanction	Date of completion	Quantity of water	Future Projection for water requirement

2.4.11 Present Waste Water Disposal Systems

Table 2.12: Details of Present Waste Water Disposal System

Waste Water Disposal	Quantity			Impact	Plan for renovation
	DA 1	DA 2	DA n		
Sewers without STP Km					
Sewers with STP Km					
Houses connected to sewers (Number)					
Houses not connected (Numbers)					
Septic tanks (Numbers)					
Community Toilets (No)					
Places of open defecation(No)					

*DA stands for Drainage Area

Table 2.13 State of Sewer System (Drainage Area Wise)

DA	Particulars	Operational Yes or No	Qty. kms	Date of installation	Condition of assets	Operating agency
	Sewers					
	Intermediate sewage pumping stations					
	Main pumping stations					
	STPs / Location					
	Location / Installed Capacity, mld / Process					
	Others, if any					

*DA stands for Drainage Area

Table 2.14 : Details of existing STPs

S.No	STP	DA1	DA2	DAn
1	Location (DA or ward)			
2	Operational Yes or No			
3	Process			
4	Installed Capacity, mld			
5	Current Capacity, mld			
6	**Wastewater influent design Parameters**			
	BOD, mg/l			
	TSS, mg/l			
	Fecal coliform			
7	**Effluent wastewater design Parameters**			
	BOD, mg/l			
	TSS, mg/l			
	Fecal coliform			

S.No	STP	DA1	DA2	DAn
8	**Influent wastewater actual Parameters**			
	BOD, mg/l			
	TSS, mg/l			
	Fecal coliform			
9	**Treated water Parameters**			
	BOD, mg/l			
	TSS, mg/l			
	Fecal coliform			
	Over all efficiency of STP*			
10	Date of installation			
11	Condition of assets			
12	Operating agency and mode of O&M			
13	Mode of discharge of effluents			
14	Whether sewer tax imposed			

*Procedure laid down in Compendium of Sewage Treatment, published by NRCD may be used (http://moef.nic.in/modules/recent-initiatives/NGRBA/Final%20Compendium.pdf)

i. Accompanying Information

The above table should be accompanied with notes covering the following points

i. Any important aspects not covered in the table
ii. Localities/wards covered with 'pit latrines'/ septic tanks with number of houses and population covered
iii. Localities/wards covered with sewer- system from the street to the drains and finally to the river.
iv. No of houses connected to the sewer system
v. No of houses not connected to the sewer system
vi. State of maintenance of the sewer system-every component of the system including sewers, pumping stations – electromechanical equipment , civil works - should be commented on, including date of installation, designed capacity, performance, need to repair, renovate, modernise, increase capacity, replace.
vii. STPs – their location, capacities, year of installation, designed and current performance, need to repair, renovate, modernise, increase capacity, replace any component or the system as a whole, their impact on river water quality and O&M details.
viii. Description and state of maintenance of each major component of the system in localities not having toilets
ix. State of Public toilets and the works required to be done to bring them to a state where they can perform their expected functions
x. Localities that do not have domestic / community toilets, thus leading to open defecation. Remedial measures required.
xi. Details of private housing projects with sewerage facilities

2.5 NON POINT SOURCES

2.5.1 Community Toilet Complexes

The following information be compiled drainage area wise in the table below

Table 2.15 Details of Existing Toilets Facilities

Drainage Area Name	Dwelling units without toilets	Community Toilet complexes		Dwelling units with dry pit latrine	Dwelling units with septic tanks	Dwelling units with access to sewer	
		Number	Toilet seat numbers			Connected to sewer	Not connected

For gathering the above information, a survey may be undertaken.

Details of activities already taken up under similar sanitation programme of the Social Welfare Department and other state agencies

Impact of existing sanitation works may be worked out on the basis of

Number of persons using it daily
Discharge points
User charges collected daily etc.

2.5.2 Crematoria

The following information may be provided

Table 2.16: Details of Existing Crematoria and Projections

Drainage Area	No of crematoria complexes		No of bodies cremated daily	Projection for additional requirement
	Wood based	Electric		

Impact of cremation on saving in wood requirement be worked out on the basis of bodies cremated in the existing crematoria.

2.5.3 Dairies

Table 2.17: Details of Dairies

Drainage Area	Total no of cattle	No of big dairies	No of cattle in big dairies	*Quantity of excreta D.M.
1				
2				
N				

*D.M stands for dry matter in excreta @ 5 kg per head

i. Quantification of dairy waste
ii. Present locations and disposal points to be marked on the city plan

2.5.4 Dhobi Ghats

i. Number locations to be marked on the city plan
ii. Number of dhobis in each ghat,
iii. Details of alternate sites , if proposed

2.5.5 Motor Garages

The information to be collected for each drainage area or ward
i. number and their locations on the city map
ii. quantification of washing from garages
iii. average number of vehicles being washed per day
iv. disposal sites of washing may be marked on the city map
v. sites reserved for the activity in the Master Plan

2.5.6 Cattle wallowing

Table 2.18 Details of Cattle Wallowing

Location Name	No of cattle that wallow	Remarks

2.5.7 Carcass Disposal

Table 2.19: Details of Carcasses disposed of

Location Name	No of carcasses disposed of/day	Remarks

Location wise number of carcasses disposed of per day
Sites reserved for carcass disposal.
Prior to taking up any project for river conservation, both cattle wallowing and carcass disposal in the river must be banned.

2.5.8 River front facilities

i. Identification of river ghats being used for bathing.
ii. Status of existing bathing ghats
iii. Requirement of new bathing ghats
iv. Impact of existing ghats be worked out

2.5.9 Solid Waste Management

i. Ward wise solid waste generation and disposal, brief description of the system including information such as-
   - Quantity generated
   - Number of bins installed
   - Number of collection sites
   - Number and type of transport vehicles for collection and their capacity per day
   - No of disposal sites

ii. State of maintenance of the system.

iii. Details of land fills / compost /incineration plants etc.

iv. Dumping of solid waste in the river be banned by local authority before taking up any project of MSW management.

2.5.9.1 Bio-Medical Waste Treatment Facilities

Table 2.20: Bio-Medical Waste Treatment Facilities – Existing

Plants	Location	Capacity	Actual Waste Treated	Remarks

Table 2.21: Bio-Medical Waste Treatment Facilities- Proposed

Plants	Location	Capacity	Actual Waste Treated	Remarks - Whether Site reserved

2.1.1 Afforestation

River banks prone to soil erosion may be identified and plotted on the map. Species that will thrive and serve the aesthetic and environmental purposes may be identified in consultation with social forestry officers.

2.6 INSTITUTIONAL DETAILS

The institutions performing functions of providing services and performing development functions may be provided in the table given below.

Table 2.22: Institutional Responsibilities for Civic Services

Service	Name of institution given responsibility for		
	Planning and design	Construction	O&M
Water supply			
Disposal of wastewater			
House Hold Sanitation			
Solid Waste Management			
Supply of electricity			

2.7 STATE OF (ULB – URBAN LOCAL BODY) MUNICIPALITY / MUNICIPAL CORPORATION

This should be provided for the last completed financial year

i. Municipal government's own resources
ii. State government grants and loans
iii. Funding from financing institutions
iv. Funding from capital market
v. Central government grants
vi. Private sector participation
vii. Cost recovery of services supplied to the people
viii. Availability of electricity in hours per day during Apr – June, July to September, Oct- Dec, Jan to March

2.8 INDUSTRIAL WASTE WITHIN MUNICIPAL LIMITS AND WHOSE EFFLUENT REACHES THE RIVER

Data on grossly polluting industry along with the monitoring plan of SPCB should be presented in the DPR. It would be desirable to mention what data should be incorporated in the DPR. Industrial estates – water used, effluent generated, treatment plants installed with their capacities. Solid Waste Generated.

Industrial effluent- sources of generation:

Table 2.23: Details of industrial Effluent

DA	Industrial Estate/ Isolated Unit	Grossly polluting or not	Effluent Generated	ETP installed	Capacity	Solid waste Generated	Treatment Facility with capacity
1							
n							

2.9 ADDITIONAL DATA REQUIRED FOR COASTAL CITIES

Following data should also be gathered for coastal cities:

i. Tidal incursion and mangroves
ii. Coast line

iii. Coastal district management plan
iv. Drain wise municipal wards with their areas and population
v. Salt water intrusion

2.10 SOURCE OF DATA

The following sources may provide the needed information:

i. State Pollution Control Board and the Central Pollution Control Board.
ii. Executive Engineer of Water Resources department in the district maintains information about drainage basins and rivers in his district. To the extent it is available with him information related to the river for which the project is proposed to be formulated should be incorporated in the FR or CSP.
iii. District planning office
iv. District officers of agriculture, forests etc.
v. Survey of India topographical sheets
vi. India Meteorological Department
vii. State Remote Sensing Agency
viii. District Census Office
ix. For flora and fauna Botanical Survey of India, Zoological Survey of India, State Pollution Control Board / Central Pollution Control Board and (local University in case any research has been done).
x. Urban Local Body
xi. Proposed components along with existing works, if any, are to be shown on maps with different colours and legends.
xii. CGWB / State GWBs; State UDD; NIC cell at State / District level; PHED/Water & Sewerage Board/Authority

CHAPTER 3
SELECTION OF CITY FOR POLLUTION ABATEMENT PROJECT & PREPARATION OF CITY SANITATION PLAN

3.1 SELECTION OF TOWNS/CITIES FOR PROJECTS UNDER NRCP/NGRBA

Based on data collected regarding polluted stretches of rivers in accordance with guidelines in Chapter 2 and the information available from CPCB and other agencies, the basin and the river should be briefly described with emphasis on the uses of the river, abstraction of water from it, and change in water quality as the river progresses on its journey. On these stretches a list of towns where the water quality for bathing is (BOD> 3mg/l, DO < 5 mg/l and Fecal coliform > MPN 2500) i.e., worse than the prescribed limits should be prepared. The greater the pollution at a location, higher should be the order in the list of priority. In these towns pollution abatement works under the NRCP should be proposed. However, for NGBRA, all mainstream Ganga towns with significant sewage generation that joins the river will be eligible in accordance with mission clean Ganga.

The Nodal Department of the State Government will prepare and submit projects under river conservation programme.

3.2 CITY SANITATION PLAN (CSP)

3.2.1 Objectives of City Sanitation Plan

The objective of preparing city sanitation plan is to formulate in consultation with the local body and other stakeholders, in sectors of wastewater and solid waste management: vision and goal in 5 years, 10 years, 15 years and 30 years and for that purpose to prepare a compendium of schemes necessary to convert the polluted stretch of the river in the state to a stretch of the river having the desired quality of water. CSP should also be linked with CDP, if any, to ensure simultaneous infrastructural growth of the city.

(a) to give an introduction of the river and its basin in the State,
(b) to identify all sources of significant pollution of the river in the stretch within the state that needs to be controlled to improve the water quality,
(c) Identify sources of pollution located in the city/town
(d) Identify component schemes of a project whose implementation will improve its water quality to the desired level and improve the environment. More specifically, the CSP will help to achieve the following objectives:
    i. Ideint and non-point sources of pollution of the river in a town
    ii. Assess how the pollution of the river affects the stakeholders. .
    iii. Identify the outcome that the stakeholders expect from the pollution abatement project.
    iv. Identify the pollution abatement schemes, called Component Schemes, and measures that should be tantify all poken to address the issue of pollution and achieve the objective of the improvement of the river water quality to the desired level. Identify for each component scheme the agency that should be given responsibility to handle it and sources of funding.

3.2.2 City Sanitation Plan to contain All Schemes Considered Necessary to improve water quality of the river

For many cities city development plans or city sanitation plans have been prepared. Under these plans some works may have been proposed or implemented. They should be taken in to account while preparing the city sanitation plan for pollution abatement of the river.

Schemes to deal with certain kinds of pollution are not funded by the NRCD. These schemes, for example, include solid waste management, industrial effluent and industrial solid waste, biomedical waste and catchment area treatment. Safe disposal of industrial and biochemical waste is legal obligation on those who generate such waste. Schemes for management of solid waste may be eligible for funding under schemes of the Ministry of Urban Development. Therefore, all schemes necessary for reducing pollution of the river whether they are fundable by NRCD or any other ministry or agency should be included in the city sanitation plan. The schemes that are fundable by the NRCD are given below.

3.3 TYPES OF SCHEMES FUNDED BY NRCD

The Schemes eligible for funding under the NRCP include

i. Sewerage schemes
ii. Non-sewerage schemes
iii. Other schemes

3.3.1 Sewerage Schemes

Schemes needed for transporting waste water from the source of its generation to the sewage treatment plants namely

i. Interception and diversion of waste water flowing in to the river
ii. Treatment of wastewater

3.3.2 Non-Sewerage Schemes

i. Community toilets for residents who do not have toilets in their own homes.
ii. Crematoria to check pollution from immersion of partially burnt human bodies.
iii. River front development to prevent people from using the banks for easing themselves and for beautification
iv. Management of such solid waste as directly pollutes the river water.
v. Schemes to check pollution of rivers cattle wallowing, dhobi ghats and washing of motor vehicles.

3.3.3 Other Schemes Related to Pollution Abatement Programme

i. Human Resource Development, capacity building, training and research in river conservation
ii. Public awareness and public participation
iii. Other miscellaneous works depending on the location specific conditions including interface with the human population

3.3.4 Schemes that are funded by other ministries/ Departments/ Agencies

i. Schemes to check pollution from solid waste, carcass disposal
ii. Plantation to check soil erosion of banks and improve environment
iii. Schemes to check pollution from dairies, carcass disposal and other waste

3.4 CONTENTS OF CITY SANITATION REPORT

a) Data

It should contain maps and all secondary data mentioned in chapter 2 relating to
i. River basin and
ii. Town proposed to be covered in the NRCP.

b) Estimation of pollution source wise and proposed schemes

The following information should be included, source of pollution wise:
i. Every source of pollution should be identified.
ii. The extent of pollution that it causes should be identified to the extent possible.
iii. Approach to dealing with the source of pollution
iv. The degree to which the pollution from the source needs to be controlled
v. The agency to which the responsibility to prepare the project report of the scheme and subsequently implement has been allocated.
    Implementing agency
    ULB
    Agency other than the above two
vi. The details of the scheme including the system and its components proposed to be installed
vii. If the scheme is eligible for funding by NRCD. the kind of Scheme to which it belongs
    Sewerage schemes
    Non sewerage schemes
    Other schemes
viii. If the scheme is not eligible for funding, the potential agency that may fund the project
ix. The impact the implementation of the scheme is likely to make on the river water quality i.e., the improvement expected from the implementation of each scheme.
x. Broad cost of the scheme

Note: Guidelines on preparing DPRs on various sources of pollution are contained in various chapters of these guidelines. For preparing the details of schemes to be provided in the city sanitation plan, to the extent possible, based on available data, the needed details should be worked out.

3.5 ABSTRACT OF SCHEMES

An abstract of schemes included in the CSP should be presented in the following tables.

Table 3.1 Schemes within the area of responsibility of government or public agencies

Name of Scheme	Implementing Agency	Likely Funding Agency
Interception and diversion of waste water	PHED or any other agency implementing such projects in the State	NRCD
Sewage treatment	Do	NRCD
Community toilet complexes	ULB	NRCD
Crematoria	ULB	NRCD
Municipal solid waste directly polluting river water	ULB	NRCD
Other municipal solid waste management	ULB	MOUD
Dairies	ULB	MOUD and MNRE (energy generation)
Other non-point sources e.g., washing vehicles, dhobi ghats etc	ULB	MOUD
River front development	Irrigation/water resources	NRCD

Table 3.2 pollution that needs to be curbed through regulation and development

Type of pollution	Regulating Agency	Development Work
Industrial effluent	SPCB	Common effluent treatment plants
Industrial solid waste	SPCB	Encourage them to create disposal facility
Bio-medical waste	SPCB	Promote establishment of facility to dispose of bio-medical waste
Open defecation	ULB	Establish community toilet complexes
Dairy waste	ULB	Promote establishment of dairies at proper locations with facility to generate energy and compost
Washing vehicles, dhobi ghats etc	ULB	Create alternative facilities

3.6 APPROVAL OF CITY SANITATION PLAN

The PMU in the district or the concerned city should submit the CSP to the SPMU who will forward it to the NRCD. This plan, as approved, should form the basis of preparation of feasibility report of sewerage schemes and the DPRs of non sewerage and other schemes.

CHAPTER 4
PREPARATION OF FEASIBILITY REPORT OF SEWERAGE SCHEMES

4.1 It has already been stated in chapter 1 that for non sewerage schemes, feasibility reports (fr) are not required and the DPRs may be prepared after the CSP has been approved. For sewerage schemes, feasibility reports need to be prepared for which the guidelines are given below.

4.2 OBJECTIVES OF FEASIBILITY REPORT (FR)

The objective of preparing a feasibility report is to identify, from amongst a number of feasible options, sewerage scheme of a project whose implementation will reduce pollution of the river and improve its water quality to the desired level. More specifically, the feasibility report will help to achieve the following objectives:

i. Identify all point sources of pollution of the river in a city
ii. Assess how the pollution of the river affects the stakeholders. .
iii. Work out details of all feasible alternative systems to address the issue of pollution and achieve the objective of improvement of river water quality. The alternatives are worked out to the level of detail that enables the comparative evaluation of alternatives and identification of the optimal system.
iv. FR would facilitate to prepare a workable or implementable plan.
v. All possible hindrances such as from public resistance, siting of major industries, environment and social concerns may be eliminated through option analysis at FR stage.

4.3 DEVELOPING OPTIONS FOR SEWERAGE SCHEMES

The approach should be based on centralised as well as decentralised collection and treatment of sewage.

4.3.1 Utilising an existing system

In drainage areas and districts where there is an existing system of waste water management, which appears capable of being repaired, refurbished, upgraded and modernised, the feasibility of augmenting to a degree that the waste water satisfies the prescribed standards by the time it reaches the river should be examined. Every component of the system should be evaluated as to its designed performance, present performance, designed capacity and present capacity and useful life left. If it is found that the system can be brought to a satisfactory state and will be sustainable, items of work that are needed should be identified and details worked out and costs estimated.

4.3.2 Covering the Area With Sewer Network

Under this system the drainage district is covered with sewers and every house is connected to the sewers.

i. Centralised System
The wastewater is conveyed to a centralised STP from where it could be suitably disposed of into the river or used for irrigation, or, locating the STP further away where land is available at cheaper rates and cheaper technology can be adopted

ii. Decentralised System

Waste water of each sewerage district is carried in sewers or in drains or partly in sewers and partly in drains to a treatment plant designed for that district which constitutes a decentralised treatment system. In the decentralised approach, the Sewerage District could be small envisaging collection, treatment and disposal of wastewater in the neighbourhood itself involving smaller quantity of wastewater.

A decentralised system could result in drastically curtailing the length and diameters of trunk sewers, in reduction of depth at which the sewers should be laid and in reducing the number of places where IPS should be installed. This may reduce the capital cost.

4.3.3 Using Open Drains in Areas Having Septic Tanks

Some Drainage Areas may have septic tanks. The effluent from the septic tank is partially treated and could satisfy conditions for being permitted to flow in open drains. Further conveyance and treatment is open to options as below:

i. It can be allowed to flow from open street drains to storm water drains. Before drains joins the river, the waste water can be taken to a STP for being treated.
ii. A network of sewers is laid so that effluent from septic tanks and other waste water is carried in them to a STP for treatment.
iii. For drainage areas that do not have septic tanks, sewers will need to be laid and houses connected to carry wastewater through a hierarchy of drains to a STP. It has then to be handled as discussed above.

4.3.4 The status of wastewater management system in the city may be presented in the following table. Where necessary a note stating the status of the component, its performance against the designed performance and whether it should be repaired, refurbished or modernised, should be appended.

Table 4.1: Existing Status of Waste Water Management

Sewage Districts	Drainage Area Name and number of drains in the district	Sewerage Districts covered with sewers and STP		Sewerage Districts Not Covered With Sewer and STP		Remarks
		State of Sewers	State of STP	Septic Tank	Discharge of waste water in street drains	

4.4 DESIGN PERIODS

Design periods for sewerage mains and STPs have been often debated due to cost considerations. Keeping in view the resource constraints and optimum utilisation of assets, a modular approach may be followed for these facilities.

The year of expected commissioning of the project shall be taken as the base year for design of various components of all projects. Design periods of various components may be adopted as given below:

Table 4.2: Design Periods

S. No.	Component	Design Period (Yrs)	Remarks
1	Land acquisition	30	Land will be required to add STP modules later. Accordingly, land should be acquired
2	Sewerage Network	30	
3	Pumping Stations - civil works	30	Cost of civil works is economical for full design period.
4	Pumps & Machineries	15	Considering modular approach
5	STP	10	Construction may be done with a modular approach in a phased manner as the population grows.
6	Rising mains	30	In case of low velocities, dual rising mains to be examined
7	Effluent disposal & Utilities	30	Provision of design capacities in the initial stages itself is economical

4.5 FUTURE POPULATION

4.5.1 Design Population

Correct and realistic projections of population for design of various components must be done to optimise costs. Floating population in respect of cities having cultural, tourism or religious importance may be considered judiciously.

4.5.2 Population Projections

For each sewerage district, population should be collected from census records for the years 1971, 1981, 1991, 2001, 2011. In case ULBs are established after 1971, respective rural population of the geographical boundary of the ULB should be considered for this purpose.

The base year shall be taken as year of completion of the project. Population projections for the base, after 10 years, mid and design years shall be made considering the past decadal growths using different recognized methods such as:

(i) Arithmetical increase method
(ii) Incremental increase method
(iii) Geometrical increase method
(iv) Simple graphical projection method
(v) Semi-Log graphical method
(vi) Ratio method
(vii) Land use and future density method - This shall also be carried out at micro level for individual wards depending upon the growth potential of individual wards in consultation with local body, development authority (if any) and city country planning department.

Future population, which appears to be more realistic and acceptable, shall be adopted giving proper justification for the same.

4.6 SEWERAGE MASTER PLANNING / SEWERAGE DISTRICTS

Master plan of the city shall be prepared for sewerage, if not prepared earlier. Considering the topography and geographical features, ridge lines, alignment of drains, railway tracks, major roads, national highways, encroachments, quicker construction and commissioning of works and availability of land for SPS and STP etc., the whole city shall be divided into a number of sewerage districts. Attempt should be made to avoid long sewers, as sewers will not be required to be laid at large depths and also intermediate pumping stations would be avoided or reduced. To the extent possible, pumping should be avoided. This may entail a larger number of small STPs as against large STPs but fewer in number.

The design of works in these districts shall be carried out in an integrated manner taking into consideration the most optimum options from techno-economic perspective with respect to interception of waste water, alignment of sewers, sewage pumping stations and sewage treatment plants etc. Topography of the area, gradient, obstructions, etc. shall be taken into account while planning the interception and diversion of waste water of the contributory areas.

4.7 RATE OF WATER SUPPLY

According to the guidelines of Government of India, which are applicable all over the country, following water supply rates are to be adopted.

Table 4.3: Recommended Per Capita Water Supply Levels for Designing Schemes

S. No.	Classification of cities	Recommended Maximum Water Supply Levels (lpcd)
1	Cities provided with piped water supply but without sewerage system	70
2	Cities provided with piped water supply where sewerage system is existing/ contemplated	135
3	Metropolitan and Mega cities provided with piped water supply where sewerage system is existing/ contemplated	150

NOTE:

1. In urban areas, where water is provided through public stand posts, 40 lpcd should be considered.
2. Figures exclude “unaccounted for water (UFW), which should be limited to 15%.
3. Figures include requirements of water for commercial, institutional and minor industries. However, bulk supply to such establishments should be assessed separately with proper justification.
4. However, the actual rate of supply of water should be supported with availability of water in the town.

4.8 STATUS OF EXISTING WATER SUPPLY

It shall be ensured that the existing water supply or under execution, has the potential to meet the water demand of the projected design population at the rate specified in the above table. DPR shall not be approved unless assurance to this effect is received.

4.9 PER CAPITA SEWAGE FLOW

The observed dry weather flow reaching the sewer system is less than that of the per capita water consumption due to loss of some water in leakage and evaporation. Generally, 80% of water supply is expected to reach the sewer system. For calculating the water consumed, the ground water extracted should also be added to the piped water supply.

4.10 GROUND WATER INFILTRATION

As per guidelines laid down by GoI, suggested estimates for ground water infiltration for sewers laid below ground water table are:

Table 4.4 Ground Water Infiltration

Infiltration	Minimum	Maximum
Liters/km/d	500	5000

With improved standards of workmanship and quality and availability of various construction aids, these values should tend towards the minimum, rather than the maximum. These values should not mean any relaxation on the water tightness test requirements.

4.11 RIVER WATER QUALITY

4.11.1 Water Quality Standards for Rivers

Water Quality Standards for rivers as per CPCB classification of Designated Best Use criteria of rivers for bathing are as given below:

Table 4.5 Water Quality Standards for Rivers

Parameters	Standards
pH	6.5 to 8.5
BOD	3 (mg/l) or less
DO	5 mg/l or more
Fecal coliform Desireable Maxm. permissible	 500 (MPN/100 ml) 2500 (MPN/100 ml)

4.11.2 Actual Water Quality of the River

Chemical quality of water of river u/s and d/s of the city, as monitored during investigations, shall be commented upon and tabulated as given below :
Name of Monitoring Agency:
Date of monitoring:
Place of monitoring

Table 4.6 Actual Water Quality of the River

Parameters	U/S of city	D/S of city
pH		
BOD (mg/l)		
DO (mg/l)		
Fecal coliform (MPN/100 ml)		

Comments on river water quality on the basis of the above shall be given.

4.11.3 Provisions for River Ganga

River Ganga has been given the status of the National River and the National River Ganga River Basin Authority (NGRBA) has been set up. The NGRBA is an empowered planning, financing, monitoring and coordinating authority for the River Ganga for effective abatement of pollution and conservation of River Ganga in keeping with sustainable development needs.

A River Ganga Basin Management Plan is being developed involving exhaustive studies in the entire basin. Works in the River Ganga basin will need to be taken up in accordance with those proposed in the management plan.

However, in the meanwhile, effluent standards have been made more stringent, for critical stretches of River Ganga, by the Ministry of Environment, Government of India on 3.2.2010 as in the table given below (Copy of OM dt. 3.2.10 attached as Annexure 3)

Table 4.7: Effluent Standards prescribed by NRCD, Ministry of Environment, Government of India:

Parameters	Units	Effluent Standards for discharge into water bodies		Effluent Standards for discharge on land
		Existing Standards	Standards revised on 3.2.10 (Annexure 3)	
pH		5.5-9.0		
BOD	mg/l	30	*20	100
TSS	mg/l	50	*30	200
Fecal coliforms	MPN/100 ml	Desirable– 1,000 Permissible– 10,000		Desirable – 1,000 Permissible – 10,000

*or lower depending on the assimilative capacity of the effluent receiving water body

4.12 QUANTITY OF WASTE WATER

For sewers, a 30-year design perspective is proposed. Actual flows measured through field investigations should be projected for this period. Similarly, for STPs and pumping stations, flows should be projected taking into consideration the population of the respective design period. The figure arrived at, following the method given in paragraph 6.7, should be adopted if there is discrepancy between the two projections.

4.13 SEWAGE TREATMENT PLANTS

4.13.1 Technology

In the NRCD document "Compendium of Sewage Treatment Technologies" published in 2009, (http://moef.nic.in/modules/recent-initiatives/NGRBA/Final%20Compendium.pdf) technologies have been evaluated on basis of

i. Performance,
ii. Energy requirement,
iii. Resource requirements and associated costs,
iv. Land requirements.
v. Annualised cost has also been worked out.

This compendium may also be referred for selection of an appropriate sewage treatment technology. It implies that depending on the desired water quality of the effluent of the STP, land requirement, availability of electricity and funds available, the technology that appears feasible should be selected using the matrix given in Compendium of Technologies. New technologies like 'In Situ Sewage Treatment through Bioremediation' not covered in the compendium may also be examined.

4.13.2 Options for locating STPs

(i) The following options have to be generally considered for locating STPs:
  (a) One, with a decentralised approach, which would envisage collection, treatment and disposal of wastewater in the neighborhood itself.
  (b) The second option involves conveying the collected wastewater to a centralised STP from where it could be suitably disposed of into the river or used for irrigation.
  (c) Locating the STP further away where land at lower rates is available and inexpensive technology can be adopted

(ii) All options have to be analysed in the right perspective taking into consideration capital and recurring costs and views of stakeholders. Proper justification should be presented in the DPR for the selected option.

4.14 WORKING OUT LAND REQUIREMENT

Sewers are laid on the road side on publicly owned land. Hence no land is required to be acquired for sewers. However, land is required for Intermediate Pumping Stations and Sewage Treatment Plants. In the above referred Compendium, the land required for treatment plants has been given. It should be used to estimate the land required for STPs. For new technologies not covered in the compendium, estimate for the land required may be based on STPs actually constructed. Land required for IPS should also be worked out.

4.15 RESOURCE RECOVERY

Water is scarce. To the extent possible after use it should be reused or recycled to the extent it is feasible. If it is not feasible other methods of resource recovery are

i. Sale of sludge as manure
ii. Sale of treated water for irrigation, horticulture

iii. Pisciculture etc
iv. Generation of electricity
v. Carbon credit

4.16 SELECTION OF BEST OPTION

The best option is to be selected as per component wise details of various feasible options.

4.17 COST ESTIMATES

At the stage of preparing feasibility report, detailed designing may not be possible for want of relevant data. Quotations for supply of bought out items such as STP, pumps and motors, sewer pipes should be obtained from reputed suppliers. The cost of other items as are on the schedule of rates of the concerned works department of the state should be used to work out cost.

Sewage pumping and treatment need uninterrupted electricity supply. Therefore, average duration of supply of electricity should be ascertained so that the number of hours during which the DG set will need to be operated can be known.

4.18 LIFE CYCLE COST

The most cost effective and feasible option may be selected through their life cycle cost analysis. The cost components that should be included are the following:

a) Capital (One time cost)
   i. Land
   ii. Cost of various components of the system.

b) Recurring (Annual)
   i. Energy (electricity & diesel)
   ii. Manpower cost in operation and maintenance
   iii. Consumables
   iv. Repair and maintenance
   v. Resource recovery (negative cost.)

4.19 FACTORS IN SELECTION OF SYSTEM OF WASTE WATER MANAGEMENT

Factors which affect the selection of system are given below:

i. Feasibility of utilising an existing wastewater management system with necessary repairs, renovation, up gradation and modernisation.
ii. Where new systems are to be established, availability of land is a critical factor. In a district if suitable land of the required size is not available for installing STP, waste water must be carried to a place where land for the STP is available.
iii. Availability of electricity. It is crucial as a centralised system usually involves a long interception sewer necessitating laying of sewers at considerable depth and installation

of intermediate pumping stations. These require power and since in most states there is shortage of power, standby arrangements in the form of DG sets have to be provided for. Thus centralised system involves high capital cost and high O&M cost.

iv. There are pros and cons of centralised and decentralised systems. They should be carefully analysed and compared. Life cycle costs of different systems should be compared.

v. The capacity of the ULB – financial, material, human resource related to implement, operate and maintain and manage the pollution abatement

vi. The ability and willingness of the people to meet their obligations to sustain the system etc.

vii. Over the life cycle of the system, the net present value of annual costs should be worked out of systems that are considered feasible and on that basis the system found to cost the least should be selected.

Based on the above factors the most suitable system may be selected.

4.20 PREPARING DRAWINGS

Drawings of works proposed should be incorporated in the feasibility report.

CHAPTER 5
DETAILED PROJECT REPORTS OF SEWERAGE SCHEMES

5.1 GENERAL

The Feasibility Report would have selected the most suitable system for pollution abatement. Design of the selected system and its components should be done following these guidelines.

NGRBA guidelines provide for the River Ganga basin, that apart from conveying sewers, pumping stations and STPs, these items should also be included in projects in unsewered areas to make the city fully sewered. Under NRCP also, branch and lateral sewers and house connections up to the property land are to be proposed to ensure comprehensive coverage.

DPR shall be prepared on the basis of detailed survey, investigation & engineering design.

Designs of all these facilities should be based on standard procedures laid down in CPHEEO manual (http://urbanindia.nic.in/publicinfo/manual.htm). In the event of absence of guideline in the manual on a particular aspect, BIS codes, standard books, state / CPWD manuals may be followed

Selection of pipe materials like GRP / DI etc shall be as per site conditions. Basis for selection of gravity sewer/rising main shall be provided in the DPR.

Existing sewerage works should be dovetailed with the proposed scheme.

Provision of dedicated feeders for SPS and STPs is essential to ensure round the clock operation. The DPR should contain details of such feeders like length of the cable from the power source, specifications of transformers and estimated cost. NRCD would not consider funding proposals which do not comply with this requirement.

5.2 Improving an Existing System

If a decision is taken to improve an existing system of waste water management by repairing, refurbishing, upgrading and / or modernizing, the items of work that are needed should be identified and the details worked out and costs estimated.

5.3 Design Parameters Covered in Chapter on Feasibility Report

Details of the following items have been given in Chapter on “Preparation of Feasibility Report of Sewerage Schemes” and, therefore, are not being repeated here:

i. Design Periods
ii. Future Population & Population Projections
iii. Sewerage Master Planning / Zoning
iv. Rate Of Water Supply
v. Status Of Existing Water Supply
vi. Per Capita Sewage Flow
vii. Ground Water Infiltration
viii. River Water Quality
    a) Water Quality Standards For Rivers

b) Actual Water Quality Of The River

5.4 QUANTITY OF WASTE WATER

For sewers, a 30-year design perspective is proposed. Actual flows measured through field investigations should be projected for this period. Similarly for STPs and pumping stations, flows should be projected taking into consideration population of the respective design period. The figure arrived at, following the method given in paragraph 4.9, should be adopted if there is discrepancy between the two projections.

There should be permanent arrangement for measuring discharge in drains.

5.5 SEWAGE QUALITY FOR STP DESIGN

Past experience indicates that normative values of parameters like BOD and SS have been taken for influent sewage despite actual quality characteristics having been established through field investigations. Such considerations result in over design of STPs with higher cost implications. This must be avoided and actual influent quality with an appropriate mark up only be considered for design purposes. For adopting BOD levels above 150 mg/l, proper justification must be provided.

Parameters for the quality of wastewater (Values of BOD and SS) shall be adopted on the basis of actual quality of wastewater incoming at STPs / sewage pumping stations under O&M in the town / other towns in the vicinity, under similar situation. Such laboratory reports shall form part of DPR.

5.6 SEWERS

Layouts of sewerage mains or sub-mains should be prepared maintaining minimum depths and shortest flow distances with laterals proposed in the DPRs. Gravity flows must be preferred over pumping mains as far as possible to minimize pumping costs.

a) Sewers shall be designed crown meeting crown. Drops shall be avoided at junction points.
b) The plans should show basic details such as GLs, contours, major drains, their points of outfall, diameter and invert levels of sewers provided, specially at junction points.
c) Layout of trunk sewer should be properly highlighted and be shown bold on the plans and the design chart.
d) Type of subsoil strata up to sewer invert level, subsoil water table data and type of road surface over the proposed sewer alignments shall be mentioned in the L-section of the proposed sewer.
e) Wherever it is not possible to generate self-cleansing velocity, flushing of sewer lines should be carried out at regular intervals. The requirement and number of flushing vans available with the O&M agency may be reviewed and provision for the same, if required, may be made in the estimate to be submitted.
f) Suitable bedding should be provided below sewers to safeguard them against possible settlement, as per the guide lines suggested in the Manual on Sewerage & Sewage Treatment of CPHEEO.
g) Soil investigation and test bores should be carried out at suitable intervals along the

alignment of sewers to ascertain the type of soil at different depths and behaviour of the ground water table and bearing capacity of the soil. The design of bedding may be done based on actual ground conditions.

h) Minimum depth of buried sewer shall be designed considering future rolling / point loads on city roads.

i) Where sewers are proposed to be laid below sub-soil water table, justification for the same and the precautionary measures to be taken during laying of sewers shall be mentioned in the DPR.

j) In case proposed sewer/rising main is crossing railway line/Highway and their bridges, copies of their permission and estimates for the same shall be annexed with the DPR.

k) A plan of action for giving sewer connections year wise during the implementation period of the work shall be prepared and a suitable provision be made in the byelaws to enforce compulsory sewer connections and user charges on the beneficiaries. The DPR may be prepared to achieve 100 % house connections for the present population within the project implementation period. This is necessary to assure flows in the sewer network and optimum utilisation of STP capacity.

l) Provision may be made in the DPR for house connections from the property lines up to the sewers including cutting and reinstatement of roads. This will also eliminate cutting of roads from time to time.

m) Suitable sewage cess / tariff / tax and sewer connection fee may be imposed on the beneficiaries to recover at least the O&M cost of the project to start with. However, full cost recovery at the earliest should be aimed at. ULBs may consider suitable incentive programs to encourage people to opt for sewer connection, e.g. property tax rebate for 'one-time' sewer connection by individuals. Besides, non-willing households, particularly having septic tank facilities may be penalized for discharging septic tank effluents in open drains / not constructing soak pit at prescribed distance from water source, water supply pipelines etc.

n) Design criteria as stipulated in CPHEEO Manual (http://urbanindia.nic.in/publicinfo/manual.htm) may be followed.

5.7 SEWAGE PUMPING STATIONS

Design of pumping stations should take into consideration the lean, average and peak flows. Pumping configuration should be appropriate for effective pumping of sewage in any of these flow conditions.

Submersible sewage pumps are now available and being extensively used, which are more economic in terms of both capital and running cost besides being operation friendly.

The following configuration of sewage pumps may be adopted:

Table 5.1: Configuration of Sewage Pumps

Length of Rising Main	Pumps	No. of Pumps
Where rising main is long and where head losses are the dominant factor	Peak Flow/2 pumps Non Peak Flow pumps	3 nos. (including 1 standby) 2 nos. (including 1 standby)
Where rising main is short and static head is dominant	Peak Flow/4 pumps	6 nos. (including 2 standby)

Accordingly size of the sump may be configured

5.7.1 Hydraulic retention time shall be taken as 3.75 minutes of design peak flow for design of sump. Pump should be designed on self priming mode.

5.7.2 Size of sump of the pumping station shall be checked with the pump manufacturer for adequacy and so mentioned in the DPR.

5.7.3 Provision of control and panel room shall be made in the DPR as per specifications of the State Electricity Board.

5.7.4 To ensure constant running of pumping stations, diesel operated generating sets may be proposed at each pumping station, if dedicated feeder line is not available.

5.8 RISING MAINS

5.8.1 Most economical size of rising main is to be determined by comparing the capitalized cost of different pipe sizes. However, size of pipe selected should be such that self-cleansing velocity is attained at least during peak hours.

5.8.2 Surge/water hammer analysis shall be calculated and made a part of the DPR.

5.8.3 Design of thrust/anchor blocks shall be done and made a part of the DPR.

5.8.4 Suitable provision of rising main accessories, wherever needed, such as thrust blocks, anchor blocks, expansion joints, scour/drain valves, air/vacuum release valves and surge protection devices shall be made in the DPR.

5.9 SEWAGE TREATMENT PLANT (S) (STP)

5.9.1 Technology

The choice of technology option for sewage treatment is of great importance. The NRCD has published in 2009, “Compendium on Sewage Treatment Technologies”. Among other things (http://moef.nic.in/modules/recent-initiatives/NGRBA/Final%20Compendium.pdf), this document throws light on performance levels and O&M costs of various technologies being tried out presently by various authorities. New technologies like 'In Situ Sewage Treatment through Bioremediation' not covered in the compendium may also be examined.

Techno-economic evaluation should be carried out through life cycle cost analysis of these options. This analysis should include capitalized costs, less revenue from resource recovery, recycling, by-product utilization etc. Ease of O & M, time required to construct and for achieving

the desired objectives and costs of mitigation of any adverse environmental impacts must be considered on the costs assigned for the alternatives. Best option arrived from the LCC analysis should be selected and details should be presented in the DPR.

5.9.2 Discharge of treated effluent

STP projects are to be formulated taking in to account recycling / reuse of effluent for irrigation, industrial purposes etc. The option of discharging the STP effluent into the river should also be considered.

All key parameters should be explained with detailed justification in the DPR.

5.9.3 Options for locating STPs

(i) The following options have to be generally considered for locating STPs:
   (a) One, with a decentralised approach, which would envisage collection, treatment and disposal of wastewater in the neighborhood itself.
   (b) The second option involves conveying the collected wastewater to a centralised STP from where it could be suitably disposed of into the river or used for irrigation.
   (c) Locating the STP further away where land at lower rates is available and inexpensive technology can be adopted

(ii) All options have to be analysed in the right perspective taking into consideration capital and recurring costs and views of stakeholders. Proper justification should be presented in the DPR for the selected option.

(iii) The proposed sites should be marked on the map.

(iv) The notification dated 14th September 2006 of MoEF makes EIA mandatory for new township projects of certain categories. This provision must be complied with for new colonies under advice of NRCD.

Also, it should be ensured that land would be acquired within a reasonable time.

5.10 RESISTANCE FROM HOUSE OWNERS

A problem that is likely to be faced in respect of branch/lateral sewers is the resistance from house owners who already have septic tanks and may not be inclined to make fresh investment for house connections. Public resistance is also likely in respect of sewerage routes and STP locations. All these issues need to be addressed through public education, awareness and participation at the required stage of the project. To encourage house owners to take house connections, the ULB may consider offering beneficiary-friendly payment terms and onetime incentive, as prescribed in clause 5.6 (i).

5.11 DEDICATED FEEDERS AND GENERATORS

Availability of uninterrupted power for continuous operation of pumping stations and STPs needs to be ensured. Diesel generation sets have not helped the situation due to high cost of operation. Provision of dedicated feeders for PSs and STPs is essential to meet programme objectives. DPR should contain details of such feeders like the length of the cable from the source of power, specifications of transformers, and estimated cost. However, capacity is to be determined on the basis of requirement.

5.12 OBJECTIVES, PERFORMANCE PARAMETERS AND RISK FACTORS

The objectives and outcome of the project, in terms of abatement of pollution of the river and improvement of water quality and of environment improvement, should be clearly spelt. There should be performance parameters of the system as a whole and of each component so that the effectiveness can be monitored and evaluated.

5.13 PERFORMANCE PARAMETERS

There should be performance parameters of each project component i.e., primary, secondary and tertiary treatment and the system as a whole so that the effectiveness can be monitored and evaluated.

Sub-system alternatives for major components such as sewage and MSW should include the alternatives of centralised systems and decentralised systems.

Since the systems consisting of sewers involving pumping stations, and STPs are complex and are energy and capital intensive, the guidelines may be followed for designing the components of the system.

5.14 COST ESTIMATES

Based on survey and investigation, data collection and design criteria, detailed estimates may be prepared, under the following subheads:
(CW Stands for Civil Works)
(EM Stands for Electrical and Mechanical Works)

Table 5.2: Cost Estimates of Land Acquisition for Sewerage Schemes

S. No.	Items	Amount, Rs lacs	Annexure	Total
		CW	EM	
1	2	3	4	5
1	Estimate of cost of land acquisition for construction of STPs including approach road			
2	Estimate of cost of land acquisition for construction of MPS including approach road			
3	Estimate of cost of land acquisition for construction of IPS including approach road			
4	Estimate of cost of land acquisition for laying of sewer lines			
5	Estimate of cost of land acquisition for laying of rising mains			
6	Estimate of cost of land acquisition for construction of effluent channels of STPs			
7	Estimate of cost of land acquisition for other miscellaneous purposes			
	Grand Total			

Table 5.3: Estimate of Cost of Sewerage Works – District Wise (Including Sewers, Rising Mains, IPS, MPS & STPs)

S. No.	Items	Amount, Rs lacs		
		CW	EM	Total
1	2	3	4	5
	Estimate of cost for sewer lines, sewage pumping stations and sewage treatment plants			
	Estimate of cost for sewer lines			
	Estimate of cost of MPS			
	Estimate of cost of IPSs			
	Estimate of cost of rising main of MPS			
	Estimate of cost of rising main of IPS			
	Estimate of cost of Renovation and Replacement of Sewers & Manholes			
	Estimate of cost of Renovation and Replacement of Sewers & Manholes			
	Estimate of cost of STP (----mld)			
	Estimate of cost of renovation / upgradation of existing STP (----mld)			
	Grand Total			
	Details of measurements			
	Sewers			
	Details of earth work, Timbering, Road Cutting & Reinstatement of Roads in sewer work etc.			
	Details of average depth of sewers & Excavation in sewer work			
	Details of length of sewers at different depths			
	Details of length of sewers under sub-soil water			
	Details of Bedding in sewer work			
	Details of different types of Manholes and Sewer Connecting Chambers			
	Other items			
	Sewage Pumping Stations			
	IPS			
	MPS			
	Sewage Treatment Plants			
	STP at ---			
	Rising Mains			
	For MPS at ---			
	For IPS at ---			
	Other items, if any			

Table 5.4 Estimate of Cost of Sewer Lines in Zone ---

S. No.	Items	Qty.	Cost Rs. Lacs		
			CW	EM	Total
1	2	3	4	5	6
	Sewer lines of dia -----mm to ---mm, including cutting of roads, temporary reinstatement of roads				
	Manholes, sewer connecting chambers etc				
	Permanent reinstatement of roads				
	Shifting of telephone, electric & other cables/lines,				
	Shifting and reinstatement of house water supply and sewer connections				
	Crossing of railway tracks etc.				
	Other miscellaneous works (mention)				

Table 5.5: Estimate of Cost of MPS / IPS

S. No.	Items	Qty.	Cost Rs. Lacs		
			CW	EM	Total
1	2	3	4	5	6
	MPS / IPS				
	Rising mains of MPS/IPS (dia/length/type)				
	Diesel generators				
	Fire fighting equipments				
	Special T&P, spares etc.				
	Boundary wall, Steel gate etc. around the campus				
	Electrification within campus				
	Roads, drainage and culverts etc within campus				
	Water Supply arrangement within campus				
	Plantation and Development of campus				
	Other items				
	Grand Total				

Note: Separate table be prepared for each MPS/IPS

Table 5.6 Details of Sewage Pumping Stations

S. No.	Location of MPS/IPS	Size	Depth of floor BGL, m	Avg. Design discharge, mld

Table 5.7: Details of Pumping Plants

S. No.	Location of MPS/IPS	No. of pumps	Type of pumps	Head*BHP of each	Other details

Table 5.8: Details of Generators

S. No.	Location of MPS/IPS	No. of Generators	Generator capacity in KVA	Other details
	Grand Total			

Table 5.9: Estimate of Cost of Sewage Treatment Plant at -----

S. No.	Items	Qty.	Cost Rs. Lacs		
			CW	EM	Total
1	2	3	4	5	6
	STP (mld)				
	Rising main from STP to carry treated effluent (dia/length/type)				
	Channel to carry treated effluent				
	Laboratory cum office building				
	Staff quarters for STP				
	Office Furniture				
	Lab Equipment,				
	Fire fighting equipment				
	Special T&P				
	Boundary wall, Steel gate etc. around STP campus				
	Electrification within STP / MPS campus				
	Roads, drainage and culverts etc within STP / MPS campus				
	Water Supply arrangement in STP / MPS campus				
	Plantation and Development of STP / MPS campus				
	Other items				
	GT				

Table 5.10: Estimate of cost of Laboratory cum Office Building

Item	Unit	Quantity	Plinth area	Rate of construction	Amount
1	2	3	4	5	6
Laboratory cum Office Building					

Table 5.11: Estimate of Cost of Staff Quarters Required for STP (--- mld)/MPS/ IPS

S. No.	Staff for which staff qtrs are admissible as per NRCD norms		Type of the Staff Quarter to be provided, as per NRCD norms	Plinth area of each quarter, as per NRCD norms, sqm	Rate of construction, Rs. Per sqm	Amount, Rs lacs
	Staff	Nos.				
1	2	3	4	5	6	7
	Grand Total					

Table 5.12: Detail of Rising Mains

S. No.	Location of MPS / IPS / STP	Discharge point	Dia, mm	Length, m	Type	Other details
	Grand Total					

Table 5.13: Estimate of Cost of Land Acquisition

S. No.	Land required for	Size of plot reqd, m^2	Area reqd, ha	Rate of land, Rs lacs/hect	Amount required, Rs lacs	Remarks
1	2	3	4	5	6	7
	IPS at ---					
	Approach road for IPS					
	MPS at ----					
	Approach road for MPS					
	STP at ---					
	Approach road for STP					
	Effluent channel					
	Sewage Farm Channel					
	Sewer lines					
	Rising mains					
	Others					
	Grand Total					

CHAPTER 6
OPERATION AND MAINTENANCE OF SEWERAGE SCHEMES

6.1 CRITICALITY OF O&M

Operation and maintenance of assets has emerged as a major concern in the success of this programme. NRCD has decided that funds for O&M for a period of 5 years initially, would be shared in the ratio of 70:30 between the centre and the State Government. Next 10 years O & M cost should also be worked out with revenue generation plan. The O & M responsibility beyond 5th year will rest with the State Government/ ULB.

Tripartite MoA amongst MoEF, State Government and the local body is also to be signed. State governments are expected to take all necessary measures available at their control to address this problem in a sustainable manner.

It is necessary to accurately work out O&M cost. The records of O&M of assets created under GAP/NRCP may be examined carefully and updated to the current levels as well as the periods when new facilities would be ready for operation. Cost of electricity is the major component of O&M accounting singly for 65-70%. These as well as other components like manpower, consumables, etc. should be calculated on a realistic basis to arrive at the total annual cost to operate an asset. Continuous availability of electricity for both STPs and PSs must be ensured on round the clock basis by the implementing agency.

Preventive maintenance or repairs needed after a few year's initial operations are often lost sight of. This is an important element of overall O&M cost and must be provided for appropriately.

The DPR must clearly reflect the total component-wise funds needed for O&M and how and wherefrom these would be provided.

If the O&M is done departmentally, there will be requirement of staff. Annexure – 7

(i) Norms of staff for
   a. Pumping stations
   b. Sewage treatment plants

(ii) Norms of covered areas for different categories of residential accommodation (Area as per CPWD norms)

(iii) Guide Lines For Staff Quarters

Given the provision of 5 years O&M expenditure in the project cost, outsourcing of O&M for this period to the contractor who supplied the plant would seem to be obvious. The contractor must be asked to offer performance guarantees through proper O&M to achieve the outcomes.

As part of capacity building programme, operation and maintenance manuals have to be made available to the ULB's staff by the DBO contractor.

6.2 RESOURCE RECOVERY AND REVENUE GENERATION

With little additional and dedicated efforts, sewage treatment could be converted into a

resource generation activity to partly meet the O&M costs. Treated sewage and sludge are both rich in nutrients and, therefore, can be suitably marketed as biological manure. With the increasing health consciousness, people prefer to eat food grown with such manure. It is, therefore, necessary to exploit this potential to the extent possible as a source of revenue generation.

Biogas rich in methane is available from ASP based plants and much more from anaerobic treatment of sludge and also from anaerobic treatment process like UASB. It is necessary to fully exploit the potential of biogas through cogeneration of power. A well-designed treatment system may produce electricity from biogas to meet the entire in-house requirement. Anaerobic process like UASB, which is energy effective, may even produce extra power to supply to the grid after meeting the in-house requirement.

Additionally, a cogeneration project can be converted into a CDM (Clean Development Mechanism-of Kyoto Protocol) activity, which would provide additional revenue through generation and sale of CER (Certified Emission Reduction) certificates. Given the global warming potential of methane as 21 times that of CO2, a well designed CDM project could help generat considerable revenue through the sale of CERs.

Given the fact that electricity alone accounts for nearly 65% to 70% of the O&M cost, a cogeneration project with CDM benefits could help in offsetting the expenditure on this account to a large extent. Therefore, STPs proposed on treatment processes like ASP, UASB etc. may include the cogeneration component depending upon economic viability. The project team must study well operating plants in the country in this regard.

It is necessary for the local bodies to enlarge the property tax base and utilise the additional revenue so generated to meet the O&M cost. There could be several other innovative ways for local bodies to raise revenue towards O&M costs e.g. taxes from pilgrim/tourist/floating population visiting the city, undertaking plantation on municipal lands and generating revenue there from etc. The underlying need is to explore all avenues to raise matching resources for O&M to achieve sustainability. Also the ULB is required to fulfill all commitment as per tripartite MoA (Annexure 5).

6.3 COST ESTIMATES FOR O&M

Various components on which expenditure is likely to be incurred are given in the following tables. Estimate of expenditure for each item may be prepared by the implementing agency.

Table 6.1: Abstract of Annual O&M Cost of Sewerage and Sewage Treatment Works

Rs. In lacs

Districts	Sewer lines	MPS, IPS	STP(s)	Total
District I				
Grand Total				

Table 6.2: Cost of Annual Operation & Maintenance of Sewer Lines

Rs in lacs

District	Estimated Cost of Sewer Lines	Annual Repairs of Sewer Lines @ 0.25%
I		
Grand Total		

Table 6.3: Cost of Annual Operation and Maintenance of Sewage Pumping Stations

Rs. in Lacs

SPS Estd./ Cost	Annual repairs of C.W. @ 1.5%	Annual repairs of E/M works @ 3%	Staff	Electric Power	DG Sets	Grand Total
1	2	3	4	5	6	7
MPS-1						
CW, -----Rs. lacs						
E/M, -----Rs. lacs						
IPS 1						
CW, -----Rs. lacs						
E/M, -----Rs. lacs						
Grand Total						

C.W. - Civil Works
E/M - Electrical / Mechanical Works

Table 6.4: Requirement of Staff on MPS / IPS for O&M

District	I	II				
Installed Capacity, HP	----HP	----HP				
Staff						

Table 6.5: Estimate of Staff Required for Annual Maintenance MPS/IPS

S. No.	Staff	Nos	Salary/Month in Lac	Month	Annual; cost Rs. In Lacs
1					
2					
3					
	Total maintenance charges				

Table 6.6: Estimate of Annual O&M of MPS/IPS

S. No.	Item	Annual Cost (Rs. In Lacs)
1	Staff	
2	Electric Consumption for running the MPS/IPS	
3	DG set	
	Total Annual Cost	

Table 6.7: Estimate of Annual Electric Consumption for Running Sewage Pumps MPS/IPS

Period of running/ no. of Pumps *	Capacity of Installation KVA		Electric Consumption					Annual Cost of Electric Consumption ***
	Each Pump	All Pumps	Other Loads	Total Load in KVA	Total Load in KW	No. of Hours Run	Total Units/ Day	
Peak (---- Pumps)								
Non Peak (---- Pumps)								
Avg (---- Pumps)								
Grand Total								

Note :-

(i) -- pumps shall run during peak period of -- hours. (-- hours by Electric and -hours by D.G)
(ii) -- pumps shall run during Average period of -- hours.
(iii) -- pump shall run during Non Peak period of --- hours.
(iv) 2 Rate of power = Rs. --/unit

Table 6.8: Estimate of Annual Maintenance of D.G. Sets – MPS /IPS

S. No.	Item	Detail
1.	Capacity of D. G. Set.	
2.	Quantity installed	
3.	Running hours considered per day	
4.	Diesel consumed in hr.	
5.	Annual consumption of diesel	
6.	Annual consumption of Mobile oil (@ 5% of diesel consumed)	
7.	Cost of diesel at Rs. --- Per lit.	
8.	Cost of Mobil oil at Rs. --- Per lit	
9.	Operator required – at the rate Rs. ---- pm	
10.	**Total of Sl. 7,8 & 9**	

Table 6.9: Cost of Annual Operation & Maintenance of STPs

STP/Estd Cost	Annual repairs		Staff	Power	Chemical			Total Cost
	CW@ 1.5%	EM@ 3%			Chlorines	Polymer	Sub Total	
STP I CW –---- EM ---- (–-- Mld)								
Grand Total								

Note:

1. Cost of electricity considered @ Rs. --- per kwh
2. Cost of Chlorine gas considered @ Rs. -- per kg
3. Cost of polymer considered @ Rs. --- per kg
4. CW: Civil Works
5. EM: Electrical and Mechanical Works

Table 6.10: Requirement of Personnel for STPs

Designation	Salary (P.M)	1 (---mld)											
Total													

Table 6.11: Electrical Load List S.T.P

Equipment	kW	Total Drives	Connected Load kW	Drives operating	Operating Load kW

O&M RECOVERY PLAN

S. No.	Description	Year		
		Base Yr	Mid design period	Design yr.
1	**2**	**3**	**4**	**5**
1	Population			
2	Annual recurring expenditure on O&M (Rs. In Lacs)			
3	Per capita cost of the O&M expenses (Rs.)			
4	Number of house holds (considering 5 members in a family)			

O&M RECOVERY PLAN

S. No.	Description	Year		
		Base Yr	Mid design period	Design yr.
1	2	3	4	5
5	Approximate Number of households taking private connections (---%, ----%, ----% of total households in year 2013, 2028, 2043)			
6	Monthly Rental Value per House			
7	Annual Rental Value per House			
8	Annual Rental Value of House in Rs. (Item no.5 x 7)			
9	**Anticipated annual income(Rs.)**			
10 (i)	Annual Income from sewer connections @ Rs. ------- per connection			
(ii)	From domestic sewer charges(---% Sewer Tax on row. 8)			
(iii)	From STP by sale of sludge			
(iv)	From others (specify)			
11	**Total anticipated annual income(Rs.)**			
	(Say Rs. In lacs)			
12	**Total annual recurring expenditure**			
	Profit/Loss(+/-)			

CHAPTER 7
COMMUNITY SANITATION SCHEME

7.1 INTRODUCTION

The problem of open defecation in the project town needs to be addressed through the community sanitation scheme. The scheme is also to tackle the sanitation problem in a decentralized manner in unsewered areas. The coverage may also be extended to crowded/ public places and pilgrim centres, etc.

The target areas where such projects would be required are (a) jhuggi-jhopri clusters, (b) unauthorized/unapproved colonies and (c) public places like railway stations, bus stands, courts, religious places etc.

The studies pertaining to community sanitation may be carried out by the ULB or through an organization which has experience of working in providing community sanitation facilities. In most cities deficiency of toilets in slums has been noticed. It is, therefore, proper for the ULB to set up community toilet complexes to address the problem of community sanitation.

7.2 PREPARING A SCHEME OF COMMUNITY TOILET COMPLEXES

7.2.1 Collection of Available Data

The following information may be obtained from records of the ULB, ward wise or drainage area wise, as it may be available

Floating and permanent population,
Present status of sanitation.
Availability and status of individual toilets.
Number of houses without toilets.
Locations where community toilets are required for community/ tourists/ floating population.
Willingness of householders to construct and pay for construction of toilets.

From municipal records information about the status of existing community toilet complexes (CTCs) in public places within limits of the ULB may be obtained. The information may be tabulated as below.

(i) Name and location
(ii) Number of seats (male + female)
(iii) Maintenance agency
(iv) Average number of users/day
(v) User charges
(vi) O&M problems and source of funding
(vii) Source of water supply
(viii) Mode of disposal of wastewater
(ix) Biogas generation, if any
(x) Status of community toilets.

Location of existing facilities should be marked on the digitized map. Photographs showing the status of cleanliness and hygiene of CTCs should also be presented.

7.3 SURVEY

(i) Provision and location of new facilities must be supported by survey of target areas.

(ii) Survey should be detailed or sample depending on the number and size of slums, unauthorised colonies and public places. If it is decided to conduct sample survey size of the sample should be decided. Normally, 15% of population should be enough

(iii) Surveys should be structured to cover all the three categories viz. jhuggi-jhopri clusters, unauthorised colonies and public places.

(iv) Current population living in target areas needing toilet facilities should be assessed realistically. In respect of public places, data of floating population should be obtained from local authorities and reported in the DPR. If not available, this data must be generated through quick surveys.

(v) Separate questionnaires should be developed for each category and circulated amongst prospective beneficiaries to elicit their views on the project. The data, among other things, should be generated on such aspects as whether the beneficiaries need such facility in their area and are ready to pay user charges.

(vi) The questionnaire should specifically target female users to elicit their commitment to use the facility once available. This opportunity must be utilised to educate the beneficiaries through questionnaire about the health hazards of open defecation and its impact on river pollution.

(vii) The data generated from field investigations should be analysed and reported in the DPR. Keeping in view the existing facilities, if any, need for new projects should be established only on the basis of the above data. According to existing norms, provision of one seat for 50 users is taken for community toilets. The size of toilet blocks should be finalised on this norm.

(viii) Surveys and stakeholders' consultations are specialised and time-consuming activities expertise for which may not be available in-house with the implementing agency.

(ix) There are a number of reputed NGOs, Community Based Organisations (CBOs) and social organisations, which are taking up such projects on turnkey basis including O&M. Such agencies only would be suitable for conducting surveys and stakeholder's consultations and thereafter preparing sustainable proposals and operating them on BOT basis.

(x) Developing or promoting a CBO from the target area itself for this purpose should be preferred, as these organisations would have the sense of ownership of the project. Their establishment cost would also be comparatively lower than others. (Please see box below).

(xi) Depending on its actual needs, it would be advisable for the implementing agency to appoint such agency(s) to implement the CTC projects and to make them sustainable. Complete details of the organisation selected for implementing the project with their past experience should be presented in the DPR.

(xii) Present arrangement of water supply to target areas, quantity supplied per person per day and source of water supply should be provided in the DPR and indicated on maps. This information is necessary for designing toilet facilities.

(xiii) Availability of the nearest sewer line, if any, to which wastewater generated from the facility could be connected should be indicated on maps.

(xiv) Once the scope of work is defined, the location of the facility should be finalised in consultation with the local body and implementing agency. Availability of suitable land as near as possible to the target population should be examined in consultation with the land owning authority. These must be plotted clearly on the map.

(xv) Surveys and field investigations must be supervised at various milestones at senior levels in the implementing agency to ensure quality DPRs. This exercise may take some time but would eventually be beneficial in improving sustainability of the programme.

7.4 SAMPLE SURVEY

If the number of slums and unauthorised colonies and population to be covered is very large and complete survey will be expensive and time consuming, sample survey of 15% households of each slum and unauthorised colony should be carried out.

7.5 INFORMATION AVAILABLE FROM SURVEY

a) Number of persons per family.
b) Education level of head of families
c) Occupation (head of families):
d) Character of houses: The distribution of houses in terms of type of construction is as below:
   Pucca, semi puccca, kutcha, huts
e) Percentage of houses having electricity:
f) Percentage of houses having water supply:
g) Percentage of houses having latrine connected to sewer / attached to septic tank with soak pit / without soak pit / pit latrine, and percentage of slum population resorting to open defecation.
h) Percentage of people willing to pay for using community toilet:
i) Number of authorized and unauthorized slums.
j) Number of slums having sewers
k) Number of slums having septic tank facility of the effluent from septic tank to flow through open drains.

7.6 LOCATION OF COMMUNITY TOILETS

Based on the outcome of field survey, sites for new public toilets should be identified. These should be so selected as to minimize likely nuisance to the neighbourhood. It should be connected to the sewer line wherever possible. The sites should be discussed with the residents of area who will use them.

7.7 DESIGN CONSIDERATIONS

7.7.1 Size

i. The size of toilet blocks may vary from 5, 10 to 15 and 20 seats depending upon the space available and number of users.

ii. Guidelines for plinth area for these types of CTC units will be as given below:

Table 7.1 : Plinth Area of Community Toilets

S. NO.	Type	Maximum Plinth Area (sq.m.)
1	10 seated	80
2	15 seated	125
3	20 seated	150

iii. The above areas are proposed maintaining for cleanliness and hygienic conditions in the complex and to make it environment and user friendly.

iv. The size may be adopted as under with a tolerance of (+) or (-) 10%.

Table 7.2 : Size of Different Units of Community Toilets

S. No.	Component	Size (sq.m.)
1.	Water Closet	0.9 x 1.2
2.	Bath room	1.2 x 1.5
3.	caretaker room	3.0 x 3.0
4.	Counter	3.0 x 1.2

v. A complex should have separate blocks for males and females.

vi. For all types of CTC blocks, two urinal for gents, two bathrooms, one each for ladies and gents, one caretaker room and one counter should be provided.

vii. Besides toilets, urinal facilities shall also be provided. Squatting and standing urinals shall be provided for males, whereas females will use toilets for urination.

viii. Washbasins shall be provided with mirrors in both the blocks.

WC Enclosure

(a) Doorframes of size 0.75 x 1.8 m could be fabricated out of pressed MS/GI sheet or other economic yet durable materials. Brass materials shall not be used at any place.

(b) These are pour and flush type toilets designed to use less water, say 1-1.5 litres, for each flushing. The WC pans should be compatible to this design.

In general good quality fixtures, floors and better specifications should be proposed to maintain cleanliness. Ordinary glazed tiles or mosaic tiles may be provided up to 1 metre high skirting level. Floor shall be of P.C.C. Doors with PVC may be proposed as wooden doors are costly and steel doors get corroded. Shutter of the door shall be 1.5 feet less than the height. For proper ventilation, pre-cast RCC jali should be used. Toilets may have architectural features to give a pleasing look.

(c) One western type WC may be provided in each block for males and females.

7.7.2 Water Supply

(a) If piped water supply is available in the area it must be utilised to meet the water needs of the toilet complex. However, if no such source is available, provision of a suitable electric pump operated bore well should be made.

(b) A water tap may be provided in each WC enclosure keeping in view the local requirement/practice. The taps should be self-closing type of CI material to avoid wastage of water. An overhead storage tank should be provided with capacities @ 400 litres/seat as given below:

Table 7.3 : Capacity of Storage Tanks for Community Toilets

S. No.	Type	Maximum Capacity
1	10 Seater	4000 litres
2	15 Seater	6000 litres
3	20 Seater	8000 litres

(c) Arrangement for rain water harvesting may be made.
(d) Solar photovoltaic cells may be installed and safety of the component may be ensured.
(e) The structure should have provision for sufficient daylight entry through walls / roofs and higher degree circulation of air through natural ventilation system.

7.7.3 Wastewater Disposal System

Connecting wastewater to a nearby sewer line, if any, should be preferred. If it is not possible, CTC units should be provided with a septic tank followed by a soak pit. In that case a comparison between the cost of sewer line and septic tank etc. should be carried out and least cost option should be selected. In the case of soak pit option, its location must be at a safe distance from a groundwater source / water supply pipeline in the area, if any.

7.7.4 Bio Gas

(a) Community Toilet Complexes should have a good potential to generate biogas which can be a source of revenue. Biogas produced from public toilet complexes is being utilized for different purposes e.g. cooking, lighting, electricity generation. The Ministry of Non-Conventional Energy Sources (MNES), Government of India provides subsidy for the construction of such biogas plants through its different state agencies. Wherever feasible, biogas generation package should be proposed. Biogas may be used for lighting of the complex and cooking in the caretaker's room. This would offset the electricity cost otherwise incurred on lighting.
(b) Detailed engineering and drawings along with bills of quantities, specifications, cross sections etc. must form part of the DPR.
(c) Bills of quantities, specifications, cross-sections etc. should be presented in a separate volume.

In this regard help of NGO and MNRE may be taken.

7.8 OPERATION AND MAINTENANCE

(i) Operation and maintenance should be accorded priority for sustaining CTC projects.
(ii) The requirement of funds for O&M should be assessed on a realistic basis.
(iii) Expenditure on O&M would comprise (a) cost of electricity and water consumption, (b) salary of caretaker, sweeper etc, (c) cost of consumables like soap, detergents,

deodorants etc. and (c) repairs and maintenance.

(iv) Revenue generated from user charges and biogas generation, if any, should be assessed again on a realistic basis. In Jhuggi-jhompri clusters instead of charging fee from individuals, family pass system with a reasonable monthly charge would be desirable.

(v) The net deficit or surplus for O&M must be indicated.

(vi) Maintenance of cleanliness and hygiene is the key for sustaining such projects. This must be kept in view while assessing the project economics.

(vii) O&M should be on long term and DBO model / basis where the operator would be authorised to collect user charges.

7.9 PUBLIC PARTICIPATION

(i) Public participation through education and awareness is a key parameter to achieve sustainability.

(ii) The NGO or CBO engaged for implementation and O&M of CTCs should organise education and awareness programmes for target groups round the year in pre and post commissioning stages.

(iii) Among other things, the focus of the programme should be to dispel health hazards due to the practice of open defecation as also its impact on river pollution.

7.10 COST ESTIMATES

(i) Cost estimates of other components should be prepared in standard formats. These should be based on the detailed bill of quantities, specification of materials, structures and rates as per the latest SORs.

(ii) Bill of quantities, specifications and drawings must be presented in a separate volume.

(iv) The DPR would also be used for preparation of NIT and tendering the project. It should, therefore, contain every thing including complete engineering drawings, longitudinal sections etc. or any other detail that would be required for NIT as well as monitoring of project implementation.

Table 7.4: Cost of constructing new Community Toilet complexes and renovating existing community toilet complexes

S. No.	Details	Amount (Rs. In lacs)	Annexure for Detailing
1.	New community toilet complexes in public places		
2.	New community toilet complexes in slum areas		
3.	Renovation of existing community toilet complexes		
4.	Where required, land acquisition		
5.	O&M Cost for 5 years		
	Grand Total		

Table 7.5: Cost of community toilet complex at public places

S. No.	Name of the Public Place	Toilet Complex (no. of seats)	Amount (Rs. In lacs)
1.			
2.			
3.			
4.			
n			

Table 7.6: Cost of community toilet complexes in slum areas

S. No.	Name of the Slum	Toilet Complex (no. of seats)	Amount (Rs. In lacs)
1.			
2.			
3.			
4.			
n			

Table 7.7: Cost of renovation of existing toilet complexes

S. No.	Name of Complex	Amount (Rs. in lacs)			
		Basic cost	Contingency 3% on col. 3	Implementation charges @ 15% on Col. 3+4	Total cost (Col. 3+4+5)
1.					
2.					
3.					
4.					
n					

7.11 Completion Schedule

It should be presented in the form of a PERT/CPM chart for monitoring purposes.

7.12 OPERATION AND MAINTENANCE

As mentioned O&M should be on DBO basis for a period of 5 years.

7.13 PERFORMANCE MONITORING

Utilisation performance of CTCs should be monitored on a regular basis and bottlenecks if any should be addressed well in time. For this purpose, a monitoring mechanism through an independent agency must be put in place.

7.14 Agency to Prepare and Implement Project

The agency to prepare and implement the project may be decided by the ULB and the State Government.

7.15 Awareness Generation and Public Participation

This is the most important component of CTC. There have been many examples of Community Toilet Complexes not being used. It is, therefore, most important that effective campaign for awareness generation and securing public participation precede implementation and the community of local users have a say in the preparation of the plan and management of the facility after its comes up, even if it is constructed and managed by specialised agency or NGO.

7.16 Amendment in Municipal Rules & Regulations

The existing laws, rules, regulations and bye-laws governing sanitation are required to be amended to prohibit open defecation and make it obligatory to use sanitary toilets. It is necessary to operate and maintain them properly so that people are attracted to use them and environmental degradation and pollution of water bodies is prevented.

Mere provision in the Municipal/Local Authority Act or framing of bye-laws will not solve the problem. The Local Authority should enforce them strictly and defaulters should be dealt with severely.

7.17 Provision for Improved Toilet Complexes.

There may be a demand for improved toilet facility especially in commercial areas. This may prove to be a potential source of revenue earning through higher user charges. Such facility may be provided on need based manner and financial viability in terms of user charges.

CHAPTER 8
CREMATORIA

8.1 INTRODUCTION

Cremation grounds are generally located on the banks of rivers. Ash and other wastes generated from such cremation grounds are disposed off into the river resulting in their pollution. Thus, cremation grounds have been identified as one of the sources of pollution under river cleaning programmes of MoEF.

The focus of MoEF is not only on minimizing river pollution from this source but also to protect and conserve valuable forest resource by upgrading the existing cremation grounds or supporting new ones with cleaner technologies and higher combustion efficiency having public acceptance.

8.2 METHODS OF CREMATION

The following three methods are used for cremating dead bodies:

(i) Conventional method

(a) This method has been in use from time immemorial. In this mode cremation is done on an open platform by burning wood. On an average, about 400 kg of wood is consumed per cremation. Projections based on the data of census of India –2001 indicate that about 4.15 million tonnes of wood equivalent to 50-60 million trees, is consumed every year in cremating dead bodies. Considering 20% ash in wood, nearly 8.5 lakh tonnes of ash generated from the process find its way into the river annually.

(b) With the increasing cost and dwindling sources of wood, people below poverty line may resort to dumping dead bodies directly into rivers.

(c) Another adverse impact of this method on environment is in terms of emission of greenhouse gas – CO_2 in significant quantities from wood burning. It is estimated that about 8 million tonnes of CO_2 is emitted annually from this operation.

(ii) Electric or Gas Based Crematoria

Electric crematorium (EC) is a cleaner alternative of cremation. But the proposal for EC should be prepared based on demand from the stakeholders including civil society

(iii) Improved Wood Based Crematoria

As the name suggests, Improved Wood Based Crematoria (IWC) operate in a traditional manner on wood only and is capable of saving wood upto 50-60 % as compared to the conventional method. In IWC, cremation is done on a specially designed elevated pyre equipped with a hood and chimney to improve combustion efficiency and minimize wastage of heat, which makes it a fuel-efficient system. It enables users to perform all-important rituals associated with the cremation process. Thus, besides being environment-friendly and fuel-efficient IWC is a user acceptable method.

8.3 DETAILED PROJECT REPORT

An executive summary of the project covering its salient features and abstract of project cost should be given in the DPR.
A checklist of important items of the project in the prescribed format as given at Annexure 11 should be attached immediately after the executive summary.

8.3.1 Baseline Status

The following information should be provided:

(i) Total population of the city as well as that of the target users – this should include floating population also for religious cities like Varanasi, Allahabad etc.

(ii) Details and current status of each of the existing cremation grounds in the following table:

- (a) Name of cremation ground
- (b) Population serviced
- (c) Conventional method
  - Number of platforms
  - Average number of cremations/day
  - Average wood consumption/cremation
  - Sale price of wood
  - Whether any subsidy provided for wood by the local body
  - Average time taken in each cremation
  - Blockage of platform after each cremation to facilitate ash collection
  - Operating agency
  - Expenditure on O&M/year
- (d) IWCs, if any,
  - Number of Platforms
  - Year of installation
  - Average number of cremations/day
  - Average wood consumption/cremation
  - Sale price of wood
  - Whether any subsidy provided for wood by the local body
  - Average time taken in each cremation
  - Blockage of platform after each cremation to facilitate ash collection
  - Operating agency
  - Expenditure on O&M/year
- (e) Electric/ rematoria, if any
  - Number of furnaces
  - Year of installation
  - Average number of cremations/day
  - User fee charged/cremation
  - Average time taken in each cremation
  - Operating agency
  - Average electricity outage/day
  - Expenditure on O&M/year

8.4 FIELD INVESTIGATIONS

The proposal may comprise either new facility or upgradation of existing facility or a combination of both.

8.5 DESIGN AND OTHER CONSIDERATIONS

Projects of electric/gas based crematoria should have the following components:

(A) Electric

(a) Furnace

(i) Furnace with appurtenant components with specifications as given below.

(ii) The number of furnaces should be decided on the basis of expected cremation load assessed through field investigations.

Furnace having power rating of 51 KW
Transformer-150 KVA
LT Panel, HT switchgear,
Heating elements
Chimney – 30 m long as per norms of SPCB/CPCB
Blower of 2800 rpm and 10 HP motor for flue gases
Fresh air blower with servo motors
Door motor for door lifting
Charging trolley
Pollution control equipment for cleaning flue gases like cyclone separator, water spray tank and slurry tank

(b) Building

(i) Provision of a proper sized building should be made for housing cremation furnace including sitting space for mourners, toilets, washrooms, drinking water etc.

(ii) Even if only one furnace is proposed, provision of building should be made for two furnaces keeping in view the future load.

(iii) The optimum size for housing two furnaces and other facilities is 30 m x 20 m

(B) Gas

(a) Furnace

Gas based crematoria may be operated on either CNG or LPG. Gas furnace with appurtenant components should have the following specifications.

Like electric crematoria, the number of furnaces should be decided on the basis of expected cremation load assessed through field investigations.

Furnace:	With necessary burners generally four burners are provided in each furnace
Fuel:	CNG or LPG
Ignition:	Direct spark ignition 7300-volt ignition transformer
Motor:	3450-220 V-2.4 A
Blower:	2800 rpm and 10 HP motor for flue gases
Chimney:	30 m long as per norms of SPCB/CPCB

Fresh air blower: with servo motors
Door motor for door lifting
Charging trolley
Pollution control equipment for cleaning flue gases like cyclone separator, water spray tank and slurry tank

(b) Building

Provision of building would be the same as in the case of electric crematoria mentioned above.

8.5.1 Improved Wood Based Crematoria (IWCs)

Proposal for new cremation grounds

(a) A new cremation ground should comprise the following components:
  (i) Pyres with shed, tray, hood and chimney and necessary civil work.
  (ii) A prayer-cum-assembly hall
  (iii) A godown for storing wood
  (iv) A room for care taker
  (v) Provision of toilets and washrooms
  (vi) Lighting arrangements
  (vii) Matching landscape

(b) No of pyres/platforms should be decided on the basis of data generated from baseline status and field investigations. However, it should not be less than two in any case to allow situations of bunching.

(c) Pyre, tray, hood and chimney should have the following specifications:

Platform for pyre:	7 m x 6 m including pathways and drainage for washings
Pyre:	2 m long x 1 m wide and 1 m high
Tray:	2.2 m long x 0.8 m wide. For each pyre 4 trays and a rack to hold these trays till ashes are collected
Hood:	2.5 m long and 1.25 m wide x 1 m high in taper and three side folding flaps
Chimney:	11 m long as meeting SPCB/CPCB norms

(d) Platform should be made with standard/economic materials to provide better aesthetics and longer life. Provision of a bathing platform (for dead body) should also be made.

(e) Pyre, tray, hood and chimney should be made of heat, corrosion and thermal shock resistant materials to withstand temperature up to 900 C and to provide at least 5 years maintenance free operation. This is necessary as local bodies are generally cash strapped and cremation grounds attract low priority for them.

(f) Prayer-cum-assembly hall with proper benches for sitting of mourners should be of 10 m x 6 m to accommodate at least 100 persons.

(g) The size of godown for storing wood will depend on the estimated requirement. It should be enough to store at least 3 months stock.

(h) Caretaker room-cum office should be of 4 mx 3 m size.

(i) Toilets, washrooms and source of drinking water should be of matching requirement. Similarly adequate lighting arrangements should be provided.

(j) Provision of minimum landscaping equivalent to 5 % of the cost of civil work (maximum) with greenery and flowerbeds etc should be provided. This is necessary for improving the aesthetics and providing soothing environment for the mourners.

(k) Estimates of civil work should be based on the latest SOR applicable for the city. Estimates of non-schedule items should be based on lowest of the three quotations obtained from prospective suppliers.

8.5.2 Proposal for Up gradation of Existing Cremation Ground

(a) For upgradation proposals, generally pyres, trays, hood and chimneys with appurtenant civil work may be considered.

(b) For inclusion of additional items, if any, referred to for the new cremation grounds proper justification should be provided.

8.6 LANDSCAPING AND ARCHITECTURE

Considering the sensitivity of the site, attempt should be made to develop the premises with compatible landscaping and architecture for better environment and aesthetics.

8.7 OPERATION AND MAINTENANCE

Charges are levied on use of crematoria. An estimate should be made and incorporated in the project cost.

All projects should have built-in components of 5 years O&M.

8.8 COST ESTIMATE

The equipment for electrical and gas based crematoria is supplied on a turnkey basis. Quotations from the suppliers should be obtained alongwith the requirements of land, civil, electrical and mechanical works. Based on this information cost estimates should be prepared and presented in the form given in the table below.

Table 8.1: Cost Estimate of Crematoria

S. No.	Name of Locality	Details of Item	Quantity	Cost/unit, Rs.	Total Cost, lacs
1.		Wood based crematoria			
2.		Electrical crematoria			
3.		Gas based crematoria			
4		Land acquisition cost			
		O&M Cost			
		Grand Total			

CHAPTER 9
ADDRESSING OTHER SOURCES OF POLLUTION

9.1 DAIRIES

The proposal may be prepared taking in to account the existing dairies in the town / city and their size etc to prevent disposal of excreta and urine into the river. Dairy is an industry and this item would not be eligible for funding by the NRCD.

9.2 DHOBI GHATS, GARAGES & CATTLE WALLOWING

The ULB should identify and take into account all dhobis (washermen) washing clothes, garages washing vehicles in the river, places with numbers of cattle wallowing in the river while preparing the proposal. Based on the information, facilities need to be created.

9.3 CARCASS DISPOSAL

Safe facility to dispose of carcass needs to be created by the ULB.

9.4 OPERATION AND MAINTENANCE

In respect to diaries, the owners should meet their own cost. The waste generated in diaries is a source of energy and compost. It should not need any financial support from the urban local body for operation and maintenance. Other sources of pollution covered above may involve expenditure for operation and maintenance. An estimate needs to be made and incorporated in the cost estimate for a period of 5 years.

9.5 COST ESTIMATES

All the schemes in this chapter are to be prepared, implemented and maintained by the ULB. The schemes need to be framed in consultation with appropriate experts. Many of these items are covered in the chapter on solid waste management. The extent to which the information about cost estimates is available there it can be picked up. This aspect is therefore, not being covered here.

CHAPTER 10
RIVER FRONT DEVELOPMENT

10.1 INTRODUCTION

Rivers in India are considered holy and there is religious significance attached to them. The banks of the rivers where they bathe need to be kept in good shape. In order to reach the benefits of rivers to the society, the programme may support River Front Development (RFD) to enhance aesthetics and environmental conditions along the banks. This can be achieved by undertaking RFD activities. RFD can be integrated with schemes like community toilet complexes, crematoria and plantation to make an area development scheme.

10.2 BASELINE STATUS

The following information should be provided:

(i) Total population of the city as well as that of the target users for individual RFD works. This should include floating population for religious cities like Varanasi, Allahabad etc. that assembles on important occasions.

(ii) Details and current status of the existing RFD works and the problems faced in their O&M.

10.3 DESIGN CRITERIA

Type A – Area Development Plans (ADP) would apply to sub-projects where larger river front stretches say 1-2 km long and 30-40 m wide are involved.

Facades of RFD works must be match with the cultural, religious and heritage value of the place.

Given the meandering characteristic of most rivers, one of the essential requirements should be the availability of water along the bank round the year.

The local bodies concerned are also to ensure that materials like municipal solid waste (MSW) and other wastes of any other kind are not allowed to be dumped on or near the riverbank. Separate guidelines are available for management of MSW.

Consultations with stakeholders are essential to assess the needs of the people based on which, components of ADP would be finalized. The underlying need is that an ADP should facilitate an interface between the community and the river.

The following components must be considered for developing an ADP:

(i) Provision of platforms and steps leading to the river to facilitate a safe approach
(ii) Changing rooms for males and females
(iii) Toilet, washroom and drinking water facilities at the ghats. It is also necessary to provide toilet facilities for the floating population assembling at such congregations. Provision of mobile toilets may be one of the ways to address this problem.
(iv) Adequate number of benches for sitting of people
(v) Lighting and landscaping of area with fountains, flowerbeds etc.
(vi) Development of approach roads, parking lots to facilitate easy access of beneficiaries

(vii) Provision of commercial activities like kiosks for sale of eatables, boating etc. These facilities should operate on pay-and use/eat basis and, therefore, are expected to be self-sustaining.
(viii) Given the size of congregations and diversity of the people assembling there suitable platforms for holding cultural and recreational programmes must be considered.

Type B - Improvement of small ghats.

(i) Like ADP, development of small ghats should comprise components like platforms and steps, changing rooms, toilets, washrooms and drinking water facilities, lighting, sitting space and matching landscape.
(ii) All these facilities should be finalized in consultation with stakeholders.

10.4 OPERATION AND MAINTENANCE

Like other works, operation and maintenance and lack of public participation have emerged as major bottlenecks in sustaining RFD works.

The ULB needs to estimate the expenditure on operation and maintenance and incorporate in this cost estimates.

With the new guidelines of NRCD all projects should have built-in components of 5 years O&M and necessary public education and awareness.

For ADPs provision of user fee must be considered to recover O & M costs to the extent possible. Suitable levies should also be charged from commercial activities to generate revenue to meet O&M expenditure.

Public awareness programmes oriented towards educating people on how to maintain the river and its fronts should be organized round the year and more so during large congregations.

The net deficit in O&M should be estimated on a realistic basis after discounting the above income, which should form part of the project cost.

Being a specialised area only organisations with at least 5 years experience in the construction and maintenance of such assets should be shortlisted for implementation of these projects on turnkey / BOT basis.

10.5 COST ESTIMATES

The scope of work covered under RFD sub-projects can not be uniform and would vary from place to place according to the needs of the people.

Estimates for all civil works must be prepared according to the latest applicable SoRs to avoid cost overrun.

Non-schedule items must be based on prevalent market rates obtained through quotations, which should be attached to the DPR.

Detailed bill of quantities, drawings and specifications of different components compatible to NITs for tendering the works should be provided in a separate volume.

An executive summery and abstract of cost should form part of the DPR to facilitate expeditious approvals.

Table 10.1: Cost estimate of River Front Development

S. No.	Item	Quantity	Cost (Rs. in lacs)
1	Provision of platforms and steps leading to the river to facilitate a safe approach		
2	Changing rooms for males and females		
3	Toilet, washroom and drinking water facilities at the ghats. It is also necessary to provide toilet facilities for the floating population assembling at such congregations. Provision of mobile toilets may be one of the ways to address this problem.		
4	Adequate number of benches for sitting of people		
5	Lighting and matching landscape including items like fountains, flowerbeds etc.		
6	Development of approach roads, parking lots to facilitate easy access of beneficiaries		
7	Provision of commercial activities like kiosks for sale of eatables, boating etc. These facilities should operate on pay-and use/eat basis and, therefore, are expected to be self-sustaining.		
8	Given the size of congregations and diversity of the people assembling there suitable platforms for holding cultural and recreational programmes must be considered.		
9	Operation and Maintenance		
10	Cost of land		
	Grand Total		

CHAPTER 11
SOLID WASTE MANAGEMENT PREPARATION OF FEASIBILITY REPORT

11.1 NEED FOR PREPARING THE FEASIBILITY REPORT OF SOLID WASTE MANAGEMENT

The solid waste stored or dumped within a city, particularly on the bank of a river gets dumped into the river and pollutes it. Unless it is managed properly it constitutes public health hazard and spoils the environment and aesthetics of the town.

Every Urban Local Body should have proper arrangement to deal with solid waste generated in the town. Augmenting, operating and maintaining solid waste management system in a sustainable manner by urban local bodies would require considerable capital investment, introduction of latest environment friendly and cost effective technologies , Public-Private Partnerships (PPP) and introduction of appropriate waste management operation and maintenance practices. The ULB may prefer to remove all fixed bins / vats and install portable / movable bins and well-designed transfer stations to provide the city aesthetics at its best possible condition. It is, therefore, necessary to prepare a project for proper management of solid waste.

11.2 RULES OF MUNICIPAL SOLID WASTE MANAGEMENT 2000

The Ministry of Environment and Forests has issued rules for Municipal Solid Wastes (Management and Handling) Rules, 1999 published in Sept 2000 (http://envfor.nic.in/legis/hsm/mswmhr.html). The Ministry of Urban Development has published a Manual on Municipal Solid Waste Management 2000 (http://urbanindia.nic.in/publicinfo/manual.htm). The guidelines in this manual should be followed in preparing the CSP and, FR of Solid Waste Management.

11.3 THE FEASIBILITY REPORT OF SWM TO BE PREPARED BY THE ULB

The ULB may prepare FR and after its approval, DPR may be prepared for SWM in the town. Such FR / DPR shall be prepared considering dovetailing of funds under JNNURM / UIDSST and after integration and synchronisation with the programmes of MoEF under NGRBA / NRCP.

11.4 DATA FOR FR OF SWM SCHEME

For preparing the FR and the DPR, data collected against chapters 2 may also be used for preparation of the reports for SWM.

11.5 THE PLANNING PROCESS

Involving people in the preparation of Feasibility Report is required to spread the awareness of the problem and to generate interest, among the stakeholders, in solving the problem.

Initial basic step is to collect and analyze data. After the data has been collected, feasible solution, from among those considered, should be selected by considering technical, economic, social and other factors.

11.6 DESIGN PERIOD

Municipal Solid Waste Management involves activities associated with generation & segregation at source, storage, collection, transfer and transport (with segregation option), processing, recovery and disposal of solid waste, which is environmentally compatible adopting principles of waste minimization / source reduction, material recycling, waste processing (energy & material recovery) & waste transformation .

Design life of land fill area should be typically for the range of 10 to 25 years.

While preparing a municipal solid waste management plan, the following design period (time-frame) involving all such activities as stated above should be decided depending upon the necessity of solid waste management plan:

(i) Short-term plan 2-5 years
(ii) Medium-term plan 5-15 years
(iii) Long-term plan 15-25 years

11.7 COMPOSITION OF SOLID WASTE

Household waste, mostly generated from kitchen and other domestic activities, is the major part of MSW, which includes both bio- degradables and non-biodegradables.

11.7.1 Composition of Wastes

The composition of Municipal waste is as below:

i. Domestic / Residential
ii. Institutional
iii. Commercial
iv. Garbage (animal & vegetable wastes form market, hotel, restaurants and food stall)
v. Rubbish
vi. Ashes
vii. Street sweeping
vii. Construction & demolition wastes
ix. Bulky wastes
x. Hazardous (I/c bio-medical & industrial) wastes

The data on quality and quantity of the waste, by category, can be lumped together and used.

In the country per capita waste generation varies between 0.2 Kg to 0.6 Kg per day in cities with population ranging from 1.0 lakh to 50 lakh. Estimation of future population, as detailed in chapter-4 should be followed for assessing the quantum of MSW in short, medium & long term plan periods. However in the absence of sufficient data, an assessment may be made in the township taking into account increasing per capita waste generation of about 1.3% per year, and growth of urban population between 3% and 3.5% per annum, yearly increase in the overall quantity of solid waste in the cities is about 5%.

11.8 WASTE CHARACTERISTICS

For preparing the DPR the physical and chemical characteristics of waste need to be determined after testing. Such laboratory reports shall form part of the DPR. For preparing FR, the average values may be adopted based on results of the testing done in other cities of the State. The parameters on which data may be obtained are as follows:

11.8.1 Physical Characteristics

a) Per capita solid waste generation
b) Biodegradable quantity of waste
c) Non-biodegradable quantity of waste
d) Moisture content (% by weight)
e) Average ash content and
f) Calorific value of waste
g) Quantity and type of recyclable waste
h) Density (Kg/M3) & composition of waste

11.8.2 Chemical Characteristics

a) Organic matter (%)
b) NPK values (%)
c) C/N ratio
d) Calorific value (Kcal/Kg)

Chemical characteristics of MSW may be given in a table as annexure of the DPR.

11.9 SYSTEM DESIGN OF SOLID WASTE MANAGEMENT

11.9.1 Approach

The approach to solid waste management focuses on:

i. Segregation of waste at source into biodegradable, non-biodegradable waste categories
ii. Appropriate waste collection (both door to door & community bin system) and storage
iii. Primary and cecondary transport of the waste to transfer stations (TS) and or disposal site.
iv. Processing and treatment of the MSW for recovery of material & energy.
v. Minimizing the waste to be disposed through sanitary land filling.
vi. Public – Private partnership for economic sustainability and proper handling and management of waste.
vii. Decentralized / centralized processing of biodegradable waste to compost to utilize its nutrient value
viii. Revenue earning from recyclable / reusable waste with the involvement of scvengers (above the age of 18 years), NGOs / CBOs:
ix. The management of SWM can be divided into four functional units
    Segregation at source, collection and storage at source
    Transfer and transport
    Processing and treatment

Disposal

Details of the above items and costs should be worked out in accordance with CPHEEO manual (http://urbanindia.nic.in/publicinfo/manual.htm).

11.10 PROCESSING AND TREATMENT

Waste processing should be aimed at minimization of the waste by recovering recyclable material and energy to ensure reduction in landfill space for final disposal of the waste. The ULBs may also consider to utilize 'Construction & demolition waste for making sub-base of road formation, filling low lying areas etc. The 'Green waste and street sweeping (particularly leafs, branch of trees etc.)' may be utilized for conversion to green manures in parks inside city. The various processes involved are segregating, composting, vermi-composting and recycling waste through value addition.

11.10.1 Segregation

The waste can be segregated at various stages as;

Sorting at the source: In areas where two bin system with door to door collection is followed, the waste shall be separated into Bio Degradable (BD) and Non Bio Degradable (NBD) waste.

Sorting at the transfer station : At transfer station the manual sorting shall be done to sort out the recyclable / reusable waste from NBD into different components to be sold e.g. metals, glass ,plastic etc. and stored at the site.

Sorting of the mixed waste shall have to be carried out into BD, recyclable/ reusable material and non-recyclable / non-reusable(NRU)

Sorting of waste shall be required at the final disposal sites also before processing as some of the waste may be directly sent to the disposal site.

11.10.2 Composting

The BD waste should be converted to manure by composting preferably through Public – Private partnership.

11.10.3 Vermi composting

Vermi-composting is decentralized method of SWM, which can be used to reduce the burden on the local body as well as economize the collection and transport component of SWM. For this the public be motivated to adopt this technology at individual house level or collectively. The cost of the method is low and suits the individual.

11.11 FINAL DISPOSAL

For final disposal land fills may be constructed at suitable location. The location should be decided after consulting the people living in the vicinity. This will be used to dump all non-biodegradable waste which is non-recyclable and non-reusable.

The proposal may include details of all infrastructural facilities and machinery required for collection, transportation, processing and disposal.

11.12 CRITERIA FOR DESIGN OF THE SWM SYSTEM

11.12.1 Design Population

1. Population forecasting
The population projection figures may be used for the design of SWM system. The design periods given in the CPHEEO manual (http://urbanindia.nic.in/publicinfo/manual.htm) may be used.

11.13 PRIVATE SECTOR PARTICIPATION IN SWM

Involvement of the public and the private sector in collection, transportation, processing and the disposal should be explored.

11.14 RESOURCE RECOVERY

Resource recovery from solid waste must be an integral part of the proposal. It can be through the following routes

a) Waste to compost
b) Waste to energy
c) Recycling
d) Any other feasible technology

Having discussed the sizes, capacities and numbers of major items that need to be incorporated in the Feasibility Report, the cost estimates should be prepared. The items that may need to be included are mentioned below.

11.15 ESTIMATING STAFF REQUIREMENTS FOR HANDLING VARIOUS KINDS OF WASTES

In ULB the following categories of staff are deployed on solid waste management. Their sanctioned strength at the time of preparation of FR should be compared with the required strength on the basis of norms which need to be developed for out put.

Table 11.1: Estimation of Staff Required for SWM

	Designation	Number
a)	Health Officer	
b)	Sanitary Inspectors	
c)	Jamadar	
d)	Sweepers	
e)	Loaders / Drivers (The present position of staff deployed and that required on optimal norm may be worked out):	

11.16 COST ESTIMATE OF SOLID WASTE MANAGEMENT

Illustrative list of items for estimating cost of the System is given below:

Table. 11.2: Illustrative list of items for estimating cost of the SWM

S. No.	Details of Item	Quantity	Cost/ unit, Rs.	Total Cost, lacs
1.0	**Collection and Storage System**			
1.1	HH / Community Bins / litter bins of various capacities			
1.2	Refuse compactor container of reqiured capacity			
1.3	*Dumper Placer container of required capacity :*			
1.4	Wheel Barrow			
1.5	Six container pedal tricycle / hand carts			
1.6	Vehicle for collection and transfer			
	Brooms / shovels / container for street sweeping			
	Tractors, Dumper & Refuge			
	Sub Total			
2.0	**Transfer Station (with proper fencing)**			
2.1	**Composting**			
3.0	**Waste Disposal site**			
3.1	Computerised weigh bridge 20 MT capacity including foundation and substructure			
3.2	Bull dozer			
3.3	Excavator			
3.4	Compactor			
3.5	Water tanker			
3.6	Tippers/ Tractor Trailers			
3.7	Development of site office building, roads, water supply, lighting etc.			
3.8	Composting a. Shredders b. Windrow turner c. Loader attachment d. Screens			
3.9	**Miscellaneous works and Miscellaneous Equipments including tackles and tools etc.**			
3.10	**Incinerator for carcass disposal**			
3.11	Plastic recycling machine			
3.12	Environmental monitoring equipment			
3.13	Training of personals for segregation of waste and working on plastic recycling machine			
3.14	Improved crematoria with two platform 1 in each zone			
	Sub Total			
	Contingency @ of 2 %			
	Sub Total			
4.0	Operation and Maintenance for 5 years			
	Grand Total			

CHAPTER 12
AFFORESTATION

12.1 OBJECTIVES

This activity may be proposed with the following objectives

1. To improve the aesthetics within the area covered by the boundaries of the scheme.
2. To check river bank erosion and as part of its beautification.

12.2 WHERE TO PLANT?

Campuses of STPs, Pumping Stations, along Effluent Channels, Pathways and areas around Crematoria, areas around Bathing Ghats and Community Toilet Complexes etc. Also, in open space belonging to ULB and available etc., river banks under the project area., and in the case of lakes erosion prone areas in the catchment.

12.3 WHAT SPECIES TO BE PLANTED?

These are essentially to be avenue / aesthetic plantations and hence suitable local flowering tree species in consultation with local people and with active participation of NGOs who are working in that area may be selected. In case of plantations around STPs, Pumping Stations and along Effluent Channels, tall plants having dense foliage shall be planted. Selection of plant species may be done in consultation with State Forest Department. Plantation of revenue earning trees shall be made, as resource recovery, in the area of STP meant for future expansion.

12.4 IMPLEMENTING AGENCY

In the States, to take up plantation is the responsibility of the State Forest Departments. They have the requisite expertise and infrastructure; they may be given the task to take up works of afforestation.

12.5 FINANCIAL NORMS FOR PLANTATION

Estimates should include provisions for maintenance for a period of 5 years including the planting year.

Provision for barbed wire fencing and / or tree guards may be kept based on requirement. For this detailed justification may be given. Low cost vegetative fencing should be encouraged.

Employment of watchmen for the purposes of protection may be proposed. Appropriate mechanism must be evolved for maintenance and protection of the plantations taken up under these guidelines by resorting to the concepts of social fencing with the involvement of NGOs, Paryavaran Vahinis, Eco-clubs, Forest Protection Committees, Panchayati Raj Institutions etc. This mechanism must be indicated in the DPR.

12.6 RECORDS TO BE MAINTAINED

The implementing agency will be required to meticulously maintain requisite documents like

plantation registers including treatment map, measurement books, accounts etc. It will also diligently maintain every six months, the survival percentage of the plantations. A minus survival rate as specified by the State Forest Department is to be ensured.

12.7 EVALUATION

Works may be monitored / evaluated through suitable entities.

12.8 COST ESTIMATES

They should be prepared in consultation with social forestry or local horticulture department and / or State Forest Department as the case may be.

CHAPTER 13
PUBLIC PARTICIPATION & PUBLIC AWARENESS AND STAKE HOLDERS CONSULTATION

13.1 INTRODUCTION

Programmes like NRCP or NGRBA are for the preservation of natural resources and these are basically for the benefit and welfare of public. The benefits of involving public in the decision making process are immense. It greatly helps in increasing public understanding of pollution abatement and subsequently defusing conflicts on government action by generating support of beneficiaries. With a small investment on this activity many complex problems can be resolved. In the light of experience gained in the implementation of GAP and NRCP, it is now recognised that effective civil society / public participation can only bring about full success of the programme.

It is necessary to formulate an effective public education, awareness and participation programme as part of DPR so as to make them socially inclusive. The programme must take into consideration the following issues.

An expert agency with right kind of background and experience may be engaged to formulate Public Participation strategy.

Two types of outcomes are expected from this activity. The first one is public participation and through it agreement on complex issues like house connections, water conservation at household levels, proper collection of garbage so that it does not choke sewers/drains, sharing increased burden of O&M cost, proper lay out of sewerage systems and location of STPs, diffusing conflicts, if any, on programme components etc. This can be best achieved through consultation at various stages of project formulation and implementation. The second one is increasing public understanding about the programmes through awareness. This should be achieved through workshops, seminars, street plays, city runs and riverside walks. Active involvement of students and teachers community in schools and colleges can greatly help in achieving the objectives. Public can also play the role of a watchdog in supervising project implementation and operation and maintenance which would help improve the quality of the programme.

Emphasis may be placed on increasing public participation under NGRBA. Apart from hiring expert agencies for this purpose, arrangements to involve Nehru Yuva Kendra Sangathan have been put in place, which should be integrated with this component.

In the above background, a comprehensive programme giving details of the activities with timetable and cost involved should be prepared and presented in the DPR. This should be taken as a continuous activity right from the beginning of the programme and must continue in post commissioning stages also.

13.2 OBJECTIVE

The objective should be to ensure that the communities are aware that

i. There is a need for conservation programme and that they will benefit from it.

ii. There are costs involved in such programmes and part of the O&M burden will have to be borne by them,
iii. The communities are effectively involved in all stages of the project cycle from conceptualisation, to preparation, to finalisation, to implementation and finally O & M.

13.3 PUBLIC AWARENESS AND PUBLIC PARTICIPATION AS FRONT END ACTIVITY

Public Awareness & Public Participation should be a front-end activity of the project.

The entire programme of conservation should be conceived, formulated, implemented, monitored and evaluated in close consultation with the stake holding communities following the approach of 'Participatory Appraisal'.

The agency that will plan, implement and coordinate the awareness campaign should be identified. With a view to focus on issues relating to protection and improvement and cleaning of rivers, a massive program of environment education and awareness is imperative. Centre and states may launch this campaign through a program of volunteers called **NATIONAL GREEN VOLUNTEERS**.

13.4 TARGET GROUPS

i. Local influential/Community leaders,
ii. Local NGOs,
iii. School teachers and students,
iv. Elite groups and organisations like Rotary Club, Lions club, Associations and forums of writers and artists, etc.,
v. Religious leaders and priests,
vi. Representatives of industry and commerce,
vii. Leaders of trade unions and organisations like safai karamchari sanghs,
viii. Leaders of teachers and students associations,
ix. Representatives of political parties including the elected office bearers and members of local bodies,
x. Members of legislative assemblies, legislative councils and parliament representative of local constituencies,
xi. Representatives of media viz. editors/correspondents of local press and key functionaries of local radio and TV stations,
xii. Grassroot level functionaries of Municipalities and state government departments like public health, forestry, Jal Nigam, PWD, etc.,

13.5 ACTION POINTS FOR COMMUNITY AWARENESS

i. Action be taken to get the Urban Local Body (ULB) to discuss the issue of river pollution – causes and effect and the need to take conservation measures.
ii. Request the ULB to set up a Committee on Awareness Generation and Public Participation for the entire city. Members of the Lok Sabha and the Vidhan Sabha may be coopted as special invitees. In turn, the Committee should invite civil society organisations in the city that are active to participate in the Awareness Generation and

Public Participation Programme.

iii. With the involvement and help of the ULB Committee, or otherwise, for each ward identify an active NGO or promote a group of interested and committed people to be involved in Pollution Abatement Project.

iv. The agency preparing the Pollution Abatement Project should prepare a plan of awareness generation and public participation and submit it to the Committee for approval. The plan could consider including the following activities, among others:-

a) Print and electronic media including the local news papers should be invited and supported in covering the issue of pollution of the rivers.

b) A website may be created to provide facts about the state of sanitation, in particular, the degradation of the river.

c) Holding locality wise meetings and group discussions with influential people whereby the extent of river pollution, the related physical and human factors, the consequent health hazards and the possible remedial measures are highlighted through talks and technical presentations by the experts and social workers (Action: Identified NGO of reputation).

d) Motivating influential group to play a leading role in promoting environmental sanitation and community health, particularly prevention of river pollution (Action: Identified NGO of reputation).

e) Motivating and advising local NGOs to participate in outlining execution and follow up efforts of community action plans for ensuring a clean and healthy community life in general and protection of river water quality in particular (Action: Identified NGO of reputation).

f) Promoting schools as models of clean living and healthy environments and training school teachers and students as motivators and informal change agents for involving families and communities in clean river programmes in general and maintenance of toilets/bathing ghats/crematoria in particular (Action: Identified NGO with excellent track record of having rendered specialised services in the area).

g) Motivating school management programmes/events administrative and teaching faculty to organise special programmes for checking river pollution and plantation of trees on river banks (Action: Identified NGO and functionaries of the Department of Forestry).

h) Motivate the local influential trade, business, professional, social service, religious associations/chambers/Clubs and individuals to participate in awareness generation programme.

i) Inform, educate and invite potential investors to associate themselves in activities as solid and liquid waste management services through an effective strategy of public-private partnership. They can also sponsor plantations on river banks and adopting a certain planted area for protection and preservation.

j) Awaken, educate, organise and motivate religious leaders and priests to participate actively in river pollution control through such efforts as educating the masses, checking the dumping of temple waste on the river bank and throwing of half burnt or unburnt dead bodies into the river (Action: NGO of reputation).

k) Motivate the office bearers of trade unions and other professional organisations like teachers and students associated to win public support for their cause by rendering some fruitful service to the society. While doing so they may give highest priority to community health promotional measures like river pollution control and conservation of the quality of river water (Action: NGO of reputation).

l) Motivate local MLAs and MPs and leaders of political parties to participate actively in the promotional efforts of community involvement for protecting river against the hazards of pollution-an effort, which shall pay them abundantly through the building of positive public opinions. They should also be motivated to form local level all party organisations/ forums to promote the measures of river pollution control. In addition, they should be motivated to take keen interest in the proper utilisation of the funds provided for river pollution. In addition, they should be persuaded to play effective liaison between the government and the people to ensure the timely completion of different programmes and activities undertaken by the Directorate of National River Conservation Programme (Action: NGO having a sound background of linkages with the legislative and political leaders).

m) Motivate leading persons representing local press and electronic media infact, they need to be properly educated and encouraged to be conscious of their social commitment and social obligations. They should also be convinced that socially conscious media shall always be aptly recognised and enormously rewarded through the creation of a sound base of enlightened clientele group which in the long run will help them through the image building process. Accordingly, the editors and correspondents of local press, the officers and key functionaries of coverage to the aspect of river pollution control measures through the active involvement of the people (Action: NGOs of repute having a sound organisation infrastructure of public relations unit).

n) Awaken, educate and encourage the grassroot level functionaries belonging to such departments of state govt. as local bodies like, public health, sewerage, forestry, water supply, public works, electricity, industry, tourism etc. to take special interest in the activities which are directly related to the aspect of river pollution control. They should be particularly motivated to be more conscious of their commitment and obligation to ensure the purity of river water so that the future of the present and coming generations of the society and so also the members of their own community is safe-guarded against health hazards. (Action: NGO having the background of specialised contribution to the area concerned).

o) Organise campaigns to encourage the use of community toilets and discourage open defecation, especially on open land near river banks.

p) In areas where there are sewers, encourage people to connect their houses to the sewer.

q) Organise, for different sections, events such as essay, debates, posters, slogan, painting, script etc.

13.6 IMPORTANT STAGES OF STAKEHOLDER CONSULTATION AWARENESS GENERATION AND SECURING PUBLIC PARTICIPATION

i. Stage of conceptualization
ii. Exploration of the desirability of taking up pollution abatement of river
iii. Preparation of Feasibility Report
iv. Preparation of DPR
v. Submission of the project to the State Government
vi. Stage of sanction by the NRCD
vii. During implementation
viii. Any stage when obstacle if faced, say in identification of land needed for works.
ix. Implementation of DPR
x. Commissioning and evaluation

13.7 COST ESTIMATE

A provision of 2%-3% of the project cost may be made for generation of public awareness and securing public participation. Various items of cost for which provision should be made are illustrated in the table below:

Table 13.1: Cost Estimate for Public Awareness and Public Participation

S. No.	Item	Basis of Calculation (Amount in lacs of Rs.)	Total Amount Rs. In Lacs
A	**Mass Media**		
1 (a)	Television (films and promotional for TV Advertisement) (Professional grade digital recording)		
(b)	Advertisement of local Cable Network		
2 (a)	Radio talks (preparation and subject expert charges)		
(b)	Advertisement in Local F.M.		
3	Print Media publicity in local papers, magazines etc. Advertisement in the tourist guide books etc., Special features and commissioned articles		
4	Print material for Distribution including publicity on match boxes, stationary, stickers, etc.		
5	Hoarding at strategic points in the city and on buses, rickshaws etc.		
6	Website Development with hosting and updation for three years		
B.	**Events**		
7	Sponsoring / Organising Events like Puja, Local Festivals etc.		

S. No.	Item	Basis of Calculation (Amount in lacs of Rs.)	Total Amount Rs. In Lacs
8	Preparation of Exhibition Material, Posters and Organising these events- rivere festival and run for the river events		
9	Special Cultural Events, Performances of Folk Media: (Folk theatre, Folk Music, Folk Stories) Street Plays **(performances specially for slum localities)**		
C.	**Groups and Meetings**		
10	Environmental Awareness at Schools Level (Talks, Essay, painting competitions, debates, other activities 5 per ward per year for 3 years		
11	Formation of Action Groups, Self help groups and support to social groups/clubs for awareness generation activities		
12	Other Awareness activities like public meetings, public debates, Meetings with different Unions, felicitation of best workers etc.		
	Total for Public Awareness and Public Participation Activities		
	Grand Total		

CHAPTER 14
TRAINING, HRD AND CAPACITY BUILDING

14.1 PHASES OF POLLUTION ABATEMENT PROJECT

A project passes through the following phases:

1. Problem identification
2. Conceptualisation
3. Project planning,
4. Project preparation
5. Project implementation,
6. Operation and maintenance
7. Monitoring and evaluation

14.2 DOMAINS OF KNOWLEDGE INVOLVED

1. Scientific and technical – Water Quality, Aquatic Biology, Civil Engg, Electrical Engg, Mechanical Engg, Remote Sensing and GIS
2. Social sciences– stakeholders analysis; social survey,
3. Communication science: awareness generation and public participation
4. Financial & economic: financial evaluation of projects, raising of financial resources
5. Institutional: institutional effectiveness in performing its functions
6. Administrative: administrative aspects
7. Legal and regulatory: developing suitable laws and regulations for effective functioning of the ULB

14.3 HUMAN RESOURCE REQUIRED

Successful project preparation, implementation and management need the manpower with diverse expertise in the above domains of knowledge with relevant experience in similar works. Skill acquisition is achieved through Education, Training and Experience.

14.4 EDUCATION NEEDS

The following table gives the required educational attainments of manpower.

Table 14.1: Educational Requirement of Staff Required for Pollution Abatement Projects

Stage of Project	Requirement of Manpower			
	Highly educated Master's Degree	Degree Level	Diploma Level	Certificate Level
Problem Identification	v	v		
Conceptualization	v	v		
Project Planning	v	v		
Project Preparation	v	v	v	
Project Implementation		v	v	v
O&M		v	v	v
Monitoring		v	v	
Evaluation	v	v		

14.5 TRAINING NEEDS

Training needs of skilled manpower are met through short term training programmes of duration of a few days, weeks and months. But training can be imparted only if the trainee has the necessary educational attainment.

Regarding the projects that are under execution, after it has been commissioned, it is necessary that staff with proper training and experience is in place for O&M of assets. The responsibility of operation and maintenance of STPs and main pumping stations should rest with the contractor who supplied the plant, for 5 years after commissioning of the project. It should be ensured that the contractors/suppliers of equipments deploy properly trained and experienced staff for this work. Even if contractors and suppliers are bound by the contract to operate and maintain the equipment they supplied or erected, they should be required to

i. Impart training to the identified personnel of the agency that owns the project and has the responsibility for its proper functioning.

ii. Provide operating manuals of the equipment installed.

14.6 EXPERIENCE NEEDS

These needs are met by the personnel working on real assignments. Those in charge of personnel management need to ensure that the needed experience is available to them with in the organisation.

14.7 FULFILLING MANPOWER NEEDS –MANPOWER DEVELOPMENT PLAN

The State Government, in the light of the state of degradation of their water resources, in particular of their rivers, should prepare a plan of capacity building and manpower development. It should consist of identifying academic disciplines in which personnel with postgraduate degree, undergraduate degree, diploma and certificate are needed and the numbers in each. The personnel that would, after education and training constitute, a pool of human resource that is equipped to handle the items of work, mentioned in these guidelines, including O&M should be identified. They should be sent to undergo suitable educational programmes and training programmes. A list of institutions of higher education with the academic disciplines where the personnel can be sent for education should be prepared.

The number of people at various levels required for such projects should be estimated and the personnel should be posted on appropriate jobs.

Training need identification is a continuous process and in the identified subject areas training institutions can be requested to develop training programmes.

It is the responsibility of those in charge of Human Resource Development in the States – in the government and local bodies – to ensure that they have the necessary manpower resources with needed educational attainments, training and experience for undertaking the work arising out of the programme of pollution abatement of rivers.

Standing arrangement with institutions engaged in education and training can help the States to ensure that they are not short of the needed manpower.

In case of shortage of manpower in specific disciplines, suitable persons can be obtained on loan or on contract or the work can be assigned to an agency that has the capability to deliver.

14.8 CAPACITY BUILDING

Capacity is a function of two aspects, namely human resource and physical and financial resources. Human resource has been dealt with above. Physical resources imply equipping the staff deployed for this work with necessary financial resources and physical resources such as space, laboratory, tools etc. The DPR should incorporate the requirement of these resources for proper operation and maintenance and management of the project.

14.9 COST ESTIMATES

Various activities involved in HRD and capacity building are mentioned in the following table.

Table 14.2 Cost Estimate of HRD and capacity building

S. No.	Items	Cost (Rs. lacs)
1.	Project Implementation Secretariat	
1.1	Office building, equipment and infrastructure for project Implementation Secretariat and design cell	
1.2	Hiring of professional for design, management, technology, monitoring	
1.3	Establishment expenses during the project implementation, audits, inspection including Staff salary	
2	Motivational Training, study tour and Skill development for supervisors, safai karamchari, sanitary inspectors, officers, design cell etc	
3	Monitoring Stations at different locations of air and water quality in the city, STPs, rivers, bathing ponds	
4	EIA assessment of works and evaluation after commissioning of the project	
	Total	

CHAPTER 15
PROJECT IMPLEMENTATION MECHANISM

The State Nodal Department must explore the possibility of promoting joint ventures in Public Private Partnership (PPP) or setting up a special purpose vehicle to implement these projects.

Projects under NGRBA and NRCP are funded on cost sharing in the ratio of 70:30 between MoEF and State Government or local body concerned. It is also stipulated that out of the share of State/local bodies, at least 1/3rd may come as direct public contribution. This stipulation is essential to inculcate the sense of ownership among beneficiaries to improve sustainability.

The State Government may employ a number of project executing agencies for different types of projects.

For the preparation of FR and DPR reputed professional consultants may be engaged by the State Government.

CHAPTER 16
PROJECT MANAGEMENT & INSTITUTIONAL ISSUES

16.1 INSTITUTIONS

Pollution abatement of rivers involves a complex of issues and institutions.

It is, therefore, obvious that institutions associated with the programme should be assigned specific responsibilities at the State Level and the town level for preparation, implementation and management of projects so that the rivers can be maintained in good health.

16.1.2 Establishment of Project Management Units in States

In those States where a number of river stretches are polluted and many projects have to be prepared, it is desirable to create a dedicated State Project Management Unit (SPMU) in the State Government, to take all measures related to matters of policy, programme, project formulation, implementation, regulation, operation and maintenance and management for pollution abatement and improvement of quality of waters in rivers and lakes in the State. In this unit the departments in charge of urban local bodies (municipalities and municipal corporations), environment, irrigation, forest, agriculture, rural development and finance should be represented.

16.1.3 State Implementing Agency

The SPMU may appoint a State Implementing Agency. The organisation that handles projects related to water supply and waste water management in the State may be a natural choice for appointment as Implementing Agency. The implementing agency may be given the responsibility to coordinate, supervise, guide and manage the programme and projects of pollution abatement of rivers. It will work under the supervision and guidance of the SPMU and will be accountable to it. It will directly handle the Core Schemes while the Non Core Schemes will be handled by ULB, Irrigation Department and others as decided by the SPMU. It should service the SPMU.

the State Implementing Agency should have a compact cell headed by an engineer who specialises in Environmental or Public Health engineering. The Cell should be equipped with computers, and suitable state-of- art software and usual equipment needed. The Cell may be provided access to necessary expertise in relevant disciplines including Remote Sensing & GIS, biology, environment, sociology, finance, communication, and urban administration. For this purpose, a panel of such experts drawn from institutions, preferably of the state government, may be maintained.

16.1.4 Project Management Unit at the District / Town / City Level

Projects have to be framed in towns and districts involving work in sectors that are handled by different agencies. Thus, a pollution abatement project for a city will have a number of component schemes. Since the objective of different components is the same i.e., improvement of water quality, there is a need for coordinated and integrated action. Therefore, for preparation of projects and their implementation, a Project Management Unit (PMU) should be set up with the DM/DC/Collector or the Chairperson of the District Planning Unit

under the Panchayati Raj System or the Mayor/ President of the ULB as the chairperson. It should have as members representative of the ULB in whose area the pollution abatement project is to come up, the district officers of the departments concerned with the schemes eligible for inclusion in the pollution abatement project. The representative of the state Implementing Agency should service the PMU and provide the necessary infrastructure and staff for it.

16.1.5 Functions of the State Implementing Agency

The SPMU should be responsible for proposing measures to the SPMU for maintaining ecological health and water quality of rivers in the state and obtaining approval. It may perform the following functions

a) Assess the ecological, particularly water quality, status of the river systems in the state on the basis of data available with the SPCB, CPCB and other organisations or generated in various studies.
b) Identify polluted stretches of rivers in the state that need to be restored.
c) Identify sources that produce load of pollution that are responsible for degradation of the identified stretches. The sources could be cities and villages or industries. Since the source of pollution are many a project will have many component schemes.
d) Select the sources from those in c) above for which projects for the abatement of pollution are to be prepared and implemented.
e) Identify specific agencies for handling specific component schemes.
f) Set up a Project Management Unit (PMU) for each city.
g) Under their supervision and guidance get the PMU to:
    i. Prepare city sanitation plans.
    ii. Prepare DPRs of component schemes of projects as in d) above
    iii. To under take survey and investigation to generate primary and collect secondary data for preparing the plans as above.
h) Arrange timely and efficient implementation of projects which have been approved.
i) Arrange quality control of all work done by them or under their supervision and guidance.
j) Arrange monitoring and evaluation of the projects implemented.
k) Decide, with the approval of SPMU, the mode of doing any work from amongst the following
    i. Departmentally and the activities to be outsourced to consultants and contractors.
    ii. Examine the feasibility of SPV/JV/PPP and decide on the mode to be adopted for a specific project and working out the necessary details of the mode chosen.
l) Set up a team for each scheme of which it has direct responsibility.
m) Process proposals for seeking financial assistance.

16.1.6 Functions of the Project Management Unit at the district level

i. It should perform the following functions
ii. Allocate the component schemes to suitable agencies for preparation of project reports, their implementation, operation and maintenance and subsequent management.
iii. Monitor progress of the schemes at different stages.

iv. Coordinate the work of different agencies as there may be overlapping activities.
v. Keep the implementing agency informed of the progress.

16.1.7 Preparation of DPR Component Scheme Wise and Integrated Summary

Works are sanctioned only on the basis of a DPR. Each component scheme will have a DPR. Therefore, a pollution abatement project in respect of a city may have as many DPRs as the number of component schemes so that it is convenient to submit it to the funding agency. However, there should be a consolidated summary of all DPRs that gives an overall view of the project, its components and costs.

DPR is very crucial and forms the foundation for the success of efforts to improve the water quality of rivers and to achieve the objectives of the NRCP. Every care should be taken to ensure that it is of high quality and, therefore, preparation of DPR deserves to be treated as a project in itself.

16.1.8 Appointment of Team to Prepare DPR Departmentally

Every agency that is assigned a component scheme should appoint a team of competent staff to undertake different activities that are required to be performed at different stages of the scheme. The project reports can either be prepared departmentally if there is in-house capacity.

16.1.9 Appointment of Consultants to Prepare DPR

If it is felt that circumstances are such that it will be difficult to departmentally undertake all the activities involved in the preparation of the DPR, an outside agency can be appointed to undertake identified activities or prepare the entire DPR. However, care has to be exercised in selecting the agency. For selecting the agency Expression of Interest (EOI) may be invited from agencies and then selecting agencies that have the manpower, financial and physical resources to prepare the DPR. Papers for submitting the EOI have to be prepared carefully so that it can be ensured that all the information needed to evaluate the capacity, competence and suitability of the agencies is provided by the interested parties. Technical and financial offers may then be invited from the selected parties.

16.1.10 Responsibility for activities and schemes

The following table suggests the agencies that can be given responsibility for schemes

Table 16.1: Planning and Implementing Agencies

Type of Schemes	Item of work	Planning and Implementing Agency
	Study of River and its basin	State Implementing Agency or Pollution Abatement Cell
	Selection of cities	"
Swerage Schemes	Sewerage Works & STPs	Institutions like Jal Nigams, Sewage Boards, PHEDs etc where they exist. In other places, the State Level Agency will decide who should do the work.

Type of Schemes	Item of work	Planning and Implementing Agency
Non Sewerage Schemes	Solid Waste	ULB
	CSS / CTC	ULB
	Crematoria	ULB
	Carcass disposal	ULB
	Cattle Wallowing	ULB
	Dairies	ULB
	Dhobi ghats	ULB
	Motor Garages	ULB
	River Front Development	Water Resources / Irrigation Department
Plantation	Plantation	Respective Implementing Agencies in whose schemes plantation is to be done

16.2 MONITORING, SUPERVISION, GUIDANCE AND QUALITY CONTROL

Whether the DPR is prepared departmentally or by a Consultant, it is necessary for the implementing agency to arrange regular monitoring, supervision of activities involved in preparation of the DPR and provide guidance from time to time and exercise quality control. This should be done by the Cell's own staff or, if there is shortage of suitable expertise, help of suitable consultants can be taken.

16.3. IMPLEMENTATION OF DPR – EXECUTION OF WORKS PROPOSED IN THE DPR

Mode of Implementation:

For implementing the works in the DPR, there are a number of options available as described below:

i. Departmental supervision,
ii. Project management agency
iii. Combination of above

16.4 INSTITUTIONAL ISSUES IN MANAGEMENT

16.4.1 Activities

In conservation and management there are a number of institutions dealing with activities including:

i. Policy, strategy and programme formulation and their implementation
ii. Supply of services
iii. Development,
iv. Management,
v. Regulation and enforcement,
vi. Coordination with national, state and local organisations.

16.4.2 Overlap in roles of institutions:

The role of three bodies is very crucial. These are:

i. Municipality which is responsible for sanitation in the city,
ii. City Development Authority which regulates the new colonies
iii. State Pollution Control Board, which is responsible for ensuring compliance by industry of the standards, prescribed under the Environmental Protection Act for effluent, solid waste and air emissions.
iv. State Agencies - performing functions of municipal bodies relating to water and waste water.
v. District administration

Many times there is an overlap in roles of several bodies with the result that the efficiency with which the function should be performed suffers. The state Government needs to resolve such overlaps. The role of each institution involved needs to be very clearly specified.

In the chapter on collection of secondary data, data that will reflect the strengths and weaknesses of the ULB and other institutions working in the city -, is required to be collected. This needs to be analysed to identify the areas where remedial measures are needed.

The PMU should solve any issues that may arise.

16.5 COST ESTIMATE OF INSTITUTIONAL ARRANGEMENTS

Since the SPMU will be a State Government body having all infrastructure of the Government, it does not need any financial support. The state implementing agency and the PMU will need financial support. Illustrative items for which funds may be required are mentioned below.

Table 16.2: Cost Estimate of Institutional arrangements - State Level Implementing Agency

S. No.	Items	Cost (Rs. In lacs)
1.1	Infrastructure and equipment such as computers, CAD	
1.2	Hiring of professional	
1.3	Establishment expenses	
1.4	Project related expenses	
1.5	Miscellaneous items	
	Total	

Table 16.3: Cost Estimate of Project Management Unit in the District/City

S. No.	Items	Cost (Rs. In lacs)
2.1	Infrastructure and equipment such as computers, CAD	
2.2	Hiring of services	
2.3	Establishment expenses	
2.4	Data collection	
2.5	Survey & investigation	
2.6	Miscellaneous items	
	Total	

Project preparation and implementation cell for specific projects agency wise

An estimate of expenses required for each component on the above lines should be prepared.

CHAPTER 17
PERFORMANCE MONITORING

The programme aims at improving the water quality of river and sanitary conditions in the city. Benchmarks are already available as designated best use quality with regard to the river water quality. The success of the programme would be established if the benchmark water quality is achieved.

A monitoring mechanism is to be put in place to monitor the performance of STPs and pumping stations and their impact on water quality of the river. It would be preferable if the monitoring is done by an independent agency appointed by the project implementing agency. Engineering educational institutions available in the city or in the State or office of the State Pollution Control Board may be considered as appropriate agencies for this purpose.

A detailed plan of monitoring the performance of assets as well as the outcome of project, which is reflected in the river water quality, must be prepared covering, among other things, the name of the monitoring agency, parameters to be monitored and their frequencies and presented in the DPR. The NRCD has a programme of water quality monitoring. This work is assigned by NRCD to reputed academic / R&D institutions and the NRCD bears the expenses of this work. However, there is a need for a dedicated person to collect data from the monitoring institution, study and analyse it to see if any corrective measure is required to be taken at the local level. Expenditure on this dedicated cell should be included in the cost estimates.

CHAPTER 18
COMPLETION SCHEDULE

Completion schedule for every scheme should be prepared and should be watched by the implementing agency.

Generally completion schedules are prepared without considering the odds that would be faced during its implementation and hence most projects are delayed. Completion schedule should, therefore, be prepared on a realistic basis. It should be presented in the form of a PERT/CPM and gantt chart for monitoring purposes.

Completion schedule should be accompanied by a quarterly physical and financial progress schedule. This should form the basis of monitoring of expenditure and obtaining grants from MoEF on a quarterly basis. Upon completion of the project, a completion report is submitted in a standard format. This format should be presented in the DPR and is given at Annexure - 8.

Utilization certificates for the funds released by MoEF shall be submitted in the formats given at Annexure 12.

CHAPTER 19
COST ESTIMATES

Estimation of Cost of Some Items

Each of the following items has been treated as a component scheme. These items are common to all the component schemes in the town. The funds allocated for these schemes are expected to cater to the requirements of all component schemes in the town.

i. Awareness generation and public participation
ii. Training, human resources development and capacity building
iii. Institutional development & strengthening
iv. Monitoring & evaluation

Based on survey and investigation, data collection and design criteria, detailed estimates may be prepared, as given in the respective chapter. The abstract of cost may be provided in the format given in the table below, under the following subheads for each scheme:

Table 19.1: Abstract of Cost of Works Proposed for Pollution Abatement

S. No.	Item		Amount
1.	Land Acquisition scheme – this cost is to be borne by the State Government / IA		As in the respective chapter
2.	Interception & Diversion Including Internal Sewers		See the chapter on I&D and Sewage Treatment
3.	Sewage Treatment		”
4.	Community Toilet Complexes		See chapter on CTC
5.	Crematoria		See chapter on Crematoria
6.	Abatement of Other Non Point Sources of Pollution		See the concerned chapter
7.	River Front Development Works		“
8.	Plantation		”
9.	Municipal Solid & Biomedical Waste management		”
10.	Tools & Plant for maintenance of Works		See table on Centages
11.	Any other identified scheme		
12.	Monitoring & Evaluation		See the concerened chapter
13.	Awareness and Public Participation		“
14.	Training, Human Resources Development and Capacity Building		”
15.	Institutional Development & Strengthening		
16.	Centage As provided in the Table 1.1 given in the chapter 1		
17.			
18.			
19.			
20.	Total cost of project		
21.	Operation & Maintenance for first 5 years of commissioning of project (of all Schemes)		
	Grand Total		

Cost of land is an important element of cost estimate. On many occasions, land is to be acquired involving an elaborate procedure under the land acquisition act. Projects are often delayed on this account. Such situations must be avoided.

Cost estimates of other components should be prepared in standard formats. These should be based on the detailed bill of quantities, specifications of materials structures and rates as per the latest SORs. It is generally seen that latest and updated SORs are always not available for the city. This results in underestimation of cost involving revision in cost. It is necessary to note that NRCD does not entertain any revised cost estimate after the project is approved and revision in cost, if any, would have to be borne by the implementing agency only. Care should, therefore, be taken that estimates are prepared taking the following into consideration:

Latest and updated SORs are used for scheduled items of work. Non-schedule items, if any, should be estimated on the basis of the current market price.

It takes some time to complete the DPR and then submit it to NRCD through State Government and finally appraisal and approval of DPR in NRCD. Sometimes, when the project cost is high, the proposal may require approvals at higher levels in Government which is a time consuming process. Therefore, implementing agency should be able to foresee escalation, if any, in the cost on this account and should make appropriate provisions in the project cost accordingly.

Bills of quantities and specifications must be presented in a separate volume.

For each major component, the estimated cost needs to be justified. For this purpose, it would be advisable to compare the cost estimate with that of a similar one approved earlier after necessary updating. This would help expediting approval in NRCD.

Necessary provision may be made in the estimate - for Centage as approved by NRCD.

The DPR would also be used for preparation of NIT and tendering the project. It should, therefore, contain complete engineering drawings, longitudinal sections etc. of the proposal that would be needed for NIT as well as monitoring of project implementation.

CHAPTER 20
EXECUTIVE SUMMARY AND CHECK LISTS

20.1 REQUIREMENT TO PREPARE EXECUTIVE SUMMARY AND CHECK LISTS OF ALL SCHEMES

The City Sanitation Plan (CSP), Feasibility Report of Sewerage Schemes and DPRs of all Schemes should contain an executive summary and a check list. There should also be an integrated executive summary and check list of the pollution abatement project as a whole.

Cost estimates of the project should also be prepared funding agency wise. Thus, one part should contain schemes to be funded by NRCD, another part to be funded by MoUD and other parts for other funding agencies, if any. In the executive summary the main items of every chapter should be covered.

20.2 CHECK LISTS

The various check lists are given below:

a) Check List of City Sanitation Plan

S. No.	Parameters	Yes	No
1.	Has the available data of the polluted stretch of the river basin been collected?		
2.	Have the maps of the river basin and the city been prepared?		
1.	Has the city been selected after studying the status of water quality of the river in the entire stretch in the state?		
2.	Has the problem of pollution with its causes been identified		
3.	Have all the sources of pollution of river been identified		
4.	Has the information of toilet facilities available in slums and elsewhere been collected		
5.	Has the condition of ghats been ascertained?		
6.	Has the expected outcome of pollution abatement project been spelt out in terms of improvement of water quality and of environment in the city been spelt out?		
7.	Has the present system of management of waste water and other works been studied		
8.	Have areas requiring up gradation of existing system of waste water management been identified.		
	Have areas where sewers to be laid been identified?		
	Have drainage areas and sewage districts been identified?		
	Has the need for following Schemes been examined?		
	(i) SWM		
	(ii) Community toilet		
	(iii) River front development		
	(iv) Other non-pint sources of pollution		
	Have agencies that will be assigned the preparation of Component Schemes been identified?		
	Has executive summary been prepared?		

b) Check list of Feasibility Report of Sewerage Schemes

S. No.	Parameters	Yes	No
1.	Has the CSP been approved?		
2.	Has the problem of pollution with its causes been identified ?		
3.	Has the expected outcome been spelt out ?		
4.	Has all available data relating to the city being necessary for FR and indicated in the Guidelines been collected?		
5.	Have maps of the city been prepared?		
6.	Has the present system of management of waste water and other works been studied ?		
7.	Have areas requiring upgradation of existing system of waste water management been identified?		
8.	Have areas where sewers to be laid been identified?		
9.	Have drainage areas and sewage districts been identified?		
10.	Have alternative systems of waste water management been worked out?		
11.	Has feasibility of options been worked out?		
12.	Has life cycle costs of options been worked out?		
13.	Have alternative options been evaluated and the most cost effective and sustainable option selected?		
14.	Has land requirement and its availability been examined?		
15.	Has executive summary been prepared?		
16.	Executive Summary attached		

c) Checklist for DPRs of Community Toilet Complexes

S. No.	Parameters	Yes ( )	No (x)
1	Approval of CSP by MoEF		
2	Executive Summary		
3	Monitoring of DPR preparation at higher levels		
4	Preparation of digitised map giving location of CTCs		
5	Baseline data and current status of utilisation of existing CTCs		
6	Consultations with stakeholders to identify CTC locations		
7	Availability of land for such locations		
8	Selection of agency for pay-and-use operation		
9	Confirmation of State Government/local body to share 30% cost		
10	Programme of public education and awareness		
11	Use of latest SoRs for preparation of cost estimates		
12	Justification of cost estimate		
13	Proposal for performance monitoring		
14	Completion schedule		

d) Checklist for Sewerage and STP DPRs

S. No.	Parameters	Yes ( )	No (x)
1	Details of total sub-projects proposed for the city		
2	Executive Summary		
3	Monitoring of DPR preparation at higher levels		
4	Preparation of digitised map giving complete details		
5	Consultations with stakeholders		
6	Current river water quality status along the city		
7	Life cycle cost analysis for selecting treatment options		
8	Acquisition of land -		
9	Inclusion of O&M cost for first 5 years of completion in the estimate		
10	Confirmation of State Government/local body to share 30% cost		
11	Inclusion of resource recovery component in the proposal		
12	Completion schedule		
13	Programme of public education and awareness		
14	Programme of training and capacity building		
15	Use of latest SoRs for preparation of cost estimates		
16	Justification of cost estimate		
17	Assessment of quality and quantity of wastewater as per guidelines		
18	Inclusion of all features on the city map as mentioned in para 2.4		
	Review of sewer system designed by consultant at the level of department		
19	Analysis of centralised vs decentralised options for locating STPs		
20	Life Cycle Cost analysis for technology of STP		
21	Public acceptance for house connections		
22	Provision of dedicated feeders for uninterrupted power supply		
23	List of grossly polluting industries with their current status and monitoring plan		
24	Projections of improvement in river water quality after completion of the project and proposal for performance monitoring		

e) Training, HRD and Capacity Building

S. No.	Parameters	Yes	No
1.	Domains of knowledge or disciplines identified?		
2.	Education needs for each domain identified?		
3.	Training needs for each domain identified?		
4.	Experience needs of each domain identified?		
5.	Physical (Space, equipment and infrastructure) needs for capacity building identified?		
6.	Individuals identified for education, training and experience identified?		
7.	Cost estimates prepared for the project broken in to annual requirement?		
8.	Name of organisation preparing the component of project mentioned?		
9.	Guidelines followed?		
10.	Schedule of activities / PERT chart prepared?		
11.	Executive Summary Enclosed?		

f) Afforestation

S. No.	Parameters	Yes	No
1.	Places for undertaking plantation identified?		
2.	Forest Department engaged to undertake plantation?		
3.	Estimates of cost made in accordance with the norms?		
4.	Arrangement made for undertaking evaluation made?		
5.	Name of organisation preparing this component of project mentioned?		
6.	Guidelines followed?		
7.	Schedule of activities / PERT chart prepared?		
8.	Executive Summary Enclosed?		

g) Public Participation and Public Awareness (PP & PA)

S. No.	Parameters	Yes	No
1.	Names of members of Project team mentioned?		
2.	Project Components for which the PP & PA to be prepared identified?		
3.	National Green Volunteers agreed to undertake the programme?		
4.	Public Awareness and Public Participation plan for each component prepared?		
5.	Target groups for each component project identified?		
6.	For each target group the complex of measures for generation of awareness and public particitpation identified?		
7.	Stages of stakeholder consultation identified?		
8.	Cost estimates for each component project prepared?		
1.	Guidelines followed?		
2.	Schedule of activities / PERT chart prepared?		
3.	Executive Summary Enclosed?		

h) Solid Waste Management

S. No.	Parameters	Yes	No
1.	ULB assigned the responsibility to prepare the Project Report of this component?		
2.	Have the guidelines of NRCD and those of Manual on Municipal Solid Waste Management 2000 been followed? http://urbanindia.nic.in/publicinfo/manual.htm		
3.	Short term, Medium term and Long term plan prepared?		
4.	Information about different categories of waste quantity and characteristics collected?		
5.	Provision for collection & storage and transportation made?		
6.	Site for garbage dumping side identified?		
7.	Private sector participation explored?		
8.	Resource recovery included as a component?		
9.	Plan for HRD, capacity building, Public Awareness and Public Participation prepared?		
10.	Guidelines followed?		
11.	Schedule of activities / PERT chart prepared?		
12.	Executive Summary Enclosed?		

i) Crematoria

S. No.	Parameters	Yes	No
1.	**ULB assigned the responsibility to prepare the Project Report of this component?**		
2.	**Baseline status of each wood based cremation ground ascertained?**		
i.	Population served		
ii.	No of platforms		
iii.	Average no of cremations /day		
iv.	Average wood consumption		
v.	Avereage time taken in each cremation		
3.	**Field Investigations carried out to determine the need for**		
i.	Cover new habitations		
ii.	Upgradation of existing crematoria		
iii.	Demand for EC, or IWC asceretained?		
4.	**Design criteria**		
i.	Specifications prescribed for the crematoria electric, gas or wood followed?		
5.	**Cost estimates**		
i.	Are they based on quotations obtained for EC or Gas based		
ii.	Has provision been made for civil works		
6.	**Sites for new crematoria identified?**		
7.	**Private sector participation explored?**		
8.	**Resource recovery included as a component?**		
9.	**Plan for HRD, capacity building, Public Awareness and Public Participation prepared?**		
10.	**Guidelines followed?**		
11.	Schedule of activities / PERT chart prepared?		
12.	Executive Summary Enclosed?		

CHAPTER 21
PROCESSES IN PROJECT PREPARATION

21.1 DPR FOR EACH COMPONENT SCHEME OF POLLUTION ABATEMENT PROJECT

A project for the abatement of pollution of a river consists of many components. Different components are within the area of responsibility of different organisations and the funding sources may also be different. Since the DPR forms the basis of consideration for the grant of financial assistance, for each component there should be a DPR. It is necessary that it should be self contained.

21.2 PROCESSES IN PREPARATION AND PROCESSING OF DPR- FLOW CHART

The processes involved are given in the flow chart figure 1. The chart is self explanatory. It will be seen that preparation of the city sanitation plan of the identified city is the first step. The schemes, which need to be implemented for improving the river water quality, are identified in the CSP. The CSP also identifies the agencies that have responsibility of different schemes. While the preparation of the DPRs of the sewerage schemes of interception and diversion of Wastewater is to be preceded by feasibility report, the DPRs of non-sewerage schemes may be prepared without preparing their feasibility report.

The CSP should be under go public consultation at the stage shown in the Flow Chart. Likewise DPRs of non-sewerage schemes and the feasibility report of sewerage schemes should also undergo consultation at the stage shown in the flow chart. The plans/reports that are subjected to public consultation should be finalized incorporating the results of these consultations.

All DPRs need to be submitted to the SPMU through the District PMU and the State implementing agency, which will submit to the NRCD. The DPRs of schemes that are eligible for funding by other Ministries / Departments should be submitted to them under intimation to the NRCD.

The processes and the activities shown in the flow chart, figure 22.1 should be invariably followed.

21.3 SUGGESTIVE STRUCTURES FOR PROJECT REPORTS

In order to ensure that the required items are covered in the project reports, the contents of chapters to be covered in the following reports are suggested:

i. City Sanitation Plan (Annexure 9)
ii. Feasibility Scheme of Sewerage Scheme (Annexure 10)
iii. Detailed Project Report (Annexure 11)

For reports of non sewerage works there is no structure suggested as these will be site specific.

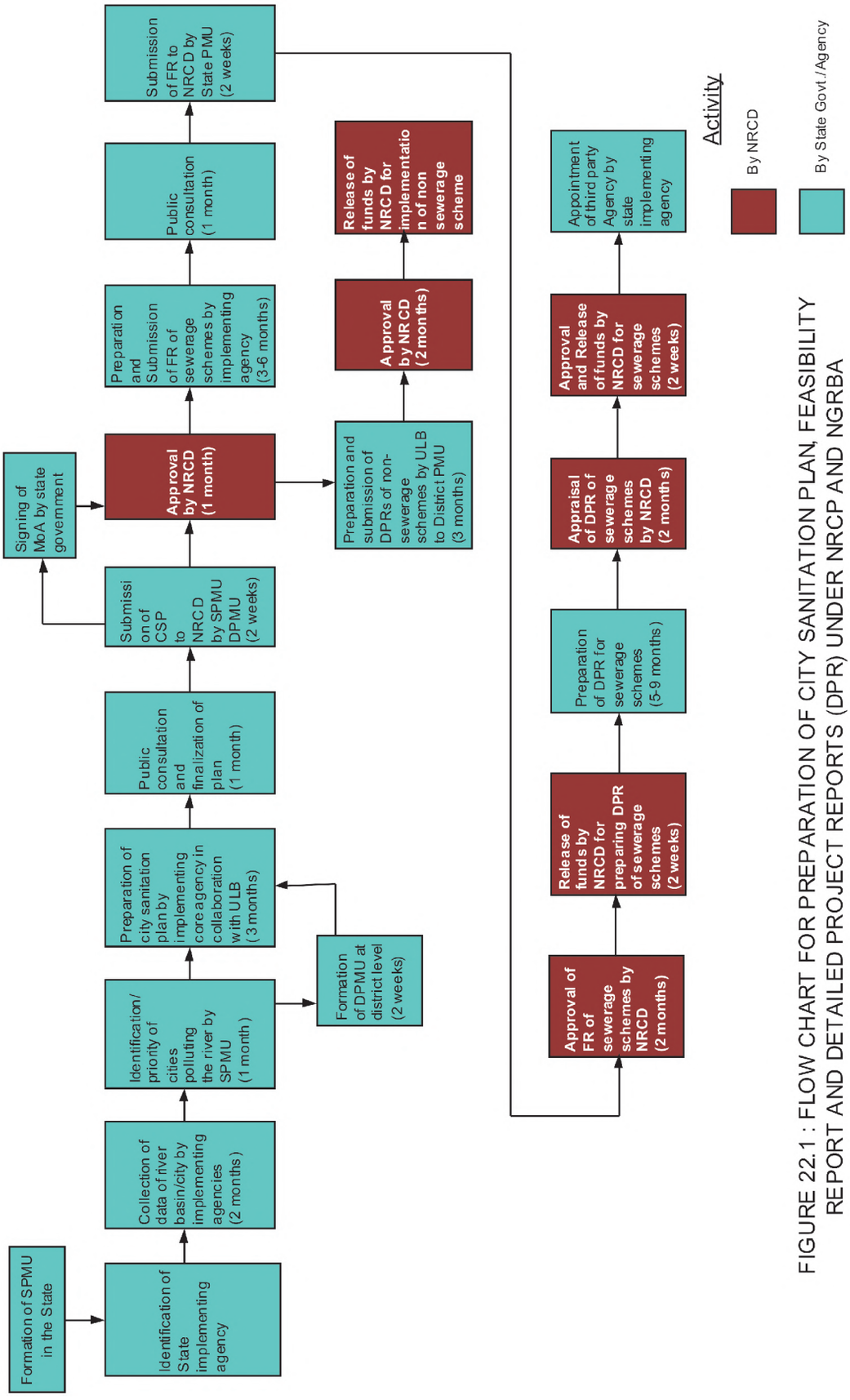

FIGURE 22.1 : FLOW CHART FOR PREPARATION OF CITY SANITATION PLAN, FEASIBILITY REPORT AND DETAILED PROJECT REPORTS (DPR) UNDER NRCP AND NGRBA

ANNEXURES

ANNEXURE-1

NATIONAL RIVER CONSERVATION PLAN (NRCP) SCHEME

(As applicable so far)

1.0 Objective

To improve the water quality of major rivers, which are the major fresh water source in the country, through the implementation of pollution abatement Schemes.

2.0 Brief History

The river-cleaning programme of the Ministry of Environment and Forests was started with the launching of the Ganga Action Plan GAP) in 1985. A Central Ganga Authority under the Prime Minister was constituted to finalize the policy framework and to oversee the implementation of the Action Plan. Chief Ministries of concerned States, Union Ministers and Secretaries of the concerned Central Ministries and experts were its members. GAP was later extended to GAP Phase-II in 1993 and then to NRCP in 1995. GAP Phase-II was merged into NRCP in December 1996. Since then a single Scheme of NRCP is under implementation as a Centrally Sponsored Scheme. The CGA was re-named as National River Conservation Authority (NRCA) with a larger mandate to cover all the programmes supported by the National River Conservation Directorate.

The functions of the NRCA are as follows:

i) To lay down, promote and approve appropriate policies and programmes (long and short-term) to achieve the objectives.
ii) To examine and approve the priorities of the National River Conservation Plan.
iii) To mobilize necessary financial resources.
iv) To review the progress of implementation of approved programmes and give necessary directions to the Steering Committee, and
v) To take all such measures as may be necessary to achieve the objectives.

Ganga Action Plan (GAP) Phase-I was started in 1985 as a 100% centrally funded Scheme. The main objective of GAP was to improve the water quality of Ganga to acceptable standards by preventing the pollution load reaching the river. Under GAP Phase-I pollution abatement works were taken up in 21 class-I towns in UP, Bihar and West Bengal. This Phase has been declared complete on 31st March 2000 at a cost of Rs. 451.70 crore.

GAP Phase-I was extended to GAP Phase-II approved in stages between 1993 to 1996, which covered the river Ganga and its major tributaries viz., Yamuna, Gomati and Damodar. This action plan covers pollution abatement works in 95 towns along the polluted stretches of four rivers spread over seven States. The total approved cost of this action plan is Rs. 1498.86 crore which was approved on 50:50 cost sharing basis between the Centre and the State Governments.

Later, however, it was felt that the river conservation activity needed to be extended to other rivers of the country also. Accordingly, the existing Scheme was merged into a National River Conservation Plan. National River Conservation Plan (NRCP) was approved for Rs. 772.08 crore

in 1995 on 50:50 cost sharing basis between the Centre and the State Government. The then Ganga Project Directorate was converted into National River Conservation Directorate for servicing the National River Conservation Authority and the Steering Committee. The objective of National River Conservation Plan being to improve the water quality of the major rivers which are the major fresh water source in the country through the implementation of pollution abatement Schemes. It covered pollution abatement works in 46 towns along the polluted stretches of 18 rivers spread over 10 States. The Ganga Action Plan Phase-II was merged with NRCP in December 1996. Seven additional towns of Tamil Nadu were approved in January 2001 at a cost of Rs. 575.30 crore on this funding pattern.

NRCP was converted into a 100% centrally funded Scheme on the lines of GAP Phase –I in November 1998. The land cost was however, to be borne by the States. Chennai Waterways in Tamil Nadu were approved in September 2000 at a cost of Rs. 491.52 crore and Yamuna Action Plan (extended phase) was approved in May, 2001 at a cost of Rs. 222.60 crore based on this funding pattern.

In a meeting of the National River Conservation Authority held in March, 2001 under the Chairmanship of Prime Minister of India., it was decided to adopt an integrated approach for the river cleaning programmes; and that all future works would be shared on a 70:30 basis between the Centre and the State Governments. Of the State share, the share of public shall be minimum of 10% of the total costs.

3.0 Activities covered

The activities under NRCP include the following: -

Interception and Diversion works to capture the raw sewage flowing into the river through open drains and divert them for treatment.

Sewage Treatment Plants for treating the diverted sewage.

Low Cost Sanitation works to prevent open defecation on riverbanks.

Electric Crematoria and Improved Wood Crematoria to conserve the use of wood and help in ensuring proper cremation of bodies brought to the burning ghats.

River Front Development works such as improvement of bathing ghats.

Public awareness and public participation.

HRD, capacity building, training and research in the area of River Conservation.

Other miscellaneous works depend upon location specific conditions including the interface with human population.

4.0 Funding Pattern

NRCD/Government of India shall bear upto 70% of the Project cost.

States and Local Bodies shall bear 30% of the Project cost of which the share of public would be a minimum of 10% to ensure public participation in the project.

The O&M shall be a part of the project and the costs thereon shall be borne entirely by the State and local bodies for which additional resources have to be demonstrably raised and committed to O&M.

The Local Bodies may raise loans from financial institutions such as HUDCO to contribute their share.

If there is a cost overrun in a project because of delay, inflation or any other reason, the contribution of NRCD/Government shall be limited to its contribution amount initially agreed. Any additional expense on account of any increase in cost shall be borne by the concerned State Government.

In addition NRCD/Government of India may undertake itself or commission projects to other institutions, voluntary agencies etc. also.

5.0 Mechanism of implementation and monitoring

Projects or River Action Plans are considered by the Govt. on the basis of pre-feasibility report estimates prepared by the State Govts. After the project is approved in principle, detailed project reports (DPR) with firmed up cost estimates for various sub-components are prepared by the State Govts./Project proponents. These DPRs are appraised and approved by the Ministry following which Administrative Approval and Expenditure Sanctions are issued. On the basis of these sanctions, the State Governments / implementing agencies award contracts according to their own policy and rules.

Progress of implementation is monitored by both the State Implementing Agencies and the Ministry through a multi-tier monitoring mechanism. This includes:

5.1 State Level

i) The progress monitoring by a team of field engineers on a day to day basis.
ii) Monthly review of progress at the Chief Executive level of the nodal implementing agency.
iii) Citizen's Monitoring Committee in each town to review the progress and provide inputs for public participation and involvement.
iv) Periodical review by the Divisional Project Monitoring Cells.
v) Periodical review of progress by a State Steering Committee chaired by the concerned Chief Secretaries.
vi) Periodical review by a High Powered Committee under the Chairmanship of Chief Minister.

5.2 Central Level

i) Regular review by NRCD officials including frequent site visits.
ii) Regular review by NRCD Project Director.
iii) Quarterly review of progress by a Steering Committee headed by Secretary of the Ministry. Chief Secretaries of the concerned States and experts in the Public Health Engineering and other related areas are the members of this Committee.
iv) Quarterly review of progress of scientific and technical aspects of the programme as well as the impact of works on the river water quality by a Monitoring Committee headed by Members Environment, Planning Commission.
v) Periodical review by a Standing Committee of NRCA headed by the Union Minister of Environment & Forests.
vi) Periodical review of progress by the National River Conservation Authority headed by Prime Minister. The concerned Chief Ministers, among others, are the members of this Committee.

6.0 Highlights of the works Undertaken under NRCP

Towns Covered	172
Rivers Covered	38
States Covered	20
Sanctioned Cost of DPR	Rs.5148.01 crore
Fund Released	Rs.3132.31 crore
Expenditure (including State Govt. Share):	Rs.3667.54 crore
Schemes Sanctioned	1105
Schemes Completed	842
Pollution load to be tackled	4397.80 MLD
Pollution load tackled (in addition to GAP - I)	3196.44 MLD

ANNEXURE-2

NGRBA-ITS OBJECTIVES, APPROACH AND FUNCTIONS

BACKGROUNDER

The Central Government, by a notification dated 20.2.2009, as set up 'National Ganga River Basin Authority' (NFRBA)as an empowered planning, financing, monitoring and coordinating authority for the Ganga river,in exercise of the powers conferred under the Environment (Protection) Act,1986. The Prime Minister is ex-officio Chairperson of the Authority, and it has as its members, the Union Ministers Concerned and the Chief Ministers of states through which Ganga flows, viz., Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, among others. The objective of the Authority is to ensure effective abatement of pollution and conservation of the river Ganga by adopting a holistic approach with the river basin as the unit of planning. The functions of the Authority include all measures necessary for planning and execution of programmes for abatement of pollution in the Ganga in keeping with sustainable development needs.

Key Features of New Approach

River basin will be the unit of planning and management. This is an internationally accepted strategy for integrated management of rivers.

Accordingly, a new institutional mechanism in the form of National Ganga River Basin Authority (NGRBA) will spearhead river conservation efforts at the national level. Implementation will be by the State Agencies and Urban Local Bodies

The new strategy will take into account the competing demands on water and will seek to ensure minimum ecological flows. STPs minimise the pollution load up to discharge standard of BOD of 30mg/litre requiring dilution to achieve river water quality of 3mg/ litre.

The minimum ecological flows or the entire Ganga will be determined through modelling exercises.

The NGRBA will take appropriate measures to regulate water abstraction for maintaining ecological flows in the river.

Functions of NGRBA

The NGRBA would be responsible for addressing the problem of pollution in Ganga in a holistic and comprehensive manner. This will include water quality, minimum ecological flows, sustainable access and other issues relevant to river ecology and management.

The NGRBA will not only be regulatory body but will also have developmental role in terms of planning & monitoring of the river conservation activities and ensuring that necessary resources are available.

The NRGBA would work for maintaining the water quality of the river Ganga upto acceptable standards. The pollution abetment activities will be taken through the existing implementation mechanisms in the State and also through special Purpose Vehicles (SPVs) at the pollution hotspots.

The NGRBA will ensure minimum ecological flow in the Ganga by regulating water abstraction and by promoting water storage projects.

The NGRBA will plan and monitor programmes for cleaning of Ganga and its tributaries. To being with, it will concentrate on Ganga main stream.

The NGRBA would draw upon professional expertise within and outside the Government for advice on techno-economic issues.

The technical and administrative support to NGRBA shall be provided by the Ministry of Environment & for advice on techno-economic issues.

The technical and administrative support to NGRBA shall be provided by the Ministry of Environment & Forests.

ANNEXURE-3

Government of India
Ministry of Environment & Forests
national River Conservation Directorate
Paryavaran Rhavan, CGO Comple,;
Lodhi Road, New Delhi-3
Dated: 3.2.2010

Office Memorandum

Sub: Stringent effluent standards for STPs on critical stretches of River Ganga- reg.

1. This Ministry is implementing ttp centrally sponsored scheme of National River Conservation Plan (NRCP) for pollution abatement of rivers in the country, on a cost sharing basis between the Central and State Governments. The Plan presently covers 38 rivers in 167 towns spread over 20 States. The pollution abatement schemes under NRCP include I&D works, sewage treatment, low cost sanitation, electric and/or improved wood crematoria etc.

2. Under NRCP, the standards being followed for treated waste water in respect of BOD and Suspended Solids (SS) are 30 & 50 mg/l respectively. These are as per the legal standards notified by CPCB. Criteria for permissible limits of fecal coliforms for sewage treatment schemes under NRCP were also separately prescribed by MoEF. Administrative directions in this regard were issued by the Ministry in October, 1999,

3. In order to achieve improved water quality iri the river, more stringent design criteria were subsequently prescribed for Yamuna in the;Delhi stretch. These are 20 and 30 mg/l for BOD and suspended solids respectively.

4. The Central Government has constituted the Natipnal Ganga River Basin Authority (NGRBA) for effective abatement of pollution and conservation of the river Ganga. NGRBA, in its first meeting held on 5tn October, 2009, has adopted the Mission Clean Ganga, under which it will be ensured that by 2020 no untreated municipal sewage or industrial effluent is discharged into the river Ganga.

5. Water quality of river Ganga has become critical in certain stretches due to various reasons, including discharge of untreated municipal & industrial wastes into the river, lack of dilution in the river etc. It is, therefore, considered necessary for achieving improved water quality in the river Ganga that more stringent design criteria for sewage treatment plants be prescribed in the critical stretches of Ganga also. It has accordingly been decided that the guidelines for design criteria for sewage treatment plants be revised to 20 £ 30 mg/l for BOD and Suspended Solids respectively in the critical stretches of Ganga river. The State Governments are advised to select techno-economically suitable sewage treatment technologies for meeting the revised guidelines in the critical stretches,

6. This issues with the approval of Minister of State (I/C) for Environment and Forest.

03/2/10
(Rajiv Gauba)
Joint Secretary

To,

As per the list

ANNEXURE-4

MEMORANDUM OF AGREEMENT

Among

Ministry of Environment and Forests (MoEF)
Government of India

State Government

and

Urban Local Body

National Ganga River Basin Authority

May 2010

MEMORANDUM OF AGREEMENT (MOA)
Among
MINISTRY OF ENVIRONMENT AND FORESTS, GOVERNMENT OF INDIA
THE STATE GOVERNMENT OF ----------
and
URBAN LOCAL BODY (ULB) ----------

Abatement of river/lake pollution is an ongoing activity required to be taken up on a continuous basis with the complete involvement of all stakeholders associated with the implementation of the program. This MOA provides a framework of commitments by all stakeholders not only for successful implementation of the program but also for proper operation and maintenance of the assets created. This agreement lays down the conditions which the State Government, the ULB and the implementing agency will undertake on the basis of the financial support provided by Government of India through the Ministry of Environment and Forests (MoEF).

THIS AGREEMENT is made on this _____day of_____20 * between the Government of India, through the Ministry of Environment and Forests,

and

The State Government of (Name of the State) _____through its_____ (Name of the Department)

and

_____the Urban Local Body.

WHEREAS

The Ministry of Environment and Forests will provide financial support to the State Governments in their efforts to conserve rivers and lakes under their jurisdiction.

The State Government/ULB will commit to provide the State's share of the capital cost of the project and full operation & maintenance (O&M) costs. The State Government/ULB will also provide commitment to fulfill the conditions laid down as Annexure 'A'.

The State Government will also ensure commitment from ULB/implementing agency to take over the assets of the project on certification of project completion by the Implementing Agency.

NOW THE PARTIES WITNESSED AS FOLLOWS:

1. Funds will be released upon execution of the MOA and sanction of DPRs by the MoEF.
2. MoEF shall release the first installment of grant to the Agency nominated by the State Government upon signing of the MoA and submission of the documents which are annexed with the Agreement as Annexure 'A'.
3. State Government will agree to bear 30% of the cost of the project or their share as decided from time to time.
4. The release of next installments of funds will be performance based, and will depend on submission of physical and financial progress reports and proper Utilization Certificates as well

as on fulfillment of commitments as set out in Annexure 'A'.

5. The State Government shall also release their share of funds in proportion to the fund releases made by Government of India from time to time.
6. The State Government will constitute a Project Review Committee headed by the Secretary of the Nodal Department for reviewing the progress of the project on quarterly basis. A representative of MoEF will be a member of this Committee.
7. The State Government will appoint the implementing agency for the projects and the implementing agency will coordinate with the ULBs as well as other agencies to ensure synergy between programs like JNNURM/UIDSSMT and approved components under the NRCP/NLCP.
8. The State Government and the ULB will be responsible for implementing, monitoring and reporting under the program.
9. The State Government shall be responsible for necessary coordination mechanism between the Implementing Agency and the ULB.
10. The State Government will ensure that the physical progress, expenditure reports and Utilisation Certificates are furnished by the Implementing Agency to MoEF on a quarterly basis. In case the Implementing Agency fails to submit such a report, further instalment of GoI's share may be withheld, until such submission.
11. MoEF or any agency nominated by it, may undertake periodic site visits to ascertain the progress of the ongoing projects and compliance of the conditions in the Checklist.
12. The responsibility of operation and maintenance will be with the ULB/ maintenance agency. The ULB will submit a report regarding the mechanism for raising resources for the operation and maintenance of assets and will provide details of the same while submitting the project report. These may include instruments like user charges, property tax, sanitation charges or innovative PPP options. Schemes will be sanctioned contingent upon evaluation of the O&M Plans submitted by the ULB/implementing agency. Subsequent fund releases would depend on satisfactory progress of implementation of O & M plan.
13. The State Government and ULB will be responsible for proper O &M of existing facilities like sewage treatment plants, sewage pumping stations, low cost sanitation, etc.
14. State Government and the Implementing Agency shall institute mechanism to ensure timely completion of projects undertaken under NRCP/NLCP
15. The cost overrun due to delay of the project or cost escalation of different items shall be borne by the State Government/ULB.
16. The implementation period can be extended, if so required, due to change in scope of work or other site specific condition. The decision in the matter of extension of time shall be at the discretion of MoEF.
17. MoEF will set up the mechanism for concurrent evaluation and monitoring of the project.
18. The State Government will provide the certification of project completion of the works.
19. In case of dispute between the parties, the matter will be resolved through mutual discussion.
20. In case of any breach regarding the terms and conditions of the MoA, MoEF shall be entitled to withhold release of subsequent installments of the grant.
21. The funds routed through MOA mechanism will be liable to statutory audit by the Controller and Auditor General of India.
22. This Memorandum of Agreement will take effect from the date of signing and would remain operative unless terminated by parties concerned by mutual consent.

SIGNATORIES

For Government of India through Joint Secretary, Ministry of Environment and Forests

For State Government, State Secretary of Nodal Department

For ULB/ Mayor / Municipal Commissioner of concerned ULB

Annexure A

CHECKLIST OF CONDITIONS

NRCP/NLCP requires certain conditions to be met by states/ cities with the objective of securing effective linkages between asset creation and asset maintenance, ultimately leading to self-sustaining delivery of urban services.

STATE LEVEL

1. Specify agency / agencies involved in planning and delivery of the following civic services,:

Sector	Agency undertaking planning	Agency undertaking delivery of services	Prevailing role of ULB/s
1. Sewerage and Sewage treatment			
2. Solid Waste Management			
3. Burials and burial grounds, cremations, cremation grounds and electric crematoriums			

CITY LEVEL

1. Preparation of Comprehensive Sewage Disposal Plan

Please provide the timeline for preparing this Comprehensive Plan for the city

Year 1	Year 2	Year 3	Year 4

2. Sewerage Network

Increase in the Sewerage network of the city

Year 1	Year 2	Year 3	Year 4

Construction of Sewage Treatment Plants to treat the captured sewage

Year 1	Year 2	Year 3	Year 4

Laying of trunk & intercepting sewers for diversion of sewage out falling into the river

Year 1	Year 2	Year 3	Year 4

Power connection to Sewage Treatment Plants and Pumping Stations

Year 1	Year 2	Year 3	Year 4

Obtain yearly consent to operate the STP from the concerned State Pollution Control Boards/Committees

3. Storm Water Drainage (Flowing into the river)

Identification of Problem Areas

Year 1	Year 2	Year 3	Year 4

Primary Drain Rehabilitation and Improvement Program

Year 1	Year 2	Year 3	Year 4

Monitoring of water quality parameter (in the Drains at confluence with river

Year 1	Year 2	Year 3	Year 4

4. Non point sources of pollution

Providing electric / improved wood based crematoria to minimize the river pollution on account of disposal of unburnt dead bodies.

Year 1	Year 2	Year 3	Year 4

Improvement of bathing ghats with toilet facilities

Year 1	Year 2	Year 3	Year 4

Identification of slums adjoining rivers and lakes

Identification of water and sanitation issues in these slums

Year 1	Year 2	Year 3	Year 4

Planning for sustainable water and sanitation solutions for households residing in these slums

Year 1	Year 2	Year 3	Year 4

Extending services of toilets, drainage, solid waste management in these slums

Year 1	Year 2	Year 3	Year 4

Removal of encroachments within duely demarcated river/lake boundry

Year 1	Year 2	Year 3	Year 4

5. User Charges

Please furnish the costs for providing the following services (total cost as well as per unit cost) and the total and per unit user charges collected in ——

Service	Total O&M Cost (Please specify the unit)		Total user charges collected (Please specify the unit)	
	Per Unit Cost	Total Cost	Per Unit Recovery	Total Recovery
Sewerage				

Time table to achieve full recovery of O&M costs from user charges (Please indicate proposed recovery level for each year)

Sewerage

Year 1	Year 2	Year 3	Year 4

6. Financial Management

Earmarking of funds for O&M

Year 1	Year 2	Year 3	Year 4

ANNEXURE-5

No.A-12012/2/2010-NRCD-II
Government of India
Ministry of Environment and Forests
NATIONAL RIVER CONSERVATION DIRECTORATE

'Paryavaran Bhawan'.
C.G.O. complex,
B-Block, Lodi Road,
New Delhi-110 003,
Dated the 16th September, 2010

To

The State Nodal Departments (As per list attached)

Sub:- Strengthening the Monitoring and Inspection Arrangements under National Ganga River Basin Authority (NGRBA) and National River Conservation Plan (NRCP)- Administrative Approval for the engagement of Third Party Inspection Agencies by States.

Sir,

1. The undersigned is directed to say that in order to strengthen the monitoring mechanism and improve transparency and accountability for projects implemented under the National Ganga River Basin Authority (NGRBA) and National River Conservation Plan (NRCP), it has been decided to introduce a Third Party Inspection (TPI) system . This system is devised along the lines of Independent Review and Monitoring Agencies (IRMA) mechanism under the JNNURM and is expected to significantly augment the capacities of State Government to monitor the physical progress of projects.

2. The TPI system would review and monitor the performance of the projects funded under the NRCP & NGRBA through the entire lifecycle of implementation on the basis of detailed on-site review, examination of appropriate documents and discussions with the Project Implementing Agencies and other key stakeholders. The monitoring would cover all four stages in the life cycle of a project, namely Pre-construction, Construction, Commissioning & trial run and, Post-construction for effective monitoring.

3. This system will come into effect from April, 2011 and will apply to new projects sanctioned after this date. Projects which have already been sanctioned and for which only the 1st installment has been released by 31 st March, 2011 will also be covered. However in such cases the pre-construction inspection will not be applicable.

4. The system will not apply to on- going projects for which more than one installment has been released by 31st March, 2011.

5. The TPIs shall be appointed by the States through a transparent process. For this purpose, the list of agencies shortlisted for independent review and monitoring agencies (IRMA) under

JNNURM may be considered. As the services of the TPIs are required to be rendered over the entire life cycle of the project development, the period of engagement will be governed by the Project schedule. the maximum period of engagement of TPI for a project shall not exceed 3 years. However, extension of services of TPI beyond 3 years shall be decided by the State Nodel Department (SND), if considered essential.

6. The scope of services of the TPIs, frequency of review visits and panel of TPI agencies are at Annexure.

7. The cost towards meeting the expenditure involved in the appointment of TPI agency will be reimbursed by the NRCD, MoEF on the basis of claims submitted by the SND The details to be furnished for the re-imbursement of expenditure are:

   i. The copy of the work order / contract issued to the TPI agency.
   ii. The copy of invoice raised by the agency.
   iii. Evidence of payment already made to TPI agency by the State Nodal Department.

   The reimbursement costs shall not exceed-

   i. Rs.2.0 lakhs per project for the review of project documentation (one time for each project.
   ii. Rs.0.5 lakhs per visit per project by the monitoring team (excluding visits undertaken for review of project documentation.

8. The TPI agencies appointed by the SND may participate in the review meetings and in the meetings of the Empowered Steering Committee (ESC) in the case of NGRBA projects. Inputs from third party monitoring will be taken into consideration in processing release of funds.

9. The TPI will undertake desk review of documents and make periodical site visits to each project as mentioned above. They may conduct additional field inspections on the specific aspects as required by SND and NRCD. TPI shall provide reasonable advance notice of planned visit to site, schedule of meetings for review, and documents required for review, etc. to the Implementing Agency(IA). TPI shall report to the SND and send copies to the NRCD, of all communication / reports / Deliverables. The SND and IA will provide necessary inputs to the TPI team. The observations of the TPI team should be discussed with the SND and IA before concluding the visit. Reports should be filed with the SND and IA within 5 days of completion of the site visits. SND shall file with NRCD copies of the TPI Reports along with their responses/comments.

10. This issues under the powers delegated to the Ministry of Environment and Forests and with the approval of Secretary, Ministry of Environment and Forests as well as with the concurrence of IFD vide their Dy. No.1368/AS(FA) dated 17-8-2010.

Yours faithfully,

---signed----
(C. UPPILI)
Under Secretary to the Government of India

Copy for information and necessary action to:

1. All Implementing Agencies of NRCP & NGRBA.
2. All officers of NRCD dealing with Projects.
3. Joint. Director of Audit, Commercial, Scientific & Misc. Works, AGCR Building, I.P. Estate, New Delhi-110 002.
4. Dir(IFD)///US(F)/US(P)/Computer Cell
5. Sanction folder/Guard file.

---signed----
(C. UPPILI)
Under Secretary to the Govt. of India

SCOPE OF SERVICES

The Third Party Inspection (TPI) Agency is expected to review and monitor all projects sanctioned under National Ganga River Basin Authority (NGRBA) and National River Conservation Plan (NRCP).

The scope of services for the TPI will include the following:-

1.1.1 Pre-construction Stage:

Review of the project at this stage is to primarily review and monitor the preparatory activities that go into a project prior to beginning actual procurement and construction. Such review should cover:

i) Review of project design documentation

a. Check extent of completion of design with respect to the sanctioned DPR
b. Review adherence to technical standards in the detailed designs / drawings prepared
c. Review the project implementation plan (level of detail, interdependencies, linkage to resources, etc.)
d. Check the sequence of design documentation with respect to project implementation plan
e. Review the probability of escalation in project cost and time delay in implementation on account of variation in design criteria, estimated quantities, unit costs, and other reasons related to design aspects
f. Review the test reports to examine adequacy of all surveys that are needed to be carried out for project design.

ii) Review of bid documentation and bid process

a. Completeness of the bid documents with respect to designed / planned project configuration, and the packaging of bids including battery limits of scope. This should include review of clarity in roles between IA and the contractors.
b. Compliance of the bid documents with respect to design standards, especially with respect to Materials of Construction
c. Alignment in the sequence of preparation of bid documents and release of tenders with respect to interdependencies in the project plan
d. Review whether due transparent and fair procurement processes have been followed as per the rules of the IA, and good practices followed in the industry
e. Review the probability of escalation in project cost and time delay in implementation on account of inefficiencies and mistakes in procurement
f. Review the bid documents with respect to appropriateness of commercial terms and conditions of the contracts

iii) Review of site preparation and clearances to begin construction

a. Undertake site visit to examine availability of land / right of way for the project, to examine that the project site is free of encumbrances; access to site is available; etc.

Report on handing over of site to the contractor for construction.

b. Report on progress with respect to shifting of utilities, if applicable.

c. Review the probability of escalation in project cost and time delay in implementation on account of delays in site preparation and statutory clearances

iv) Review of project management mechanisms

a. Report on whether mechanisms have been put in place for independent monitoring of physical quality of materials / construction / fabrication.

b. Assess the institutional capacity of IA to manage implementation of the project in terms of dedicated man power, internal systems, and technical capacity, etc. Assessment should take into account agencies hired by IA to assist in project implementation.

1.1.2 Construction Stage

Review of the project through the course of its construction is to primarily review and monitor physical progress, financial progress, commercial performance, project quality, compliance to statutes and other requirements. Such review to be conducted periodically over the construction period should cover:

i) Report on Physical progress of the project

a. Review the physical performance accomplished in the project with respect to the milestones projected in the DPR or the project implementation plan finalized at pre-construction stage.

b. Review of rescheduling of milestones on the basis of performance.

c. Report on abnormal delays in project activities and advice on remedial measures.

ii) Report on Quality Assurance Systems and Project quality

a. Report on methodology and frequency of tests carried out by the contractor/quality assurance consultant by examining Requests for Inspection (RFI) and reports. Ensure that they are in line with good industry practices.

b. Confirm that the materials used for construction are as per the specifications of contract agreement 2.

c. Report about cases of non-conformance from quality reviews based on available documents and interactions.

iii) Report on the Commercial performance and Financial progress of the project:

a. Commercial performance

b. Review and report on commercial performance of contractors under the project with respect to commercial terms and conditions, i.e. performance with respect to clauses such as – guarantee / warranty, defects–liability, licenses, bank guarantee, insurance, payment schedule, taxes, dispute resolution mechanisms, etc.

c. Highlight and report on enforcement of critical commercial terms and conditions by either party that has an impact on time and cost of the project.

d. Suggest remedial measures to improve commercial performance

e. Financial progress of the project
f. Report on adequacy of systems for project related financial management.
g. Report the quantum and timelines of contribution of funds from all the counter parties of the project by verifying receipts statements.
h. Review documents related to claim for payments and payments made. Such documents will include – Invoices, Measurement Book, Bank statements, etc.
i. Report on utilization of funds in verification with bank reconciliation statements.
j. Remedial measures to improve financial progress
k. Report any major variation in overall project cost, due to changes in the Bill of
l. Quantities as per the contract.

v) Compliance to the statutory requirements

a. Report on compliance to directives by State and Central environmental agencies stated during the environmental clearance of the project, compliance with the Environmental Management Plan for the project, and good environmental management practices of the industry.
b. Report on provision, installation, and usage of health and safety equipments, procedures and practices at site by visual observation and examination of records. The report should include health and safety issues concerning workers at site.
c. Report on standards of health and sanitation arrangements maintained at campsite by visual observation and discussion with the concerned stakeholders.
d. Report about the progress of Resettlement and Rehabilitation of Project Affected Persons
e. Report on persons requiring resettlement and rehabilitation assistance as reported by the land acquisition team and the DPR.
f. Report on compensation awarded and / or to be paid as per the records.
g. Report on court cases, which likely to affect the physical progress of the project.

1.3.3 Commissioning, Trial run and Testing Stage

i) Report on necessary training imparted to the operations and maintenance (O&M) team for taking over the completed project. The agency will check with records and discussion with participants.
ii) Report on stages of testing and level of participation by the O&M team.
iii) Reports on handing over of all documentation, “As Built” drawings operational instructions and equipment manuals to the O&M team.
iv) Report on trial runs and completion of project.

1.1.3 Post Construction Stage

i) To report on overall performance of the asset created (project) with respect to Capacity – delivering capacity requirements
ii) Functionality – meeting all functional requirements
iii) Usage – extent of usage, break downs and shut downs
iv) Performance of the O & M team

FREQUENCY OF REVIEW VISITS

The required frequency of reviews by TPIs is mentioned below, and shall vary based on the requirements of specific project. Review visits at a frequency higher than that mentioned below, shall only be undertaken at the express request by either the State Nodal Department or NRCD, MoEF. The table below provides an indication of the effort estimate required from the TPI.

S. No	Nature of review	Timing	Method of review	Frequency
Pre-Construction Stage				
1.	Review of project design document	On completion of design of project/ project component	Design documents and drawings	Once
2.	Review of bid documentation and bid process	Review of documentation prior to NIT Review of bid process through its duration	Proof of Advertisement, letters, and correspondence Bid Documents, Contract agreements	Once
3.	Review of site preparation and clearances to begin construction	Prior to start of construction	Inter departmental correspondences Official records	Once
4.	Review of Project Management Systems	After deployment of Project Management Systems	As per official records Observations Discussions with PEA	Monthly / Quarterly*
Construction Stage & Commissioning, Trial-Runs and Testing Stage				
5.	Report on Physical progress of project	After handing over the site to contractor/ concessionaire, and regularly over the Construction period	Reports and documents submitted by PIU Review of milestones as per Contract agreement Discussions with PEA	Monthly / Quarterly*
6.	Report on quality assurance system		Request for inspection (RFI) reports Contract agreement and physical observation Discussions with PEA	

S. No	Nature of review	Timing	Method of review	Frequency
7.	Commercial Performance	Over the construction period	Contract and Relevant documents	Quarterly
8	Financial Performance		Invoices, Measurement Book, Bank statements BOQ as per contracts	
9	Compliance to the statutory requirements	Pre-Construction, during Construction and Post-Construction	As per the MoEF guidelines EMP document for the project. Comparison with relevant legislation / rules	Monthly / Quarterly*
10	Safety and Health	Construction and Post-Construction stage	As per relevant standards/ good practices / Contracts	Monthly / Quarterly*
11	Progress of Resettlement and Rehabilitation	During Pre-Construction and Construction stage if the Land acquisition process is not completed.	As per R&R Action Plan submitted along with DPR/ Land acquisition proposal submitted, Records of Competent Authority No. of court cases against land acquisition for the project	
12	Commissioning, Trial runs and Testing	Commissioning, Trial Runs and Testing Stage	As per Records and discussion with Concerned officials	Once
	Post-Construction Stage			
13	Report on overall performance of the asset created (project)	Post Construction Stage, about one year after project completion	Records and discussion with officials / beneficiary community	Once

PANEL OF TPI AGENCIES

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MSV INTERNATIONAL INC., 6302, Phase-IV,DLF Gurgaon -122 002 Haryana Ph: 0124-4002603/04 Fax:0124-4002605 E-mail: info@msvgroup.com	MUKESH & ASSOCIATES CONSULTANTS & ENGINEERS 5/3,Ragavan Street, Swarnapuri Salem -636 004 Ph:0427-2330395/2330568/2331109 Fax:0427-2330209 E-mail: mukeshassociates@vsnl.com
NATIONAL CONSULTANCY FOR PLANNING AND ENGINEERING, 9-4-131/17/A, Tombs Road Akbar Bagh, Toli Chowki Hyderabad – 500 008 E-mail: ncpe_consult@rediffmail.com	OPERATIONS RESEARCH GROUP PVT. LIMITED D-24, Second Floor South Extension – Part -1 New Delhi – 110 049 Ph: 011-24603549/27694909 Fax: 011-24603549 E-mail: dbanerjee@orgplindia.com
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ANNEXURE-6

LIST OF POLLUTED RIVER STRETCHES
Source CPCB

POLLUTED RIVER STRETCHES (BOD>30mg/l and BOD exceeding 6mg/l on all occasions)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
ANDHRA PRADESH				
1. Musi	D/s Hyderabad & Rangareddy	Hyderabad & Secundrabad	1.Nagole, Rangareddy	34
			2. Hyderabad D/s	23
2. Nakkavagu	D/s Medak	Medak	1.Bachugudem, Medak	50
ASSAM				
3. Bharalu	D/S Guwahati	Guwahati Sewage	1.D/S Guwahati	31.5
4. Kalong	D/s of Nagaon (Elangabeel System)	Nagaon- Sewage	1. Elangabeel System Pond	50
CHANDIGARH				
5. Patiala ki Rao	Patiala Ki Rao	Chandigarh	1.Patiala Ki Rao	50
6. Attawa Choe	Attawa Choe (N-Choe)	Chandigarh	2.Attawa Choe (N-Choe)	50
7. Sukhna Choe	Sukhna Choe	Chandigarh	3.Sukhna Choe	50
DELHI				
8. Yamuna	Wazirabad to Okhla	Industrial & Domestic Waste from Delhi	1.NizaMoUDdin	55
			2.Okhla Bridge	32
			3.D/S Of Okhla A/C Shahdara Drain	70
GUJARAT				
9. Sabarmati	Ahmedabad to D/S of Vautha	Discharge from Meshwa & Ahemdabad	1. After Conf. With Meshwa At Vautha (Near Dhokla),	48
			2. At Ahmedabad At V.N. Bridge,	31
			3. At Vill. Miroli Taluka Dascroi, Ahmedabad	103
			4. At railway Bridge,Ahmedabad	29
			5. At Kheroj Bridge	12
			6. At Hansol Bridge	15
10. Amlakhadi	Along Ankeshwar	Industrial & Domestic waste from Ankeshwar	1.Amlakhedi after confluence of wastewater from Ankleshwar	46
11. Bhogavo	Surendranagar		1.D/s of Surendranagar	50
12. Daman River Ganga	Vapi D/S to Confl. with sea	Industrial & Domestic waste from Vapi, Salvas,Daman & Kachigaon	1.Kachi Gaon D/s	30

POLLUTED RIVER STRETCHES (BOD>30mg/l and BOD exceeding 6mg/l on all occasions)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
HARYANA				
13. Ghaggar	Interstate border of Punjab & Haryana to Ottu wier at Sirsa	Industrial & Municipal waste from Patiala, Derabassi, Sirsa	1. Before Ottu Weir (Before Mixing Of Satluj Canal Water)	50
			2. Gh-1 At Road Brdg. Sirsa,Debwali Road	33.2
			3. Gh-2 At Chandarpur Syphon,	40
			4. Near Bankarpur, Dera Bassi	22
			5. U/S Dhakansu Nallah	21
14. Markanda	Kala Amb to Narayan Garh	Industrial & Domestic waste from Kala Amb	1.Kala Amb D/S	590
15. Western Yamuna Canal	D/s of Yamuna Nagar	Yamuna Nagar Industrial & Domestic wastewater	1.100 metre D/s after receiving Industrial & Sewage effluent	247
			2.At Damla d/s of Yamuna Nagar	188
HIMACHAL PRADESH				
16. Sukhna	D/s Parwanoo	Parwanoo sewage	1.At Parwanoo, Solan	36
MADHYA PRADESH				
17. Khan	Indore	Indore Sewage	1.Sakkar Khadi (Near Indore)	50
			2.Sanwer	50
			3.Kabit Khedi	50
18. Chambal	Nagda D/s	Industrial & domestic wastewater of Grasim Citieship & Nagda	1.Nagda D/s	34
MAHARASHTRA				
19. Bhima	Vithalwadi to Takli	Pune – Sewage	1. Pune, D/S Of Bundgarden	40
		Daunt -Sewage	2. Pune U/S Vithalwadi	28.2
			3. Pargaon (After confluence with Mule Martha)	16
20. Godavari	Nashik D/s to Paithan	Nasik Sewage	1.Nashik D/s	36
			2.Jayakwadi Dam, Raher	6.5
			3.U/S Of River Gangapur Dam, Nasik	6
			4.U/s of Paithan, Jayakwadi	6.8
			5.D/s of Paithan, Pathegaon	7.4
			6.Near Someshwar Temple	7.5
			7.Hanuman Ghat, Nashik	9
			8. Nasik D/S	18
			9.Panchavati At Ramkund	12
			10.KapilaGodavari, confl.Point, Tapovan	14
			11.Saikheda	16
			12. Tapovan	20

POLLUTED RIVER STRETCHES (BOD>30mg/l and BOD exceeding 6mg/l on all occasions)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
21. Mula & Mutha	D/s Pune city	City Sewage of Pune	1.Mula-Mutha River at Mundhawa Bridge	36
			2.Mula at Aunth Bridge	
			3.Mula –Harrison Bridge	50
			4.Mutha at sangam Bridge	32
22. Pawana	Pune-Sangavi Gaon	Pune Sewage	1.Pune-Sangavi Gaon	36
23. Indrayani	Alandi to confluence with Bhima	Pune Sewage	1.Alandi Gaon	36
24. Koyna	Karad D/s	Karad Sewage	1.At Karad	35.5
25. Mithi	Mumbai Stretch	Mumbai	1. Mithi river	50
26. Kundalika	Are Khurd	Roha sewage	1.Are Khurd	50
			2. Kundalika At Roha city	6.5
PUNJAB				
27. Satluj	D/S of Zenith Paper Mill to Bridge Harike, Amritsar	Sewage from Ludhiana & Jalandhar	1.100m D/S Budha Nala	48
			Confl.,Ludhiana	
			2. D/S East Bein	6.2
			3.Boat Bdg. Dharmkotnakodar Road,	18
			Jalandhar	
			4. 1 Km. D/S of Zenith	22
28. Ghaggar	Mubarkpur to Sardulgarh (Entire length in Punjab)	Municipal & Industrial discharge from Patiala, Chandigarh, Sukhna paper mills & Derra Bassi, Sardulgarh, Moonak,	1.D/S Dhakansu Nallah	32
			2.D/S Jharmal Nadi	32
			3.D/S Sardulgarh	45
			4.100m D/S Conf. With	40
			R. Saraswati (Patiala)	
			5.Ratanheri, D/S Of	50
			Patiala Nadi (After Confl.)	
			6.Moonak,	38
			7.U/S Jharmal Nadi,	40
			8.U/S Sardulgarh,	45
			9.D/s Chhatbir	10
			10. Mubarakpur Rest House(Patiala)	10
			11. Near Bankarpur, Dera Bassi	12
			12. U/s Dhakanshu Nallah	18
TAMIL NADU				
29. Adyar	Along Chennai	Chennai- Industrial & Municipal Wastewater	Nandambakkam, Ekattuthangal, Jaferkhanpet, Maraimalai bridge, Kotturpuram bridge, Boat club	43
30. Coovum	Along Chennai	Chennai- Industrial & Municipal wastewater	Annanagar, Arumbakkam, Amanjikarai, Poonamalle, College Road, Central Jail, Napier Bridge	105

POLLUTED RIVER STRETCHES (BOD>30mg/l and BOD exceeding 6mg/l on all occasions)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
31. Cauvery	Erode D/s	Erode Sewage	1.Erode near Chirapalayam	38
UTTAR PRADESH				
32. Yamuna	Kosi Kalan to Juhika	Sewage from Agra, Mathura, Bateshwar, Vrindavan & Etawah	1.D/S Of Agra, U.P.	33
			2.Mazawali	37
			3.Bateswar, U.P	26
			4.Etawah, U.P.	27
			5.Mathura U/S , U.P.	20
33. Hindon	Saharanpur to confluence with River Yamuna	Sewage & Industrial effluent from Ghaziabad, Saharanpur & Muzaffarnagar	1.Ghaziabad D/S, U.P.	36
			2. Confl. With R. Krishni & Kali Near Binauli City, Meerut	36
			3.Pura mahadev	34
			4. Saharanpur D/s	24
34. Western Kali	Muzaffar Nagar to Confluence with Hindon	Sewage & Industrial effluents from Muzaffar nagar & Mansoorpur	1.Kalinadi At U/S Of Muzaffar Nagar 2.Kalinadi At D/S Of Muzaffar Nagar	32
				364
35. Kali Nadi Eastern	Kannauj	Industrial and Municipal sewage from Meerut,Modinagar, Bulandsahar, Hapur, Gulaothi and Kannauj	1. At Kannauj (Before Conf.)	120
			2. U/S of Gulaothi City In Bulandsahar,	183
POLLUTED RIVER STRETCHES(BOD between 20 & 30 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
KARNATAKA				
1. Bhadra	D/s of Bhadravathi to confluence with Tunga	Industrial & Domestic	1.D/S Of Bhadravathi	22.5
		Waste water from Bhadravathi	2. D/s of KIOCL Road Bridge, Near Holehunnur	7.8
MAHARASHTRA				
2. Tapi	M.P. Border to Bhusaval	Bhusaval Sewage	1.Ajnand Village	21
			2.Uphad Village	22
			3. Bhusawal U/s	19
3. Girna	Malegaon to Jalgaon	Malegaon Sewage	1.Malegaon (Manmad)	23
		Jalgaon Sewage	2. Jalgaon	10
4. Nira	D/s of Jubilant Organosis, Pune	Industrial wastewater	1. D/s of Jubilant Organosis, Pune	21. 2
MANIPUR				
5. Nambul	Hump Bridge to Heirangoithong	Sewage	1. Heirangoithong	24
			2. Hump Bridge	26
RAJASTHAN				
6. Jojari	Along Jodhpur	Industrial & Domestic waste from Jodhpur	1.D/S Jodhpur	10.5-25.1
7. Bandi	Along Pali	Industrial & Domestic waste from Pali	1.D/S Pali	30-141

POLLUTED RIVER STRETCHES (BOD>30mg/l and BOD exceeding 6mg/l on all occasions)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
8. Berech	D/S of Udaipur	Industrial & Domestic waste from Udaipur and Chittorgarh	1.D/S Udaipur	6.2-22.1
9. Khetri	Along Khetri	Industrial & Domestic waste from Khetri	1.D/S Khetri Complex	8.1-31.2
TAMIL NADU				
10. Noyyal	Along coimbatoor, Tirupur, Palyanakotti	Industrial & domestic wastewater from coimbatoor, Tirupur, Palyanakotti	1.Vicinity of Tirupur	>26
UTTAR PRADESH				
11. Bagad	D/S of Gajraula	Industrial effluent of Jubilant organics	1.D/s of Jubilant Organics	BOD - >26
12. River Ganga	Kannauj D/S to Kanpur D/s(Jajmau Pumping station	Industrial effluent from Kanpur	1.Kanpur D/S(Jajmau Pumping Station	21
			2. Kannauj D/s, U.P.	6
			3.Kanpur U/s(Ranighat), U.P.	6.4
UTTARAKHAND				
13. Kosi	D/S of Kashipur	Sewage & Industrial waste from Kashipur	1.D/S of Kahsipur	13
14. Dhela & Kichha	D/S of Kashipur	Sewage & Industrial waste from Kashipur	1.Dhela D/S of Kashipur	187
			2.Kichha D/S of Kashipur	17
15. Bahalla	D/S of Kashipur	Sewage & Industrial waste from Kashipur	1.D/S of Kashipur	15-22

POLLUTED RIVER STRETCHES(BOD between 10 & 20 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
ANDHRA PRADESH				
1. Manjira	D/s Gowdicharla	Industrial effluent of Ganpati sugar & Impact of Nakavagu	1.Gowdicharla a/c with Nakavagu	16
			2.Near Ganpati sugars	18
ASSAM				
2. Deepar Bill	D/s Guwahati	Guwahati	1.Deepar Bill	11
GUJARAT				
3. Khari	Lali village, Ahemdabad	Municipal & Industrial waste from Ahemdabad	1.Lali Village Near Ahmedabad	19
4. Kolak	D/s Patalia.		1.At Patalia Bdg.	12
			2. At Railway Bridge No. 313 Vapi, Valsad	8
5. Mindhola	D/s State Highway Bridge Sachin		1.Mindhola At State Highway Bridge Sachin	12
6. Shedi	Along Kheda	Kheda Sewage	1. At Kheda	19
HARYANA				
7. Gurgaon Canal	D/s of Delhi	Delhi	1. GC-1 Near Badarpur Border	24

POLLUTED RIVER STRETCHES(BOD between 10 & 20 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
JHARKHAND				
8 Subarnrekha	D/s of Ranchi (Tatisilwal)	Industrial & domestic waste from Ranchi	1.Ranchi(tatisilwal)	10. 5
			2. Namkum Road bridge	6.8
KARNATAKA				
9 Tunga	D/S of Shimoga	Shimoga Sewage	1.D/S Of Shimoga City	13.5
10 Tungabhadra	Harihar D/S to Hara eahalli Bridge. & Ullanur	Harihar Sewage & Grasim waste	1.Haralahalli Bridge	16.5
11 Laxmantirtha	D/s of Hunsur City	Hunsur Sewage	1.D/s of Hunsur city	10
KERALA				
12 Karamana	Karamana At Moonnattumukku		1.Karamana At Moonnattumukku	11
MADHYA PRADESH				
13 Kshipra	Ujjain to confluence with Chambal	Ujjain- sewage	1.Ramghat At Ujjain,	15
			2.Trivenisangam (1 Km. D/S of Sangam)	14
			3.Siddhawat D/S of Ujjain	8
14 Narmada	Hoshangabad	Industrial & Domestic Wastewater	1.Hoshangabad D/s	11.4
MAHARASHTRA				
15 WeinRiver Ganga	D/S Ashti	Municipal sewage of Ashti city	1.At Ashti	10.5
			2.After Confluence of Kanhan	9
			3. D/s of Ellora Paper mill	9.4
			4.U/s of Ellora paper mill	8.6
			5.U/s of Gaurav paper mills, Jackwell	9
			6. D/s of Gaurav paper mills, Jackwell	7.8
16 Wardha	Along Rajura village	Paper mill waste	1.Rajura Bridge	11
			2.D/s of ACC Ghuggus	13
			3.At confluence point of Pangange & Wardha at Jaud	8.5
17 Bhima	Narsinghpur D/s	Nira – discharge	1. Narsinghpur,(D/SAfter.Confl.With R.Nira),	16.2
18 Krishna	Dhomdam to Kolhapur	Sewage & Industrial waste from Karad & Sangli	1. Krishna Bridge, Karad,	11. 6
			2. At Kshetra Mahuli	12
			3. Krishna Vennasangam at Mahuli	17.6
			4. At Wai	12.6
			5. Mahabaleshwar Dhom Dam Near Koina Dam,	8.6
19 Purna	Andura village		1. D/s of confl. of Morna & Purna, Andura village	10.2
			2. Purna at Dhupeshwar	

POLLUTED RIVER STRETCHES(BOD between 10 & 20 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
20. Nira	Along Pulgaon	Pulgaon Cotton Mill	1.Pulgaon Cotton Mill, Wardha	11.8
			2.Sarole Bdg.On Pune-Banglore Highway	
21 Chandrabhaga	Along Pandharpur City	Sewage Of	1. D/S Of Pandharpur City	12
		Pandharpur City	2. U/S Of Pandharpur City	10.5
22. Venna River	Varye, Satara		1. Satara D/s	12
TRIPURA				
23. Agartala Canal	D/s Agartala	Agartala sewage	1.Near Pragati Vidyabhawan, Agartala,	14.6
UTTAR PRADESH				
24. Gomti	Lucknow to Jaunpur	Sewage & Industrial effluent from Lucknow and Jaunpur.	1. Jaunpur D/S, U.P.	12
			2. Lucknow D/S, U.P.	14
25. River Ganga	Varanasi D/S	Discharge through Kalinadi & RamRiver Ganga sewage & Industrial effluent from Kannauaj and Kanpur	1.Varanasi D/S (Malviya Bridge)	14
26. RamRiver Ganga	Upstream Kannauj	Sewage & Industrial waste water from Ramnagar & Moradabad	1.RamRiver Ganga At Kannauj (Before Conf.)	16

POLLUTED RIVER STRETCHES (BOD Between 6-10 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
ANDHRA PRADESH				
1. Krishna	Wadepally		1.Krishna at Wadepally A/c with River Musi	8
2. Godavari	D/S of Rajamundary	Rajamundary	1.Rajamundary D/S	6
3. Maner	Warangal U/S	Warangal	1.Warangal U/s	6.1
ASSAM				
4. Burhidihing	Margherita to Duliajan	Margherita	1.Burhidihing At Margherita	7.9
			2.Burhidihing at Duliajan	7
BIHAR				
5. Sikrana	Sikrana At Chanpatiya	**Chanpatiya**	1.Chanpatiya	8
CHATTISGARH				
6. Arpa	Arpa river D/S of Bilaspur	Bilaspur	1.D/S Bilaspur	7
7. Seonath	U/S Rajnandgaon		1.U/S Rajnandgaon	7.1

POLLUTED RIVER STRETCHES (BOD Between 6-10 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
GUJARAT				
8. Mahi	D/s Sevalia and Vasad	Municipal waste from Sevalia & Vasad	1.Vasad	6.8
			2.Near Rajasthan border at Kadana Dam	8.2
9. River Dhadar	D/s Kothada	Kothada	1.River Dhadar At Kothada	9
10. Tapi	Rander Bridge to Surat	Municipal & Industrial waste from Surat	1.Rander Bridge, Surat	7.4
			2.Tapi at ONGC bridge, Surat	6
11. Kim	D/s Surat	Municipal Sewage	1.Sahol Bridge, Olpad Hansol Road, Surat	6
HIMACHAL PRADESH				
12. Markanda	D/S of Paonta Sahib	Water from Paonta Sahib	1.Markanda At Paonta, Distt. Sirmour	8.2
13. Beas	D/S of Mandi	Domestic waste from Mandi	1. D/s Mandi	7.6
JHARKHAND				
14. Sankh	Along Bolba	Municipal Sewage	1.Bolba	6.2
KARNATAKA				
15. Kali	Along Dandeli City	West Coast Paper Mill waste	1.D/S West Coast Paper Mill	7
16. Krishna	U/S Of Ugarkhurd Barrage		1. U/S Of Ugarkhurd Barrage	9.8
MADHYA PRADESH				
17. Tons	Tons Along Madhavgarh	Sewage	1.Tons At Madhavgarh	8
18. Kalisot	Mandideep	Sewage & industrial effluent	1.Near road bridge, Mandideep	6
19. Betwa	Raisen	Sewage from Raisen	1.At Nayapur D/s, Mandideep Industrial Area No.1, Raisen	6.8
MAHARASHTRA				
20. Kalu	Atale village to Confl. with Ulhas	Municipal & Industrial waste water	1.Atale village	7.5
21. Kanhan	D/S Nagpur	Industrial & Domestic Waste of Nagpur	1.D/S of Nagpur	8.8
			2.U/s of M/s Vidharbha paper mill, Sinora	8.8
			3.D/s of M/s Vidharbha paper mill, Sinora	9.8
22. Kolar	Along Kamptee	Municipal waste water	1.Before Confluence To Kanhan At Kamptee	7
23. Ulhas	Mohane	Industrial & Domestic runoff Ulhasnagar	1.U/S Of Nrc Bund At Mohane	6
			2.Jhambul Water Works	7.5
24. PanchRiver Ganga	Kolhapur	Industrial & Municipal sewage of Kolhapur	1.D/S Of Kolhapur City	6.4
25. PatalRiver Ganga	Khopoli to Esturaine region	Industrial & Municipal sewage from khopoli, Rasayani & Paundh	1. Shilphata	6
			2. Near Intake Of Midc W/W	9

POLLUTED RIVER STRETCHES (BOD Between 6-10 mg/l)				
River	**Polluted Stretch**	**Source/City**	**Monitoring Location**	**BOD (mg/l)**
26. Rangavali	Along Navapur	Sewage of Navapur	1.D/S Of Navapur	8.4
MEGHALAYA				
27. Kharkhala	Near Sutnga Khlieri, Jaintia Hills		1.Near Sutnga Khlieriat,Jaintia Hills Dt.	7
28. Umtrew	Umtrew At Byrnihat East		1.Umtrew At Byrnihat East	7.7
ORISSA				
29. Kathjodi	Along Cuttack	Cuttack Sewage	1.Cuttack D/S	6.4
PONDICHERRY				
30. Arasalar	Along Karaikal	Domestic waste of Karaikal	1.Arasalar River Karaikal Region,	7
RAJASTHAN				
31. Chambal	D/S Kota city	Industrial & Domestic waste from Kota	1.Kota D/S (2 Km. From City)	6.2
TAMIL NADU				
32. Vaigai	Along Madurai	Madurai-Industrial & domestic wastewater	1.Vicinity of Madurai	>6
33. Tambiraparani	Along AmbasaMoUDam	Madura Coats Indusitrial waste	1.Rail Bdg. Nr. AmbasaMoUDam	6
34. Cauvery	Tiruchirapalli to Grand Anaicut	Municipal sewage of Erode, Tiruchirapalli	1.Tiruchirappalli D/S	6
			2.Trichy,Grand Anaicut	7.8
			3.1Km D/s of Bhavani river confluence	7.3
35. Bhavani	Bhavani	Municipal sewage	1.Bhavani Sagar Bhavani	7.6
			2..Bhavani at Bhavani	6.8
UTTAR PRADESH				
36. River Ganga	D/s of Haridwar		1.D/s of Haridwar	7.6
WEST BENGAL				
37. Damodar	D/s Asansol		1.Narainpur After Confl. Of Nunia Nallah	6.8
			2.Near Mujher Mana Village After Conf. of Tamla Nallah	6.8
38. River Ganga	D/s Dakshineshwar	Industrial waste & sewage from Dakshineshwar	1.Dakshineshwar	6

POLLUTED RIVER STRETCHES (BOD between 3& 6 mg/l)			
River	**Polluted Stretch**	**Monitoring Location**	**BOD (mg/l)**
ANDHRA PRADESH			
1. TUNGABHADRA	D/s Manthralayam	1. Manthralayam , Kurnool	3.3
2. KRISHNA	Thangadi , Mahaboobnagar	1. Thangadi , Mahaboobnagar	3.1
3. PENNAR	Puspagini,	1. A/C Papagni, Puspagini	3.2
CHHATTISGARH			
4. MAHANADI	Rajim U/s to interstate boundary with Orissa	1. U/s Rajim	3.2
		2. Interstate Boundry	3.1
GUJARAT			
5. MAHI	D/s Mujpur	1. At Umeta Bridge	3.1
		2. At Mujpur	3.2
6. PANAM	D/s Lunawada	1. At Lunawada	3.7
7. SABARMATI	Dharoi Dam to Mahudi jain Temple	1. Dharoi Dam	3
		2. At Mahudi Jain Temple	3.5
8. AMBIKA	D/s Bilimora	1. At Bilimora	4.2
9. ANAS	D/s Dahod	1. Anas At Dahod,(Kushalgarh),Dist. Panchmahal	3.8
10. BALESHWAR KHADI		1. Baleshwar Khadi At N.H. No. 8	4.5
11. KAVERI		1. Bridge At Billimora-Valsad Road	3
HARYANA			
12. YAMUNA	Kalanaur to Sonepat	1.Hathnikund	3
		2. At Kalanaur	4
		3. At Sonepat	5
		4. U/s Paonta Sahib	3
KARNATAKA			
13 TUNGABHADRA	Ullanur D/s	1. At Ullanur	3.1
14 HUNDRI	Joharpur D/s	1. Joharpur(V), Near Temple, Kurnool	3.1
15 KUNDU	Nandayal D/s	1. Nandyal, Near Over Bdg., Kurnool	3.1
16 ARKAVATI	D/s of Kanakapura	1. D/S of Kanakapura City	5
17 MALPRABHA	D/s of Khanapur	1. D/S of Khanapur Village	4.1
KERALA			
18 PUZHACKAL		1. At Puzhackal Bridge	4
19 KADAMBAYAR	D/s Brahmapuram	1. At Brahmapuram	3
MADHYA PRADESH			
20 NARMADA	Hoshangabad D/s	1.at Sethanighat	3.1
		2. at Hoshangabad	3.2
21 MANDAKINI	D/s Chitrakut	1. At Chitrakut	5
MAHARASHTRA			
22 ULHAS	Along Badlapur	1. U/s of Badlapur,	3.4
23 BHATSA	Along Pise village	1. D/s of Pise Dam Near Pise Village (Ulhas)	3.3

POLLUTED RIVER STRETCHES (BOD between 3& 6 mg/l)			
River	**Polluted Stretch**	**Monitoring Location**	**BOD (mg/l)**
NAGALAND			
24 DHANSIRI	Along Dimapur	1. Near Check Gate (Dimapur Khutkhuti Road)	3.2
		2. Full Nagarjan	3.6
		3. Nuton Basti	4.8
		4. City Boundary Bridge (Diphu Road)	3.2
ORISSA			
25 BRAHMANI	Panposh to Rourkela	1. D/s Panposh	4.6
		2. Rourkela D/s	3
26 MAHANADI	Cuttack D/s	1. Cuttack D/s	4.6
27 KUAKHAI	Along Bhubaneshwar	1. At Bhubaneshwar	3.2
SIKKIM			
28 TEESTA	D/s Gangtok	1. After confluence with River Ranichu at Singtam	3
		2. After confluence with Rangichu after meeting the industrial effluents from the City Ranichu	3.1
		3. At Melli downstream	3.2
29 RANICHU	D/s Gangtok	1. Before confluence with River Teesta at Singtam	3.5
		2. After confluence of Ranichu and Rorachu at Ranipool	3.2
30 DIKCHU	D/s Gangtok	1. Before confiuence with River Teesta Near NHPC Hydroelectric Power Project	3.4
31 MANEY KHOLA	D/s Gangtok	1. After Confluence with Ray Khola at Adampool after meeting waste of STP	3.2
		2. At Burtuk near Army Base Camp, 4 Km U/s of Gangtok	3.2
TAMILNADU			
32 PALAR	Along Vellore	1. Vaniyambadi Water Supply Head Work	4
TRIPURA			
33 HAORA	Agartala D/s	1. Chandrapur, Agartala D/s of Haora	3.5
UTTAR PRADESH			
34 SARYU	Along Ayodhya	1. At Ayodhya at main Bathing Ghat	3
35 RIHAND	Along Renukut	1. Renukut U/S	3.3
		2. Renukut D/S	3.2
WEST BENGAL			
36 BARAKAR	D/s Asansol	1. At Asansol (Water Intake Point)	3.8

ANNEXURE-7

NORMS FOR STAFF AND STAFF QUARTERS FOR SEWAGE PUMPING STATIONS AND STPS

A. STAFF QUARTERS

1. Sewage Pumping Stations

Staff	Installed capacity < 150 HP	Installed capacity 150-300 HP	Installed capacity 300-500 HP	Installed capacity >500 HP
Pump Operators	Type B 1	Type B 1	Type B 1	Type B 1
Beldars	Type A 1	Type A 1	Type A 1	Type A 2
Pump Mechanics				Type B 1
Electricians				Type B 1
Total	**2**	**2**	**2**	**5**

2. Sewage Treatment Plants

SN	Staff	Types of staff Qts.	10 mld	40 mld	80 mld	120 mld
1	**ASP / Biofiltration**					
	Beldars	**A**	4	4	6	8
	Operators	**B**	2	4	4	6
	Electrician class 1	**B**	1	1	1	1
	Pump mechanic/Fitters class 1	**C**	-	1	1	1
	J.E.	**C**	-	1	1	1
	A.E.	**D**	-	-	1	1
	Operators (Power Plant)	**B**	-	2	2	2
	Sub-total		**7**	**11+2**	**14+2**	**18+2**
2	**Oxidation Pond**					
	Beldars	**A**	2	2		
3	**Aerated Lagoons**					
	Beldars	**A**	2	2		
	Operators	**B**	2	2		
4	**UASB Treatment Plants**					
	Operators	B	1+1	1+1	1+1	1+1
	-	-	-	-	-	-
	Sweepers	A	1	1	1	1
	Watchmen/Gatemen	A	1	1	1	1
	Electrician cum Mechanic	B	1	1	1	1
	Chemists***	B	1	1	1	1
	J.E.**	C	1	1	1	1
	A.E.(Civil)	D	-	1	1	1
	EE(Civil)	-	-	-	-	-

Note: *Operators' quarter for Power Package
**One J.E. would look after more UASB Plants in a city
***One Chemist would look after more UASB Plants in a city with a single laboratory.

3. Covered Areas for Different Categories of Residential Accommodation (Area as per CPWD norms)

Personnel	Type	Plinth Area
Sweepers, Watchmen	A	34.20 sq.m.
Operators, Electricians & Chemists	B	45.60 sq.m.
J.Es.	C	62.70 sq.m.
A.Es.	D	86.00 sq.m.

4. Guide Lines for Staff Quarters

1. No staff quarters are necessary for the IPS and MPS, if the installed capacity is less than 150 HP.
2. The staffing pattern for STP has been taken as per the guidelines of the Expert Committee set up by NRCD for the above purpose.
3. Number and type of quarters for different capacities any types of treatment plants have been worked out taking into consideration the operating staff in shifts. Quarters have also been proposed for minimum maintenance staff in large pumping stations and STPs.
4. Only a few supervisory staff at large STPs are to be considered for staff quarters at the site of treatment plant.
5. The pay scales and type of accommodation are based as per norms laid down by the Ministry of Urban Development.
6. If the land is not available at the site of MPS for construction of staff quarters, these quarters can be constructed at the site of treatment plant.
7. Staff quarters are not to be treated as rent-free.
8. 20% of the operating staff in shifts is to be provided quarters in the vicinity of STP.
9. States can adopt their own eligibility norms for different categories of staff, provided the variations are not too large.

B. REQUIREMENT OF STAFF FOR SEWAGE PUMPING STATIONS

Staff Required	Installed Capacity < 150 HP	Installed Capacity 150-300 HP	Installed Capacity 300-500 HP	Installed Capacity >500 HP
J.E.	½	½	1	1
Pump Mechanics	1	1	1 ½	1 ½
Electricians	1	1	1	1
Pump Operators	1x3	1x3	1x3	1x3
Beldars	1x2	1x2	1x3	2x3
Sweepers	1x1	1x1	1x1	1x1

C. REQUIREMENT OF STAFF FOR STPs

Designation	Activated sludge Process/UASB				High Rate Filtration				Oxidation Ditch				Oxidation Pond				Aerated Lagoon			
Capacity, mld	10	40	80	120	10	40	80	120	10	40	80	120	10	40	80	120	10	40	80	120
Ex Engineer (Project Manager)	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
AE(E&M)Asstt. Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AE(Civil)Astt. Manager	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	1
JE(E&M)Junior Manager	4	4	6	6	4	4	6	6	4	4	6	6	-	-	-	-	4	4	4	4
JE(Civil)Junior Manager	-	-	1	2	-	-	1	2	1	1	1	2	1	1	1	1	1	1	1	2
Fitter(Mech)Ist Class	1	1	2	2	1	1	2	2	1	1	2	2	-	-	-	-	-	-	1	1
Electn, Ist class	1	1	2	3	1	1	1	2	1	1	2	2	-	-	-	-	1	1	2	2
Fitter, 2nd class	-	-	1	1	-	-	1	1	-	-	1	1	1	1	1	1	1	1	1	1
Electn, 2nd class	1	1	2	2	1	1	2	2	1	1	2	2	1	1	1	1	1	1	2	2
Gardener	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
Driver	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1
Cleaner	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1
Jr. Accountant	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
UDC, Senior Astt.	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1	1
LDC/Typist Junior Astt.	1	1	2	3	1	1	2	3	1	1	2	3	1	1	2	2	1	1	1	2
Peon	1	1	2	3	1	1	2	3	1	1	2	3	-	-	1	1	1	1	1	2
Jr. Steno	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
Chemist	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
Asst. Chemist	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1
Lab Astt.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lab Attendant.	1	2	2	2	1	2	2	2	1	2	2	2	1	1	1	1	1	1	1	1
Sweeper	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
Welder cum Balcksmith	-	-	1	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
Operators	12	16	19	19	12	16	19	19	8	8	12	12	-	-	1	1	4	4	4	4
Labour (Beldars)	28	44	54	73	28	44	53	72	21	28	48	52	11	20	36	50	10	14	27	34

ANNEXURE-8

COMPLETION REPORT (Part A)
(General Abstract of Cost)

1. Name of the scheme:
2. Sanctioned Amount:
3. Date of sanction:
4. Date of Scheduled start:
5. Date of actual start:
6. Date of Scheduled Completion:
7. Date of actual completion
8. Actual Expr.

Sl. No	Sub-head/ component	As per sanctioned Estimate			As executed			Variation		Reasons for Variation	Cost as per executed quantity & Rates as per sanctioned Estimate	Escalation Due to variation in quantity Col. 12 Col. 5	Escalation Due to price variation Col. 8- Col.5- Col. 13	Remarks
		Item	Qty	Amt.	Item	Qty	Amt.	Saving (+)	Excess (-)					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Certified (1) That there has been no material deviations from the sanctioned plans and specifications other than those approved by the competent authority.

(2) That the works have been completed as per specifications and completion drawings enclosed

(3) That the site has been cleared of all malba, rubbish and surplus materials, contractors' hutments and his materials etc

COMPLETION REPORT (Part B)

Name of the Scheme: Details of variations in the scope of work

Component/Sub-head:

Sl. No	Description of item of work	As per sanctioned Estimate				As executed				Variation		Reasons for Variation	Cost as per executed quantity & Rates As per sanctioned Estimate	Escalation Due to variation in quantities col. 14-Col. 6.	Escalation Due to price variation Col. 10 - Col. 6 - Col. 15	Remarks
		Qty	Unit	Rate	Amt.	Qty	Unit	Rate	Amt.	Saving (+)	Excess (-)					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

ANNEXURE-9

SUGGESTIVE STRUCTURE OF THE CITY SANITATION PLAN REPORT

Chapters	Description
(i)	**Table of Contents**
(ii)	**List of Abbreviations**
(iii)	**SALIENT FEATURES OF THE PROJECT**
(iv)	**EXECUTIVE SUMMARY**
1.	**ABOUT THE PROJECT AREA**
1.1	**Authority for preparation of project**
1.2	**Composition of the team set up for preparing the City Sanitation plan**
1.3	**Description of the project area**
i.	Brief description of the polluted stretch of the river and its basin
ii.	Justification for selecting the town for project formulation under NRCP / NGRBA
iii.	Brief history of the town
iv.	Geographical Location
v.	Climate
vi.	Topography
vii.	Drainage channels
viii.	Administrative divisions
ix.	Commercial aspects
x.	Industrial activities
xi.	Educational activities
xii.	Cultural activities
xiii.	Religious activities
xiv.	Socio –Economic status
xv.	Town Management
xvi.	Land cost in and around the town (copy of rates be attached in support)
xvii.	City Development plan, if any, covering the sewerage and non sewerage aspects.
1.4	**Population within the project area**
i.	Ward wise Census population of the last 5 decades, area, no. of households, growth rate, density of population
ii.	Slum wise population of the last 5 decades
iii.	Details of future population projections as per the City Master Plan
iv.	Cattle population
2.	**SEWERAGE WORKS**
2.1	**Status of water supply**
i.	Actual Water supply from different sources ward wise, Population covered and rate of water supplied in different areas
ii.	Proposals for augmentation of water supply system
2.2	**Status of existing waste water disposal works**
i.	Existing works
ii.	Works under execution
iii.	Works sanctioned but not yet started
iv.	Total waste water generation
v.	Industrial flow

Chapters	Description
2.3	**Status of Pollution of the river**
i.	Nos. & details of drainage channels
ii.	Waste water flow carried by drains,
iii.	Details of measurement of flows in drains along with copies of test reports
iv.	Waste water characteristics of different drains,
v.	Details of measurement of Waste water characteristics along with copies of test reports
vi.	Water quality of the river u/s, d/s and at outfalls of drains discharging into the river
vii.	Details of measurement of the quality of river water along with copies of test reports
viii.	Methodology followed for flow measurement and quality characteristics
ix.	Water quality standards of river water quality
2.4	**Justification of the project for pollution abatement of the river**
3.	**NON SEWERAGE WORKS**
3.1	**Community Sanitation Scheme**
a)	**For each ward provide the following information**
i.	floating and permanent population
ii.	Number of houses not having toilet
iii.	Slum wise population
iv.	Slum wise availability of public toilets
b)	**Details of plan for Slum rehabilitation, if any**.
c)	**Identification of Slums where CTCs are required**
d)	**Identification of Public places where Toilet Complexes are required.**
3.2	**Crematoria**
a)	**Base line information**
i.	Total population including floating population
ii.	Details of existing cremation grounds- Electrical, Gas Based, Wood based (Conventional)
iii.	No of bodies cremated in each cremation ground
iv.	Wood consumption per cremation ground wise.
b)	**Cremation grounds where Improved Wood Based Criteria / Electric Furnace are justified**
3.3	**River Front Development**
	Baseline status
	For each ghat
	Number of users – peak at any given time and average
	Approximate dimensions of the ghat
	The state of the ghat
	Improvements required
	Locations of new ghats needed
	Approximate dimensions of new ghats
3.4	**Dhobi Ghats**
	Dhobi ghat wise information
	Specific location
	Number of dhobis washing clothes
	Identification of locations where alternative facilities to the affected dhobis can be provided.

Chapters	Description
3.5	**Carcass Disposal**
	The number of cattle that die in the town
	Existing arrangements for safe carcass disposal
	Identification of the need for carcass disposal.
3.6	**Others (Waste Disposal from dairies, slaughter houses etc.**
4.	**SOLID WASTE MANAGEMENT**
	Baseline information municipal ward wise
	Category wise quantity of solid waste and its characteristics
	Bio- degradable and non biodegradable waste
	Industrial Waste
	Bio-medical waste
	Segregation of the waste
	Collection and storage system
	Transfer System
	Garbage Dumping and Disposal site(s)
	Solid waste converted to compost – composting site and its capacity
	Solid waste recycled
	Deficiencies in the SWM system
	Justification for up grading the present system or a new system
5.	**CONSULTATION WITH STAKE HOLDERS**
	Resolutions of ULBs for CSP adoption
	Consultation with community
6.	**FINANCIAL STRATEGY FOR EXECUTING THE DIFFERENT COMPONENTS**
7.	**MAPS**
	(MAPS – Several themes can be shown in one map depending upon convenience)
i.	Map of the Country and State showing the location of the town
ii.	Map showing the polluted river with its basin and the selected town
iii.	Map of the city showing River Basin and details as mentioned in chapter 3
iv.	Map of the city showing drains and their outfall points
v.	Map of the city showing land use
vi.	Map of the city showing existing water supply works
vii.	Map of the city showing existing sewerage works
viii.	Map of the city showing Municipal wards
ix.	Map of the city showing Industrial Estates
x.	Map of the city showing Grossly polluting units
xi.	Map of the city showing Slums
xii.	Map of the city showing markets and commercial places (For Toilet Complexes)
xiii.	Map of the city showing existing community toilet complexes
xiv.	Map of the city showing Crematoria
xv.	Map of the city showing Ghats (River fronts where people collect for bathing)
xvi.	Map of the city showing Dhobi ghats
xvii.	Map of the city showing Cattle wallowing sites
xviii.	Map of the city showing Washing of motor vehicles
xix.	Map of the city showing Garbage dumping sites
xx.	Map of the city showing Bio-medical treatment facilities

Note:

CSP is a comprehensive document covering wider issues of sanitation works required for the city.

The CSP should flow from the City Development Plan, wherever applicable / feasible.

Base line data on present status should be as accurate as possible.

It is in the best interest of the city, its residents, the local body and other stake holders.

Planning and development may involve people along with other stakeholders in structured and scientific manner

Financial status of the city government (overall financial profile) may answer :

- What budgetary and accounting practices are being followed?
- What sources of revenue does the city govt. have or plans for meeting the sustainability (recoveries)?
- criteria for fixing user charges
- (sector-wise financial profile - Water supply, sewerage, Sanitation)

ANNEXURE-10

Suggestive Structure of the Feasibility Report For Sewerage Works
The project should include the following chapters

Chapters	Description
i.	Table of Contents
ii	List of Abbreviations
iii	**Executive Summary**
1	**ABOUT THE PROJECT AREA**
	Authority for preparation of project
	Description of the project area
	Brief history of the town
	Geographical Location
	Climate
	Topography
	Drainage channels
	Administrative divisions
	Commercial aspects
	Industrial activities
	Educational activities
	Cultural activities
	Religious activities
	Socio –Economic status
	Town Management
	Land cost in and around the town (copy of rates be attached in support)
	City Development Plan, if any, covering the sewerage works
1.2	**Population within the project area**
	Census population of the last 5 decades, area, no. of households, growth rate, density of population
	Slum population of the last 5 decades
	Details of future population projections as per the City Master Plan
1.3	**Status of water supply**
	Actual Water supply from different sources ward wise, Population covered and rate of water supplied in different areas
	Proposals for augmentation of water supply system
1.4	**Status of existing waste water disposal works**
	Existing works
	Works under execution
	Works sanctioned but not yet started
1.5	**Status of Pollution of the river**
	Nos. & details of drainage channels
	Waste water flow carried by drains,
	Details of measurement of flows in drains along with copies of test reports
	Waste water characteristics of different drains,

Chapters	Description
	Details of measurement of Waste water characteristics along with copies of test reports
	Water quality of the river u/s, d/s and at outfalls of drains discharging into the river
	Details of measurement of the quality of river water along with copies of test reports
	Methodology followed for flow measurement and quality characteristics
	Water quality standards of river water quality
	Justification of the project for pollution abatement of the river
2	**APPROACH AND SEWERAGE DISTRICTS**
2.1	**Approach**
	Design Criteria
	Design periods
	Population projections for the town for design periods
	Norms of rate of water supply
	Interception factor (IF)
	Plans for renovation, up gradation, augmentation etc of the existing sewerage works
2.2	**Drainage areas**
	Description
	Details
	Population projections of each drainage area for design years
	Actual water supply from different sources, Population covered and rate of water supplied in different areas
	Projected waste water flows in each drainage area in design years based on projected flows in drains and actual lpcd*populn*IF
2.3	**SEWERAGE DISTRICTS**
2.3.1	**Details of Decentralized Option**
	Possible no. of sewerage districts, based on topography, existing sewerage works, availability of land for SPS and STPs, location of rly lines, ridge lines, rivers, National Highways etc, availability of power, encroachments, quicker construction and commissioning of works etc.
	Population projections of each district in design years
	Projected waste water flows in each district in design years
	Lengths of sewer lines and capacity of SPS, STPs in each district
	Availability of land for various components in each district
	Approx capital and O&M cost of works in each district
	Economics of option of providing land at farther distance at cheaper rates and providing STP of cheaper technology
2.3.2	**Details of Centralized option**
	Capacity of STP
	Life Cycle Cost of STP
	Anticipated number of SPS
	Land required for various components
	Land available for various components
	Land cost in and near the town (copy of rates be attached in support)
	O&M cost of proposed works
	Life Cycle Cost of proposed works
	Economics of option of providing land at farther distance at cheaper rates and providing STP of cheaper technology

Chapters	Description
3.3.3	**LCC of centralized v/s decentralized options for various combination of no. of districts**
3	**OPTION ADOPTED**
	Finally deciding no. of districts and Justification
	Brief description of each district, works proposed, approx capital and O&M cost of works
	Impact of the proposed works on the health of the river, as compared to the river water quality standards
	General Abstract of Cost (Comprehensive)
4	**INSTITUTIONAL ARRANGEMENTS**
5	**ENVIRONMENTAL IMPACT ASSESSMENT**
6	**COST ESTIMATES AND RESOURCE REQUIREMNT**
	Abstract of cost estimates for each component of works
	Possible Resources
	Phasing
	Resource recovery plan
7	**ANNEXURES**
	Data collected as mentioned in chapter 2
	Executive Summary of City Development Plan, if any
	Executive Summary of City Sanitation Plan
	Approval of City Sanitation Plan by ULB
	Approval of City Sanitation Plan by the State Government
	Approval of City Sanitation Plan by NRCD
	Test Reports of River Water Quality, including those by CPCB, SPCB and other agencies
	Reports of quantity and quality of waste water in the drains
	Rates of Land Acquisition in and around the town
	Sub Soil Water Data
8	**Drawings**
	Map of the Country and State showing the location of the town
	City map showing surrounding areas (based on survey of India topographical map)
	Satellite imagery of the town
	Map of the city showing River Basin and details as mentioned in chapter 3
	Map of the city showing drains and their outfall points
	Map of the city showing land use
	Map of the city showing existing and proposed `water supply works
	Map of the city showing existing sewerage works
	General Layout of city showing all proposed sewage districts
	City plan showing the broad location of Non Sewage works ij the city plan map

ANNEXURE-11

Suggestive Structure of the DPRs (only for Sewerage works)

Chapters	Description
i.	Table of Contents
ii	List of Abbreviations
iii	Salient Features Of The Project
iv	Executive Summary
1	**ABOUT THE PROJECT AREA**
1.1	**Authority for preparation of project**
1.2	**Description of the project area**
	Brief history of the town
	Geographical Location
	Climate
	Topography
	Drainage channels
	Administrative divisions
	Commercial aspects
	Industrial activities
	Educational activities
	Cultural activities
	Religious activities
	Socio –Economic status
	Town Management
	Soil characteristics
1.3	**Population within the project area**
	Census population of the last 5 decades, area, no. of households, growth rate, density of population
	Slum population of the last 5 decades
	Details of future population projections as per the City Master Plan
1.4	**Status of water supply**
	Actual Water supply from different sources ward wise, Population covered and rate of water supplied in different areas
	Proposals for augmentation of water supply system
1.5	**Status of existing waste water disposal works**
	Existing works
	Works under execution
	Works sanctioned but not yet started
1.6	**Status of drains**
	Nos. & details of drainage channels
	Waste water flow carried by drains,
	Details of measurement of flows in drains along with copies of test reports
	Waste water characteristics of different drains,
	Details of measurement of Waste water characteristics along with copies of test reports

Chapters	Description
1.7	**River water quality**
	Water quality of the river u/s, d/s and at outfalls of drains discharging into the river
	Details of measurement of the quality of river water along with copies of test reports
	Methodology followed for flow measurement and quality characteristics
	Water quality standards of river water quality
1.8	**Justification of the project for pollution abatement of the river**
2	**APPROACH and status of existing works**
2.1	**Description of sewerage districts**
2.2	**Design Considerations**
	Design periods of various components
	Norms for rate of water supply
2.3	**Population within the project area**
	Census population of the last 5 decades
	Details of future population projections as per the City Master Plan
	Population Projections of each district in design years
2.4	**Water Supply**
	Actual Water supply from different sources ward wise, Population covered and rate of water supplied in different areas
	Proposals for augmentation of water supply system
	Rate of water supply in each district
2.5	**Sewage Generation**
	Interception Factor
	Sewage Generation in each district in design years as per norms of rate of water supply
	Sewage Generation in each district in design years as per projected actual flows in drains
	Sewage Generation in each district in design years as adopted
2.6	**Status of existing waste water disposal works**
	Existing works
	Works under execution
	Works sanctioned but not yet started
	Details of proposed renovation, up gradation, augmentation etc of the existing sewerage works
3	**Design Details of proposed works**
3.1	**Design Criteria**
	Design periods of various components
	Norms for rate of water supply
32	**Sewer network**
	Hydraulic Design of Sewer Network, District wise
	Design of sewer Bedding

Chapters	Description
3.3	**Sewage pumping stations**
	Hydraulic Designs of Sewage Pumping Stations
	Design of capacities of Pumping Plants of sewage pumping stations
	Design of capacities of Generators
	Design of Economical sizes of Rising Mains
3.4	**Sewage treatment plants**
	Capacities of STPs
	Characteristics of raw water
	Characteristics of treated effluent
	Disposal of treated effluent
	Life Cycle Cost analysis for different technologies of treatment of waste
	Calculations for land required for various components
	Hydraulic Design of Sewage Treatment Plant, component wise
	Electrical Load List of S.T.Ps
	Sewer network
	Hydraulic Design of Sewer Network, District wise
	Design of sewer Bedding
	Land required for various components
3.5	**Other provisions**
	House connections
	Land
	Staff Quarters
	Reinstatement of roads
	Design of sewer Bedding
	Permission from Forest, Railways, Telephone etc departments
4	**Environmental Impact assessment of works**
5	**Implementation programme**
6	**Institutional Arrangement**
	Capacity of ULB – financial, material, human resources related to implement, operate and maintain the WWMS
	Proposed strengthening plan
7	**Financial and ECONOMIC Analysis**
	Abstract of Cost estimates
	Cost sharing of the project
	Schedule of demand of funds
	Economics
	Estimate of Annual O&M Cost of Sewerage Works for 5 years
	O&M Recovery Plan for 15 years
	Break up of Cost of works(component wise) and its schedule of execution
	Schedule of funding
	Estimate of Cost of Annual O&M of Sewer Lines
	Estimate of Cost of Annual O&M of Sewage Pumping Stations
	Estimate of Cost of Staff Required for O&M of MPS/IPS
	Estimate of Cost of O&M of MPS/IPS

Chapters	Description
	Estimate of Cost of Annual Electric Consumption for Running Sewage Pumps MPS/IPS
	Estimate of Cost of Annual O&M of D.G. Sets – MPS /IPS
	Estimate of Cost of Annual O&M of STPs
	Requirement of Staff for O&M of MPS / IPS
	Requirement of Staff for O&M of STPs
8	**ANNEXURES**
	Data collected as mentioned in chapter 2
	Executive Summary of City Development Plan
	Executive Summary of City Sanitation Plan, as approved
	Executive Summary of FR, as approved
	Approval of City Sanitation Plan by the State Government
	Approval of City Sanitation Plan by NRCD
	Approval of Feasibility Report by the State Government
	Approval of Feasibility Report by NRCD
	Test Reports of River Water Quality, including those by CPCB, SPCB and other agencies
	Test Reports of Discharge of drains
	Rates of Land Acquisition in and around the town (copy of rates be attached in support)
	Approved Labour Rates applicable in the project area
	Approved Material Rates applicable in the project area
	Schedule of Rates for the District / Town for various items
	Sub Soil characteristics and Water Data
	Rates of PWD for reinstatement of roads
	Budgetary Offers of various components
9	**ESTIMATES**
	Unit Estimate of Manhole, size wise
	Unit Estimate of Boundary Wall
	Unit Estimate of Steel Gate
	Unit Estimate of House Connection from property Line upt o Sewer Line
	Unit Estimate of Gully Pits
	Abstract of Cost of Sewerage Works (Including Sewers, Rising Mains, IPS, MPS & STPs)
	Estimate of Cost of Sewer Lines, sewerage district wise
	Estimate of Cost of Civil Works of MPS, pumping station wise
	Estimate of Cost of Civil Works of IPS, pumping station wise
	Estimate of Cost of Rising Mains of MPS / IPS /STP, pumping station / STP wise
	Estimate of Cost of Civil Works of Sewage Treatment Plant, STP wise
	Estimate of Cost of Civil Works of various components of Sewage Treatment Plant, STP wise
	Estimate of Cost of Laboratory cum Office Building
	Estimate of Cost of Staff Quarters Required for STPs//MPS/ IPS
	Estimate of Cost of Land Acquisition for Sewerage Works
	Estimate of Cost of Boundary Wall
	Estimate of Cost of Permission from Forest Department
	Estimate of Cost of Shifting of Electric Cables, Lines etc./ Telephone Poles, Cables etc.
	Estimate of Cost of Special T&P
	Estimate of Cost of EM Works, component wise

Chapters	Description
10	**DRAWINGS**
	Map of the Country and State showing the location of the town
	City map and surrounding area (based on Survey of India map)
	Satellite imagery showing plan of the city including roads, water bodies etc
	Map of the city showing River Basin and details as mentioned in chapter 3
	District Map showing Polluted cities
	Map of the city showing drains, their outfall points, land use
	Contour plan of the city in appropriate scale and contour interval
	Map of the city showing existing and proposed water supply works
	Map of the city showing existing sewerage works
	Plan of proposed Sewers showing GLs, ILs, Diameters etc.
	L-Sections of Sewers
	Manholes
	Sewage Pumping Stations (plan, sections)
	Sewer Bedding Details
	Site Plan of STP indicating land requirement for design year
	Outline drawings of recommended STP technology structure covering hydraulic flow and broad with dimensions, levels

ANNEXURE-12

Ministry of Environment & Forests

UTILISATION CERTIFICATE

(To be sent in duplicate to the Ministry of Environment & Forests)
for the financial year (Form_____ to _____)

1. Title of the Project/Scheme:
2. Name of the Organisation:
3. Principal Investigator:
4. Ministry of Environment And Forests letter No. and date of sanctioning the project :
5. Amount brought forward from the previous financial year quoting Ministry of Environment and Forests letter no. and date on which the authority to carry forward the said amount was given :
6. Amount received from Ministry of Environment & Forests, during the financial year (please give No. and date of sanctions Showing the amount paid)
7. Total amount that was available for expenditure (including commitment) incurred during the Financial Year (S. No. 5+S. No. 6)
8. Actual Expenditure (Excluding commitments) incurred during the financial year:
9. Unspent balance refunded if any (Please give details of cheque no. etc.)
10. Balance amount available at the end of the financial year:
11. Amount allowed to be carried forward to the next financial year vide letter no. and date:

Certified that the expenditure of Rs. _____ (Rupees _____)mentioned against column 8 was actually incurred on the Project / Scheme for the purpose for which it was sanctioned and balance amount is available on _____ .

(Signature of Principal Investigator)	(Signature of Registrar/ Accounts Officer)	(Signature of Head of the Organisation)

ACCEPTED AND COUNTERSIGNED
COMPETENT AUTHORITY
MINISTRY OF ENVIRONMENT AND FORESTS

Form of Utilisation Certificate

(Form GFR 19-A)
[See Rule 212(1)]

Name of the Organisation :

Financial Year :

S. No.	Ministry of Environment and Forests Sanction for Released Amount		
	Letter No.	Date	Amount (Rs. in Lakhs)
1.			

1. Certified that out of Rs. --------- of grants-in-aid sanctioned during the year ---------- in favour of ---------- under Ministry of Environment and Forests letter No. ---------- dated ---------- ,and Rs.----------on account of unspent balance of the previous year, a sum of Rs.---------- has been utilized during the period for purpose of "----------." for which it was sanctioned and that the balance of Rs—---------- remaining unutilized at the end of the year will be adjusted during ---------- towards the grants-in-aid payable during the next year ----------

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of checks exercised

1.
2.
3.
4.

Signature ……..

Designation …….. Date ……..

Operating

Countersigned _____

National Mission for Clean Ganga

Ministry of Jal Shakti

Department of Water Resources, River Development &

Ganga Rejuvenation, Government of India

Environmental and Social Management Framework (ESMF)

Prepared by

The Energy and Resources Institute (January 2011)

Updated by

Lea Associates South Asia Pvt. Ltd. (16 March 2020)

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Addendum-I Addendum to Environmental and Social Management Framework of Namami Gange Programme (April 2017)

List of Abbreviations

AF	Affected Family
BPL	Below Poverty Line
CPRs	Common Property Resources
EA	Executing Agency
EMP	Environmental Management Plan
EP	Entitled Person
ESA	Environmental and Social Assessment
ESMF	Environmental and Social Management Framework
GAP	Ganga Action Plan
GEMP	Generic Environmental Management Plan
GoI	Government of India
GSMP	Generic Safeguard Management Plan
ha	Hectare
LAA	Land Acquisition Act
MoJS, DoWR, RD&GR	Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation
MoEF &CC	Ministry of Environment, Forests & Climate Change
NGO	Non-Government Organization
NGP	Namami Gange Program
NMCG	National Mission for Clean Ganga
NLCP	National Lake Conservation Plan
NRCD	National River Conservation Directorate
PAP	Project Affected Person
RFCTLARR 2013	Right to fair compensation and transparency in land acquisition, rehabilitation and Resettlement Act, 2013
R & R	Resettlement and Rehabilitation
RAP	Resettlement Action Plan
ROW	Right of Way
SC	Scheduled Caste
SMCG	State Mission for Clean Ganga
SRCA	State River Conservation Authorities
SECs	State Executive Committees
u/s	Under Section
ULB	Urban Local Body

Glossary of Terms

Bigha	1/5 of an acre
Development Block	A number of villages grouped together form a Development Block.
District Collector/ Magistrate	Administrative head of a District.
Divisional Commissioner	Administrative head of a division comprising of a number of Districts.
Grievance Redress Cell	A cell set up for grievance redress by the competent authority at various levels
Hectare	A unit for measuring land area. (10,000 m^2).
Kachha	Structures with stone/ mud wall/ thatch roof
Non-titleholders	Drawing economic benefits from a piece of land, but not the owner of the land
Panchayat	Elected local self-governing body at village level.
Panchayat Samiti	Local Self-governing body at Block level
Pucca	Cement, bricks or concrete build structure
Sarpanch	Elected Head/chief of a village level body.
Semi Pucca	Structures with tiles/ thatch roof/ brick cement wall
Tehsil/ Subdivision	A group of Blocks

EXECUTIVE SUMMARY

Background

1. River Ganga has significant economic, environmental and cultural value in India. Rising in the Himalayas and flowing into the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of north and eastern India. The Ganga basin – which also extends into parts of Nepal, China and Bangladesh – accounts for 26 per cent of India's landmass, 30 per cent of its water resources and more than 40 per cent of its population. The Ganga also serves as one of India's holiest rivers whose cultural and spiritual significance transcends the boundaries of the basin.

2. Despite its importance, extreme pollution pressures pose a great threat to the biodiversity and environmental sustainability of the Ganga, with detrimental effects on both the quantity and quality of its flows. Increasing population in the basin and haphazard urbanization and industrial growth has significantly impacted the water quality of River Ganga, particularly during the dry season.

3. The previous attempt to clean the river, such as Ganga Action Plan (GAP) launched in 1985 have provided some gains in arresting rate of water quality degradation, but lot more needs to be done. The lessons drawn from this prior experience indicate that improving water quality in the Ganga three-pronged approach has been adopted as mentioned below:

(i). Establishing a basin-level, multi-sectoral framework for addressing pollution in the river (including national/state policies and river basin management institutions);
(ii). Making relevant institutions operational and effective (e.g. with the capacity to plan, implement and manage investments and enforce regulations); and,
(iii). Implementing a phased program of prioritized infrastructure investments (with emphasis on sustainable operations and mobilization of community support)

4. As a major first step in this direction, the Government of India (GoI) has established the National Ganga River Basin Authority (NGRBA) in 2009 and National Council for River Ganga (Rejuvenation, Protection and Management) in 2016, as an Authority has been created for comprehensive management of the river. The NGRBA was established through Gazette notification of the Government of India S.O. No. 521 (Extraordinary) dated 20 February 2009 under section 3 of the Environment Protection Act, 1986, as an empowered planning, financing, monitoring and coordinating authority for the Ganga River.

5. The Namami Gange Programme launched in 2015 has adopted a river-basin approach and has been given a multi- sectoral mandate to address both water quantity and quality aspects. Under Namami Gange Programme, diverse set of interventions for cleaning and rejuvenation of river Ganga have been taken up. These include pollution abatement activities including sewage, industrial effluent, Solid Waste etc., River Front Management, Aviral Dhara, Rural Sanitation, Afforestation, Biodiversity Conservation, Public Participation etc. The programme covers short term, medium term and long term activities.

6. The pace of these projects has gathered momentum and all efforts are being made to complete these projects well within the respective timelines.

7. National Ganga River Basin Project (NGRBP) started in 2011 and funded by World Bank has now been included as a part of Namami Gange Programme.

National Mission for Clean Ganga (NMCG)

8. The National Mission for Clean Ganga was established in the form of a national level Program Management Group (PMG) in 2011, for seeking $1bn assistance from World Bank. Cabinet Committee on Economic Affairs (CCEA) accorded approval on 28.04.2011 for the World bank assisted National Ganga River Basin Project (NGRBP) at an estimated cost of Rs. 7000 crore to be implemented by NMCG as a registered Society under the Societies Registration Act 1860, to act as an implementation arm of NGRBA (External Funding).

9. With change in Allocation of Business Rules, 1961 vide Gazette Notification dated 31.07.2014, the work related to Ganga and its tributaries was transferred to Ministry of Water Resources, River Development and Ganga Rejuvenation (Now Ministry of Jal Shakti) from the Ministry of Environment & Forests. The next major development in the evolution of NMCG was launch of Namami Gange Programme on 13th May 2015 with the approval of Cabinet as a Central Sector Scheme (100% central assistance), with components including all objectives of NGRBA. The non-lapsable fund of Rs 20,000 crore was earmarked for five-year period, 2015-2020.

10. The Namami Gange Program with a definite timeline of five year required a truly empowered implementing body. This realization led to reconstitution of NMCG as an Authority on 7th October 2016. With simultaneous dissolution of NGRBA, the present form of NMCG as an Authority is the designated body to take all necessary decisions and actions for pollution abatement and rejuvenation of River Ganga. Later in 2019, **Ministry of Jal Shakti** was formed by merging Ministry of Water Resources, River Development & Ganga Rejuvenation and Ministry of Drinking Water and Sanitation. Now, NMCG falls under the Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti.

Brief Project Description

11. The earlier NGRBP programme usually has 70% central share and 30% state share at the sub-projects levels and support for 5 years of Operation and Maintenance. After launching of Namami Gange programme almost all the new projects sanctioned under Namami Gange Programme would have 100% funding from the Central Government for the entire life cycle cost of the assets created, which includes 15-year Operation & Maintenance cost as well. Namami Gange Programme has been segregated into three different components:

- **Component 1**: **Institutional Development:** This component will support to the national, state and municipal governments to strengthen implementation and financing arrangements and develop a framework to improve Ganga river basin management.
- **Component 2: Infrastructure Development:** Pertains to the initiatives to be undertaken under National Ganga Plan in 5 major sectors i.e. Infrastructure Development (Sewage Treatment, River Front Development, and Industrial Wastewater Treatment & Solid Waste Management), Ecological Sustainability and Research & Development and Communication & Public Outreach.
- **Component 3: Program communication and management:** NMCG conducts a range of vibrant communication activities ranging from ground-level community engagement exercises, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign.

12. The Ganga-2 project is basically a continuation of Ganga-1 project with a portfolio of investment of US$400 million under Ganga-2. The portfolio of river pollution mitigation projects to be implemented under the Namami Gange and its components areas under.

Portfolio of Projects: NGRBP

13. The portfolio of river pollution mitigation projects to be implemented under the Namami Gange and its components areas under.

S.No.	Portfolio of Projects	Components
(i)	Sewerage and Sanitation Schemes	▪ Provision for an entirely new sewerage network including individual house connections and gravity based interception and diversion arrangements to drains carrying sanitary sullage/dry weather flow ▪ Extensions to existing sewerage networks in some parts of cities/towns to include areas which are un-sewered hitherto or to newly developed areas in the recent years
(ii)	Sewage Treatment Plants/Facility	▪ Entirely new sewage treatment plant/facility ▪ Augmentation of capacities in existing sewage treatment plant/facility ▪ Remodeling/Renovation of existing sewage treatment facilities, resulting in better effluent quality and augmented treatment capacity
(iii)	Solid Waste Treatment Facilities	▪ Engineered landfills with leachate collection and treatment systems ▪ Waste segregation and composting facilities
(iv)	Industrial Pollution Control Facilities	▪ Common Industrial Effluent Treatment Plants(CETP's) ▪ Hazardous Waste Treatment, Storage and Disposal Facility(TSDF's) ▪ Other Industrial Effluent Treatment and disposal facility
(v)	River Front Development Schemes	▪ River Front Development and beautification schemes of river banks ▪ Construction of Bathing Ghats ▪ Redevelopment of Cremation grounds, situated on river banks ▪ Development of electric and or gas-based crematoriums situated on river banks

14. The implementation of these projects is spread across several cities and/or towns within the Ganga basin states/UT of Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal.

Key Achievements under Namami Gange Programme

15. Under Namami Gange programme, till December 2019, a total of 310 projects have been sanctioned at an estimated cost of Rs.28909.59 Crore, out of which 114 projects have been completed and made operational; rest of the projects are at various stages of implementation. These projects are related to: Sewerage Infrastructure, Ghat Entry Level activities, Institutional development, project Implementation support/ research & study projects/ public relations and Public Outreach, Biodiversity education, Construction of IHHL across Gram Panchayats near Ganga River, Composite Ecological Task Force & Ganga Mitra, Bioremediation and Afforestation etc.

16. Under Ganga-1 (funded by World Bank), 35 sewerage and STP schemes are expected to be completed by December 2021 with installed STP capacity of 620 MLD and laying of 3035 km. of sewerage network. In these installed STP capacity by December 2021, nearly 424 MLD of sewage is expected to be treated and with this 25,032 Metric tonnes of BOD is expected to stop in getting discharged to river Ganga annually. Further, with completion of Patna River Front project (90% work is completed and opened to public) a good public place has been created to the people of Patna and has become a showcase for spreading awareness for river rejuvenation and proactive measures for disposal of solid waste in the river bank areas. The crematoria developed under Patna river front has enormously helped in reducing the burden of waste disposal associated with the cremation activities.

17. Additionally, the Ganga-1 has helped to developed the institutional mechanism in Namami Gange projects to spread the programme to the district level by formation of NMCG, SMCGs (in UK, UP, Bihar, Jhakhand and West Bengal), State Ganga Committee and District Ganga Committee for suitable implementation and monitoring of projects. All these projects are generally supported with 15 years of Operation and Maintenance which is a paradigm shift in project formation as compared with previous Ganga cleaning programme. Further people's participation has been increased manifold for the success of the programme by organizing various state and national level programmes like "Swachhata Pakhwara" (15 days long programme to clean the banks along river between 15-30th March every year), Swachta Hi Sewa, Vraksharopan , Ganga Utsav, Rafting Expedition , Ganga Yatra etc.

18. For the 1st time, projects are packages in the forms of Hybrid annuity and PPP mode in the sewerage sector projects in India under the Ganga-1 (under Namami Gange) which ensures performance-based payment plan to enhance the performance of the STPs to meet the desired effluent criteria.

19. Since the roll-out of the HAM in 2016, 7 HAM projects have been awarded and 10 more are at different stages of preparation and bidding. A market study was carried out as part of the Ganga 2 preparation to capture the emerging lessons from the HAM contracting mode.

20. Till date out of the 35 sewerage projects sanctioned under Ganga-1 (world Bank funded), 11 projects are already completed, and another 15 projects are expected to be completed by December 2020.

Identified Thrust Areas and Action Points under Namami Gange

21. There are 7 identified thrust areas and 21 action points for the rejuvenation of Ganga and its tributaries, as below, the details are given in the main report.

- *Thrust Area 1-Aviral Dhara*
- *Thrust Area 2-Nirmal Dhara*
- *Thrust Area 3-Protection and Beautification of riverfront and development of Public amenities*
- *Thrust Area 4-Inter-ministerial Coordination, State's participation and Capacity building*
- *Thrust Area 5-Research and Monitoring*
- *Thrust Area 6-Conservation of plants and aquatic species*
- *Thrust Area 7-People's participation and Creating Awareness*

22. The Ganga 1 projects were mostly on the main-stem of river Ganga which covered the 5 basin States i.e. Bihar, Jharkhand, Uttar Pradesh, West Bengal and Uttarakhand. The Ganga 2 projects are in continuation to the Ganga 1 projects and sub-project which are similar in nature. The focus of NMCG has also included from Ganga main-stem to the polluted stretches of the tributaries of river Ganga. Thus, the need was felt for updating the ESMF to showcase the inclusion of the tributaries, projects and sub-projects with respect to Ganga 1 and Ganga 2.

23. Accordingly, the ESMF document has been updated to provide an overview of the Ganga basin profile including major tributaries like Ramganga, Kali, Yamuna (downstream of Delhi), Hindon, Gomti, Betwa, Chambal, Parbati, Shipra, Sind, Tons, Son, Damodar, Ajay, Burhi Gandak, Kiul, Kosi, Mahananda, Ken and Ghagra. The Ganga basin covers 11 States i.e. Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal.

Environmental and Social Analysis (ESA) and Management Framework (ESMF)

24. All potential projects and sub-projects planned under the NGRBP/Namami Gange programme may

have environmental and social impacts. Therefore, the purpose of developing the Environmental and Social Management Framework (ESMF) was to facilitate the management of environmental and social issues of all investment projects proposed by the NGRBA/Namami Gange at the very beginning of project planning and implementation. The ESMF currently addresses the broader portfolio of projects[1] to be implemented under the Namami Gange along with its implementation methods like Hybrid Annuity Mode (HAM), DBOT etc. As specific project identification will operate as a demand-driven process and also depends on many other factors like polluted river stretch etc., a single ESMF common to the NMCG, SMCG and all other project implementing agencies is required so that project specific ESIA and ESMP or ESDDRs are prepared based upon a common guideline. In this line the ESMF was updated depicting all the various process of project implementation and revised land acquisition details in August 2017. This version of the ESMF is now being updated considering the inclusion of tributaries; a basic profile of such tributaries is already presented in **Annex-I**.

Objectives of ESMF:

25. The ESMF for Namami Gange project[2] has following objectives:

- Determine key social and environmental issues associated with River Ganga and possible activities that could be initiated by NGRBA, both at national as well as state level;
- Conduct an environmental and social impact assessment of the investments proposed to be supported by the project, identify potential environmental and social impacts associated with such investments and recommend measures to mitigate impacts;
- Carry out an analysis of various stakeholders associated with the project, identify their concerns with regard to environmental and social aspects, and recommend measures to mainstream these aspects into the project;
- Develop an Environmental and Social Management Plan (ESMP) for the project, to ensure that environmental and social issues are effectively addressed in project design and implementation.

Laws and Regulatory Framework

Relevant National key Legislations
• *Environment Protection Act, 1986*
• *Environmental Impact Assessment (EIA)Notification 14th Sep' 2006*
• *Air (Prevention and Control of Pollution) Act, 1981*
• *Water Prevention and Control of Pollution Act, 1974*
• *The Noise Pollution (Regulation and Control) Rules, 2000*
• *The Wildlife (Protection) Act, 1972 and Its Amendments*
• *The Forest (Conservation) Act, 1980*
• *Solid Waste Management Rules, 2016*
• *Construction and Demolition Waste Management Rules, 2016*
• *Coastal Regulation Zone(CRZ) Notification 2011 & amendments after*
• *The Ancient Monuments and Archaeological Sites and Remains Act , 1958*
• *Disaster Management Act, 2005*
• *The National Green Tribunal Act, 2010*
• *Public Liability and Insurance Act, 1991*
• *Explosive Act, 1984*
• *Minor Mineral and concession Rules*

[1]Portfolio of projects are discussed in detail in Chapter V

[2] 'Project' comprises all the sub-projects sanctioned under Namami Gange

- *The Motor Vehicles (Amendment) Act, 2019*
- *National Forest Policy, 1988*
- *The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996*
- *Hazardous Wastes (Management and Handling) Rules, 1989 (the Rules govern handling, movement and disposal of hazardous waste);*
- *Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, amended 1994 and 2000 (the Rules provide indicative criteria for hazardous chemicals and require occupiers to identify major accident hazards and prepare on-site and off-site emergency plans).*
- *Right to fair compensation and transparency in land acquisition, rehabilitation and Resettlement Act 2013*

Applicable World Bank Policies

- *Environmental Assessment (OP 4.01)- Umbrella Policy applicable for all infrastructural projects- Applicable in all Investment*
- *Natural Habitats (OP 4.04)- to protect natural habitat including forest & wildlife areas- Applicable where Forest and Wild Life are impacted due to project*
- *Forestry (OP 4.36) – to protect the health and quality of forest, welfare and right of people dependent on forest resource and utilization of natural forests or plantations. - Applicable where Forest land are impacted due to project*
- *Involuntary Resettlement (4.12)- to avoid minimize involuntary resettlement where feasible- Applicable in case of Private land Acquisition*
- *International Waterways (OP 7.50) - Since Ganga River and its tributaries are considered international waterways. Therefore, the policy has been triggered.*
- *Physical Cultural Resources (OP 4.11) - Considering the presence of number of historic and heritage structure in the project area and cultural significance of the Ganga River, this policy has been triggered.*

Environmental and Social Baseline

26. The Ganga basin encompasses an area of more than a million square kilometers (1,086,000 sq.km.) spread over four countries: India, Nepal, Bangladesh and China. With 861,404 sq.km. within India itself, the Ganga basin is the largest river basin in India and covers approximately 26.3 per cent of India's total geographical area. The Ganga flows through the states of Uttarakhand, Uttar Pradesh, Bihar, Delhi, Haryana, Himachal Pradesh, Madhya Pradesh, Jharkhand and West Bengal. The Ganga rises in the Garhwal Himalaya (30^{o} 55'N, 79^{o}7'E) as the Bhagirathi. Throughout the course of the Ganga, from its source at Gaumukh to its mouth at Sagar Island in Bay of Bengal, it is a common practice for Indians to take daily dip in the holy waters of the Ganga, especially at places of pilgrimage like Rishikesh, Haridwar, Garhmukteshwar, Kannauj, Prayagraj (formerly known as Allahabad), Mirzapur and Varanasi.

27. Based on stream characteristics, the entire 2,525 km course of the Ganga can be divided into the following major five sections: (i) mountainous, (ii) upper plain, (iii) middle plain, (iv) deltaic non-tidal and (v) deltaic tidal plain. In term of physiography, the Ganga basin falls entirely in three major i.e. 1) Northern Mountains, (2) Great Plains (3) Central Highlands regions of India. Major soil type of the Ganga Basin is alluvial soil 52% followed by red soil (11%). Climatically, the tropical and subtropical temperature zones are most predominant in the entire Ganga basin. May is the hottest month in most part of the basin, while January is coldest. The weather in the Ganga basin is characterized by a distinct wet season during the period of south west monsoon (June to September). The Ganga basin, by virtue of its alluvial makeup, is endowed with vast resources of ground water. The mean annual replenishable groundwater in India as a whole has been assessed at 446.87 billion cumec per year, of which about 219.09 billion cumec per year (49%) lies in the states of the Ganga basin. Land use of the Ganga basin is extensively cultivated,

constituting approximately more than 45 per cent of the total area of the India. With respect to forest cover, Ganga basin has 17.53% of forest cover to its total geographical region; this is comparatively lesser than country level (21%). This may be due to having major area occupied under Agriculture.

28. The detailed baseline profile of other tributaries is presented in **Annex-I**. Increasing population, urbanization, industrialization, and the use of agricultural chemicals continue to pose a significant threat to water quality in the Ganga basin today. The number of cities and towns in the Ganga basin has increased from 1873 in 1991 to 1949 in 2001, while the urban population has increased from 88 million in 1991 to 128 million in 2001. As per census 2011, total 324 class I and class II cities are located in Ganga Basin.

29. The Ganga basin evidently demands treatment of sewage and minimum ecological flow for its survival as a river. Since a river is a living eco-system and therefore ultimate goal should be to protect the functioning of the river eco-system.

30. The Ganga basin is one of the most densely populated and fertile river basins in the world. The basin supports about 600 million people over an area of approximately 860,000 sq. km of which some 100 million are directly dependent on the river and its tributaries.

31. For Ganga stem cities/town, projects have been taken up to create 3308 MLD sewage treatment capacity against the generation of 2953 MLD (Year 2016). The sewage treatment capacity in Ganga main stem towns have now increased from 1575 MLD (Year Dec 2016) to 1954 MLD (Sept 2019), excluding 410 MLD sewage treatment through East Kolkata Wetland.

Identification of potential Environmental and Social Impacts and Mitigation Measures

32. Since the Project proposed under Namami Gange Scheme are pollution abatement project of River Basin. Although few negative impact may also be encountered due to having project proposal on a fresh land, located in busy city limit and catering city' sanitation etc. Potential Impact and Mitigation measures applicable for Namami Gange project has been detailed in **Appendix I** of the ESMF Guideline. However, major impact with respect to Environment and Social is presented below:

Type of Project	Potential major Impact
Sewerage Scheme	• surface and groundwater contamination due to leakage and/or improper joints in sewers • severance of utilities and requirement for relocation due to sewer laying • disruption due to local traffic diversion and congestion during sewer laying works • impact on public/private properties and other sensitive receptors along the sewer alignment during construction • disposal of excess excavated soil and construction debris • Exploitation of water sources for meeting construction water demand. • air and noise pollution from construction equipment's • Health and safety concerns of workers, while laying or rehabilitating existing sewers.
Sewage Treatment Plants	• change in land use pattern, in case of proposed sewage treatment plants at new locations • change in channel hydraulics, triggering erosion and siltation problems, if sewage treatment plants are proposed in flood plains • change in hydrology and drainage patterns due to the construction activity, particularly, if sewage treatment facility is located in flood plains • Health and safety issues associated with operation and maintenance of sewage

Type of Project	Potential major Impact
	treatment facility, particularly exposure to methane and other noxious gases, sludge contaminated with heavy metals etc. • issues associated with the disposal of sludge, if sewage is likely to be contaminated with heavy metals due to mix of industrial waste with sewage • Emission of methane, if not utilized for power generation or any other gainful applications. • water logging problems due to improper/ inadequate disposal of treated effluent or effluent not conforming to stipulated discharge standards during operation • Sludge from a waste treatment plant may constitute a hazardous and nonhazardous waste.
Industrial Pollution Control Initiatives	• Pollution of water resources • Soil contamination due to the disposal of untreated / partially treated effluents and / or hazardous wastes • air quality, odor and fly nuisance due to the improper operation of treatment facilities • health impacts on the neighboring communities • Issues of leachate and loss of productivity to agriculture lands due to the disposal of sludge from the facilities.
Solid Waste Management Investments	• surface and ground water contamination due to unmanaged leachate collection and disposal • change in channel hydraulics, triggering erosion and siltation problems, if solid waste management facility is proposed in flood plains • change in hydrology and drainage pattern, if the facility is located in flood plains • air quality, odor and fly nuisance due to the improper operation of waste disposal or processing facilities • issues pertaining to siting of facility such as change in land use pattern, proximity to settlements, cultural properties and any other sensitive receptors • air and noise pollution from construction equipment's • Health and safety issues associated with operation and maintenance of solid waste treatment facility, particularly of workers manually handling wastes.
River Front Management Investments	• change in land use, and drainage pattern • change in channel hydraulics, triggering \erosion and siltation problems either at in situ or elsewhere along the course of river • impact due to inadequate solid and liquid waste disposal arrangements • impact due to inadequate sanitation, health and safety facilities • impact on river water quality due to proposed amenities • impact on environmental aesthetics and cultural value
Major Social Impact applicable for all kind of project	• Direct purchase of small land parcels for SPS/ Lifting station • Land acquisition / taking for sewerage treatment plant leading to loss of livelihood / displacement of non-titleholders / titleholders • Temporary land taking causing inconvenience to local community • Temporary loss of common grazing area

33. **Mitigation Measure:** Mitigation measure applicable during planning -designing phase, construction phase and operational phase has been presented in **Appendix III A & III B** of ESMF for Sewerage scheme and STP projects. Few insights of major points are described below, which is applicable for all STP, Sewerage and River Front Development projects:

- **Regulatory Compliance:** Obtain necessary approval with respect to project as per regulatory compliance

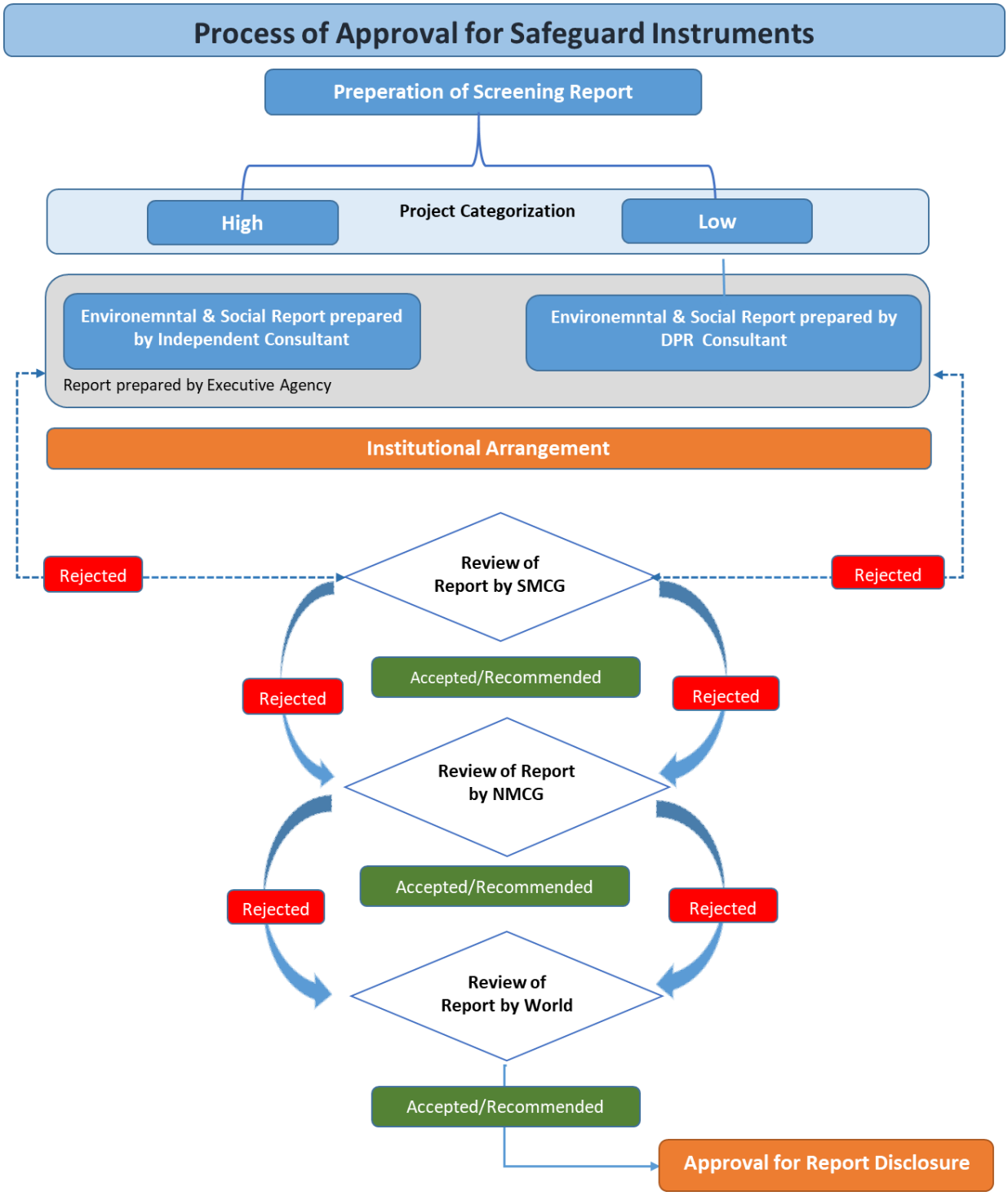
- **Flood Risk Management:** The Design Consultants should design for bypass arrangements, to discharge untreated sewage.
- **Landscape:** Undertake Landscape afforestation in nearby areas this will also to cater the issue of Odor, Noise.
- **Treated Wastewater:** The treated water quality shall comply with the standards laid down by the state pollution control board for disposal onto the land, water body or for irrigation use.
- **Sludge:** Providing adequate and safe sludge disposal facilities, Digested Sludge from a waste treatment plant may constitute a hazardous and nonhazardous waste, therefore periodic testing of Sludge to assess the content of hazardous chemical should be identified (as per CPHEEO manual 2016) before it final disposal at the identified dumping site of MC. Dumping shall be done when the authorized land fill site is not available nearby to project region.
- **Location:** Careful planning and design of STP with adequate buffer zones. Future growth of the surrounding areas shall be considered. Select appropriate location away from sensitive locations such as schools and hospitals other Air, water, Noise, Soil Pollution control measure during construction stage (presented in Sample EMP).
- **Health and Safety:** During construction stage, assurance of safe work environment and incident free execution of the project, health and safety of worker as well as overall project is significant in the Namami Gange projects. As per relevant Factory Act 1948 & The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, concessionaire has to be ensured all related measures reflected in the Site specific ESMP of the projects and will be part of Bid documents.

Procedure for Environmental and Social Management

34. The Environment and Social Management Framework (ESMF) is an integral part of the NGRBA framework document. The ESMF is aligned with the Environment and Social safeguard policies of World Bank and the concerned rules and regulations of Government of India. This would be used as an umbrella guideline by the Namami Gange program (the NMCG and SMCGs) while preparing and/ or appraising, approving and executing the investments.

Environment and Social Assessment for DBOT Projects:

35. As per ESMF guideline each project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts (Screening Checklist), based on outcome of screening analysis, proposed investment shall be categorized as High and Low category. Therefore, as per ESMF, the sub-projects are categorized into (i) High Impact and (ii) Low Impact category, in which, for High Category Project, a detailed Environment and Social Assessment and Management Plan (ESAMP) has been carried out preferably by a separate consultant apart from the DPR consultant. The procedures for implementation of ESMF in these types of projects are summarized in above flow chart. The approved ESAMP will form part of the bidding document. After the award of work the selected contractor may need to update the ESAMP based upon the detailed design of the project and shall prepare a site specific ESAMP.



Environment and Social Assessment for the HAM based PPP Projects:

36. The agreed action for Environment and Social assessment of projects under HAM projects include:

- ESDDR along with Environment and Social Management Action Plan (ESMAP) will be prepared at the DPR stage;
- The ESDDR will cover the basis nature of the projects, a very brief description of the environment and present status along with screening checklist and an analysis of environmental and social issues associated with the project.
- The ESDDR (carried out by the project) will describe the future action plan to be taken during the detailed design stage by the Concessionaire[3] like:

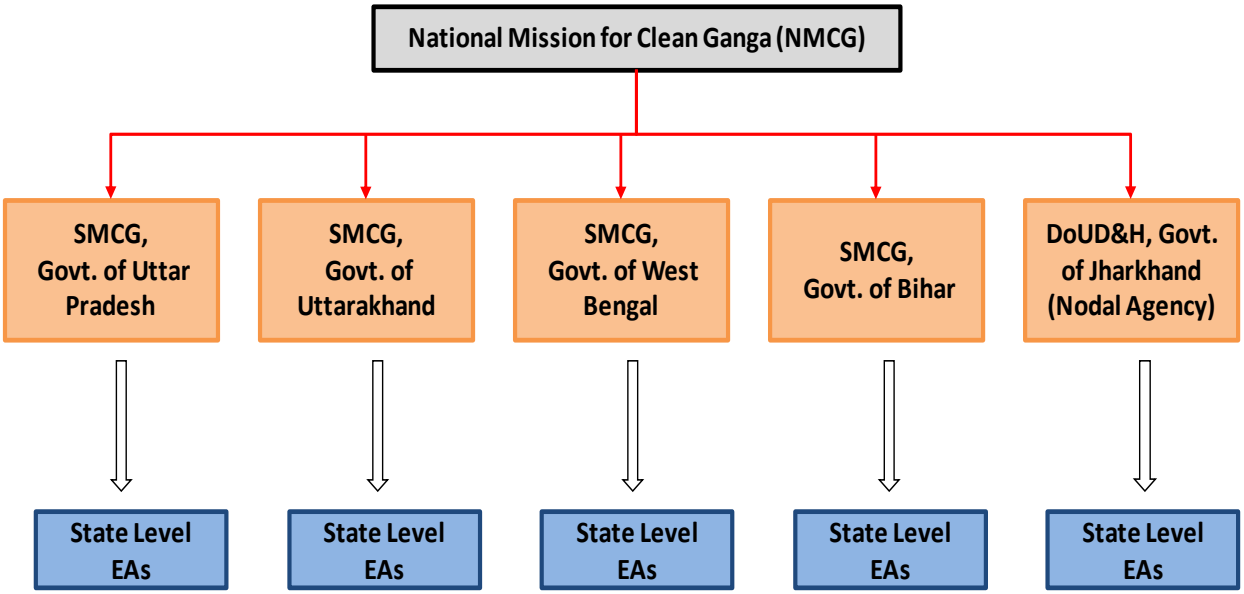
[3] Concessionaire is a company who signs the concession agreement with the owner (NMCG/SMCG/Executive Agency) to complete the investment under Hybrid Annuity Mode (HAM).

- Various regulatory clearances (e.g. environmental clearance, forest clearance, NOC etc. as applicable)
- Preparation of Environmental and Social Assessment (ESA)/EIA
- Resettlement Action Plan (RAP), as applicable
- other actions, and management measures to be implemented by the Concessionaire

37. ESDDR can become part of the bidding document. The public consultation and disclosure process will continue during project implementation. The draft EIA/EMP/RAP etc. for the specific sub-projects will be discussed with the affected communities and the final documents will be placed on the websites of the NMCG and the SMCGs. The copies of the EMP and RAP will also be placed at the offices of the executing agencies, district magistrate and contractor's office. The executive summary of the EIA and RAP will also be translated into local language and placed in the office of the Gram Panchayat of the affected villages.

38. **Project Monitoring and Training:** NMCG, through the respective SMCGs monitors all the approved investments under the Namami Gange program to ensure conformity to the requirements of the ESMF. The training program for SMCG, EA and various relevant stakeholders has been envisaged in ESMF, includes an orientation program on the ESMF, Project Management, Engineering and Public Health. Module has been at **Table 7-3**.

39. The implementation arrangements for the NMCG program are summarized below



40. **Institutional Arrangement** The NMCG, through the respective SMCGs will monitor all the approved investments under the Namami Gange program to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of construction, operation and maintenance. The monitoring will be carried out through the environmental and social safeguard compliance reports that form a part of Quarterly Progress Reports for all investments and regular visits by the environmental and social specialists of the NMCG and SMCGs. In addition to the above, the NMCG will undertake an annual ESMF audit and will review the status of ESMF compliance, as per the sample terms of reference provided in **Appendix VI**. World Bank also make necessary mission visits to the project sites once in six months to check the safeguard measures for ongoing projects as well as projects under operation. During the mission visits necessary compliance monitoring of the previous mission is also checked.

41. At the NMCG as well at the 5 SMCG levels, one officer for Environmental Safeguard and once

officer for Social safeguard are appointed for managing social and environmental issues. These officers assist the EAs in implementation of ESMF provisions. In the EA, an officer each are designated as social and environment officer who are responsible for the implementation of ESMF tasks at the field level with the assistance and participation of the local self-government.

42. Further in each of the sub-project levels, each of the contracting agencies also deploy their own Environment and Health and Safety officer to implement the ESAMP at site.

43. **Present Functionality of Grievance Redress Mechanism:** At NMCG GRM officers are designated to address all queries registered in the NMCG portal. The GRM officer is supported by one social expert who coordinates with all the SMCGs. At SMCG level, reporting of grievances are being monitored by environmental and social experts. The details are mentioned in the report.

1. BACKGROUND

1.1. INTRODUCTION

1. River Ganga has significant economic, environmental, and cultural value in India. Rising in the Himalayas and flowing into the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of north and eastern India. The Ganga basin (which also extends into parts of Nepal, China and Bangladesh) accounts for about 26 percent of India's landmass, 30 percent of its water resources, and more than 40 percent of its population. Ganga is India's holiest river and has a cultural and spiritual significance that far transcends the boundaries of the basin.

2. Increasing population in the basin and haphazard urbanization and industrial growth has significantly impacted the water quality of River Ganga, particularly during the dry season. The primary sources of pollution are untreated sewage and industrial wastewater. Non-point pollution sources from agriculture and livestock, religious activities at various locations along the river, as well as poor solid waste management, also contributes to pollution. In addition, substantial abstraction of water, primarily for irrigation, has led to low flows and associated poor water quality in the critical middle stretch of the river.

3. The previous attempt to clean the river, such as Ganga Action Plan (GAP) launched in 1985 have provided some gains in arresting rate of water quality degradation, but lot more needs to be done.

4. Lessons from earlier experience indicate that improving water quality in the Ganga cannot be achieved by plugging the infrastructure gap alone. Any effective initiative will have to adopt a three-pronged approach by (i) establishing a basin-level multi- sectoral strategy for addressing pollution in the river (ii) making relevant institutions operational and effective and (iii) implementing a phased program for Ganga clean-up.

5. As a major first step in this direction, the Government of India (GoI) has established the National Ganga River Basin Authority (NGRBA) in 2009 and National Council for River Ganga (Rejuvenation, Protection and Management) in 2016, as an Authority has been created for comprehensive management of the river. The Namami Gange Programme will adopt a river-basin approach and has been given a multi-sectoral mandate to address both water quantity and quality aspects. The Namami Gange Program has resolved that by year 2020 no untreated municipal sewage or industrial effluent will be discharged into River Ganga. National Ganga River Basin Project (NGRBP) started in 2011 is funded by World Bank has now been included as a part of Namami Gange Programme.

1.2. OBJECTIVE

6. The Namami Gange program will finance infrastructure investments to reduce pollution loads at priority locations on the river. The investments are intended to exemplify, among other attributes, the high standards of technical preparation and implementation, sustainability of operations, and public participation. Most investments in the Namami Gange program are expected to be in the wastewater sector, particularly in wastewater treatment plants and sewerage networks. Investments will also be supported in industrial pollution control and prevention (e.g. common effluent treatment plants), solid waste management (e.g. collection, transport and disposal systems), and river front management (e.g.

improvement of the built environment along river stretches, improvement of small ghats and electric crematoria, and the conservation and preservation of ecologically sensitive sites). Many investments are likely to combine elements of more than one of these sectors.

7. An investment framework has been finalized for selection of program investments. The objectives of this investment framework are to:

a) Provide a filter for all the Namami Gange investments for ensuring that the selected investments are well-prepared and amongst the most effective in reducing the pollution loads;

b) make transparent the decision-making process on investments selection;

c) Ensure that the investments are implemented in a sustainable manner; and

d) Investment projects needs to ensure compliance with National and local Environmental and Social legislation/regulation, World Bank safeguards policies as well as EHS guidelines (wherever applicable).

1.3. THE ESMF

8. The **Annex-I** covers River Ganga and some of the major and minor tributaries which are spread across the eleven Ganga basin States/UT of Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal. The tributaries of Ganga covered in ESMF are Ramganga, Kali, Yamuna (downstream of Delhi), Hindon, Gomti, Betwa, Chambal, Parbati, Kshipra, Sind, Tons, Son, Damodar, Ajay, Burhi Gandak, Kiul, Kosi, Mahananda, Ken and Ghagra.

9. The Aravalli ranges have been designated as Natural Conservation Zone in the Plan in accordance with Regional Plan-2021. For protection of Aravallis, the notification of the MoEF, Government of India dated 07.05.1992, shall be applicable. Similarly, for execution of any project, the project proponent will have to obtain environmental clearance in terms of notification dated 14.09.2006, which is mandatory in nature. Similarly, the restrictions applicable to the Eco-Sensitive Zone notified by MoEF or for protection of environment shall also be followed and implemented.

10. Few of the tributaries of Yamuna (Chambal, Sahibi) which have influence of Aravalli region in the state of Rajasthan and Haryana are Eco sensitive area. In order to protect the area falling under Aravalli Range and restrict activities which are likely to cause environmental degradation, MOEF &CC has issued a notification dated 7th May, 1992, and prohibit tree cutting, mining and new development activities like Construction of any clusters of dwelling units, farms houses, sheds, community centers, information centers, Transmission line etc. Punjab land preservation Act 1900 is applicable in these zones, so in case of involvement of any project interventions such as (establishment of STP, CETP, and Landfill site) prior approval from MOEF &CC shall be required along with preparation of EIA, EMP according to respective guideline.

11. The Ganga 1 projects were mostly on the main-stem of river Ganga which covered the 5 basin States i.e. Bihar, Jharkhand, Uttar Pradesh, West Bengal and Uttarakhand. The Ganga 2 projects are in continuation to the Ganga 1 projects and sub-project which are similar in nature. The focus of NMCG has now Included Ganga main-stem to the polluted stretches of the tributaries of river Ganga. Thus, the need was felt for updating the ESMF to showcase the inclusion of the tributaries, projects and sub-projects with respect to Ganga 1 and Ganga 2. Ganga 2 is the continuation of Ganga 1. The projects in Ganga 2 have been taken up on the tributaries of river Ganga especially the Kali, Ramganga, Hindon, and Yamuna (downstream of Delhi). Further, the updation of the ESMF has also provided an opportunity to update the report based

on the latest information w.r.t. identified thrust areas and action points; key achievements; funding mechanism; brief on Namami Gange programme, NMCG Authority and Ministry of Jal Shakti; Vision & objectives of NMCG; Policy making Apex Council, State Ganga Committees; State River Conservation Authorities; census data; water quality monitoring data; water supply; waste water and sewage generation data.

12. Under Ganga-1 (funded by World Bank), 35 sewerage and STP schemes are expected to be completed by December 2021 with installed STP capacity of 620 MLD and laying of 3035km of sewerage network. In these installed STP capacity by December 2021, nearly 424 MLD of sewage is expected to be treated and with this 25,032 Metric tonnes of BOD is expected to stop in getting discharged to river Ganga annually. Further, with completion of Patna River Front project (90% work is completed and opened to public) a good public place has been created to the people of Patna and has become a showcase for spreading awareness for river rejuvenation and proactive measures for disposal of solid waste in the river bank areas. The crematoria developed under Patna river front has enormously helped in reducing the burden of waste disposal associated with the cremation activities.

13. Additionally, the Ganga-1 has helped to developed the institutional mechanism in Namami Gange projects to spread the programme to the district level by formation of NMCG, SMCGs (in UK, UP, Bihar, Jhakhand and West Bengal), State Ganga Committee and District Ganga Committee for suitable implementation and monitoring of projects. All these projects are generally supported with 15 years of Operation and Maintenance which is a paradigm shift in project formation as compared with previous Ganga cleaning programme. Further people's participation has been increased manifold for the success of the programme by organizing various state and national level programmes like "Swachhata Pakhwara" (15 days long programme to clean the banks along river between 15-30th March every year), Swachta Hi Sewa, Vraksharopan , Ganga Utsav, Rafting Expedition , Ganga Yatra etc.

14. For the 1st time, projects are packages in the forms of Hybrid annuity and PPP mode in the sewerage sector projects in India under the Ganga-1 (under Namami Gange) which ensures performance-based payment plan to enhance the performance of the STPs to meet the desired effluent criteria.

15. With the addition of tributaries under Ganga 2, baseline section of the ESMF was updated to reflect the baseline status of expanded project boundary. The Technical Assistance programme of Ganga 1 supported a comprehensive and multidisciplinary Strategic Social and Environmental Assessment (SESA). The SESA was completed in March 2020 and recommendations given will be suitably integrated in the various activities of Ganga 2. An annual E&S Audit of the all the sub projects has been undertaken for the last two years. The Audit results shows compliance with the project ESMF.

16. Since the roll-out of the HAM in 2016, 7 HAM projects have been awarded and 10 more are at different stages of preparation and bidding. A market study was carried out as part of the Ganga 2 preparation to capture the emerging lessons from the HAM contracting mode.

17. Given the distributed nature of investments in multiple states, the investments under the program may entail environmental and social impacts. The environment and social frameworks intended to help manage the social and environmental impacts through appropriate measures during the planning, design, construction and operation phases of various investments. The framework will identify the adverse environment and social impacts and provide specific guidance on the policies and procedures to be followed for environmental and social assessment along with roles and responsibilities of the implementing agencies.

18. The projects taken up by NMCG are taken up either on DBOT or on Hybrid Annuity based PPP mode (HAM). The projects of NMCG will be developed by a private sector entity selected through PPP concept under annuity or Hybrid annuity or any other contractual arrangement between the public entity and a private company. Under this model, Environment and Social Due Diligence Report (ESDDR) and Environment and Social Management Action Plan (ESMAP) will be prepared at the DPR stage. The ESDDR would cover the brief description of the environment, current status with screening checklist and analysis of both social and environmental project related issues and ESMAP would include the action plan to be taken during the design stage.

19. The document essentially comprises the following key sections:

- A brief summary of key probable Environmental and Social Impacts
- Environment and Social Regulatory Framework applicable for the program
- Environment Management Framework
- Social Management Framework
- Project Appraisal, Monitoring and Reporting Arrangements
- Institutional Arrangements
- Training and Capacity Building for ESMF

2. PROGRAMMES AND INSTITUTIONAL FRAMEWORK

2.1. BACKGROUND

20. In order to achieve the objective of 'Clean Ganga by 2020', NGRBA provides financial assistance for implementation of river pollution abatement/mitigation projects in Ganga basin states. The first phase of such initiative is supported by The World Bank, in the states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. In addition to complying with various technical and performance standards, the projects to be supported under this program shall comply with the Environmental and Social Management Framework, as detailed out in the earlier sections. The implementation, monitoring and reporting arrangements for the ESMF have been worked out within the overall institutional structure for implementation of the NGRBA program, as described in the sections below.

2.2. NGRBA

21. The Government of India (GoI) constituted the National Ganga River Basin Authority (NGRBA), on 20th February 2009, for comprehensive management of the Ganga River under section 3(3) of the Environment Protection Act, 1986. Under the same Act, the eleven NGRBA program states have notified the State River Conservation Authorities (SRCAs) thereby defining the apex policy and decision-making structure at the state level. The Union Ministry of Environment and Forests (MoEF) was the nodal agency for the NGRBA program and will have the lead responsibility for project implementation and ensuring that the project development objectives are met. Similarly, at the state level, the SRCA nodal departments will have the responsibility for project implementation in the respective states. As a major first step in this direction, the Government of India (GoI) has established the National Ganga River Basin Authority (NGRBA) in 2009 and in 2016 National Council for River Ganga (Rejuvenation, Protection and Management), as an Authority has been created for comprehensive management of the river. The Namami Gange Programme will adopt a river-basin approach and has been given a multi- sectoral mandate to address both water quantity and quality aspects.

2.3. NAMAMI GANGE PROGRAMME

22. Government of India launched "Namami Gange" an Integrated Conservative Mission programme on 13th July 2015. The Namami Gange programme is an umbrella programme which covers the previously sanctioned ongoing projects as well as the projects in new components with multi sector mandate to address both water quality and water quantity issues. The programme aims at integrating previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive and better coordinated interventions. The programme structure attempts to bring all stakeholders on one platform to take a holistic approach towards the task of Ganga cleaning and rejuvenation. Namami Gange Programme has been segregated into two different components:

Component 1 Institutional Development	:	This component will support to the national, state and municipal governments to strengthen implementation and financing arrangements and develop a framework to improve Ganga river basin management.
Component 2 Infrastructure Development	:	Pertains to the initiatives to be undertaken in 5 major sectors i.e. Infrastructure Development (Sewage Treatment, River Front Development, and Industrial Wastewater Treatment & Solid Waste Management), Institutional Development, Ecological Sustainability, Research & Development and Communication & Public Outreach.
Component 3 Program Communication and Management	:	NMCG conducts a range of vibrant communication activities ranging from ground-level community engagement exercises, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign

23. In addition to the physical resource value, the socio-cultural significance of Ganga River is also enormous. Despite this iconic status and religious heritage, the Ganga today is facing formidable pollution pressures, along with the attendant threats to its biodiversity and environmental sustainability. The absence of adequate infrastructure, along with weak environmental governance and little technical expertise to manage these extreme pollution pressures, has resulted in the rapid deterioration of the water's quality in recent decades. At the same time, the River is extremely polluted, and many studies point to its high level of environmental depletion. The World Bank recognizes that the pollution in River Ganga is primarily a result of inadequate infrastructure, the weak capacity of local water and wastewater utilities in the basin, and the poor state of environmental monitoring and regulation. It is further attributed to factors such as (i) inadequacy of municipal wastewater infrastructure and services, (ii) industrial pollution, (iii) solid waste and non-point sources, and (iv) inadequate in-stream flows.

24. The major development in the evolution of NMCG was launch of Namami Gange Programme on 13th May 2015 with the approval of Cabinet as a Central Sector Scheme (100% central assistance), with components including all objectives of NGRBA. Rs 20,000 crore non-lapsable funds were earmarked for five-year period, 2015-2020.

2.4. NMCG AUTHORITY

25. NMCG has been constituted as authorities at Central, State and District levels vide Notification no. Estt-01/2016-17/111/NMCG dated 7th October 2016 under the provisions of EP Act, 1986, to take measures for prevention, control and abatement of environmental pollution in River Ganga and to ensure continuous adequate flow of water so as to rejuvenate the River Ganga to its natural and pristine condition and for matters connected therewith. As per the above notification, NMCG is to be constituted as National Council for Rejuvenation, Protection and Management of River Ganga. Accordingly, State Ganga Rejuvenation, Protection and Management Committee and District Ganga Protection Committee has been constituted in the 9 States (Uttarakhand, Uttar Pradesh, Jharkhand, Bihar, West Bengal, Chhattisgarh, Himachal Pradesh Madhya Pradesh and Rajasthan) and its districts.

2.5. THE MINISTRY OF JAL SHAKTI (DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA REJUVENATION)

26. Ministry of Jal Shakti is a ministry under Government of India which was formed in May 2019

with a vision of "Optimal sustainable development, maintenance of quality and efficient use of water resources to match with the growing demands on this precious natural resource of the country". This ministry was formed by merging of two ministries; Ministry of Water Resources, River Development & Ganga Rejuvenation and Ministry of Drinking Water and Sanitation.

27. The ministry has been incorporated with an aim to clean the river Ganges. They would also be engaged in coordination, mediation and facilitation in regard to the resolution of differences or disputes relating to Inter-State Rivers and in some instances overseeing of implementation of inter-state projects and negotiate talks with neighboring countries, with regard to river waters, water resources development projects and the operation of the Indus Water Treaty. The ministry has also launched its special campaigns on social media so that citizens of the country become aware of water conservation.

28. The Minister of Jal Shakti is the head of this ministry and is one of the cabinet ministers of the Government of India.

2.6. NMCG: VISION

29. The vision for Ganga Rejuvenation constitutes restoring the wholesomeness of the river defined in terms of ensuring "Aviral Dhara" (Continuous Flow), "Nirmal Dhara" (Unpolluted Flow), geologic and ecological integrity. There are 7 identified thrust areas and 21 action points for the rejuvenation of Ganga and its tributaries. These thrust areas and action points are as under:

Table 2-1: Thrust Areas and Action Points

Thrust Areas	Action Points
1. Aviral Dhara	1. Determine and maintain environmental flow
2. Nirmal Dhara	2. Upgrade existing Sewage Treatment Plants 3. Creating additional treatment capacity 4. Industrial pollution abatement 5. Development of 'Ganga Grams' 6. Managing agricultural run-off 7. Development of model dhobi ghats 8. Creating model cremation ghats
3. River Front Development	9. River Front Development 10. Public amenities in selected towns 11. Ganga Task Force
4. Capacity Building	12. Support for DPR preparation 13. Capacity Building
5. Research and Monitoring	14. GIS and Spatial Planning 15. Research projects 16. National Ganga Monitoring Centre 17. Ganga knowledge centre and Ganga institute of river sciences
6. Protection of aquatic flora and fauna	18. Afforestation drive of medicinal plants and native tree species 19. Conserving diversity of Gangetic aquatic life
7. Awareness Creation	20. Ganga vichar manch, Ganga prahari, Ganga mitra 21. Communication and Public Outreach Activities

2.7. NMCG: OBJECTIVES

30. The Namami Gange program will finance infrastructure investments to reduce pollution loads at priority locations on the river. The investments are intended to exemplify, among other attributes, the high standards of technical preparation and implementation, sustainability of operations, and public participation. Most investments in the Namami Gange program are expected to be in the wastewater

sector, particularly in wastewater treatment plants and sewerage networks. Investments will also be supported in industrial pollution control and prevention (e.g. common effluent treatment plants), solid waste management (e.g. collection, transport and disposal systems), and river front management (e.g. improvement of the built environment along river stretches, improvement of small *ghats* and electric crematoria, and the conservation and preservation of ecologically sensitive sites). Many investments are likely to combine elements of more than one of these sectors.

31. An investment framework has been finalized for selection of program investments. The objectives of this investment's framework are to:

- provide a filter for all the Namami Gange investments, for ensuring that the selected investments are well-prepared and amongst the most effective in reducing the pollution loads;
- make transparent the decision-making process on investments selection; and
- Ensure that the investments are implemented in a sustainable manner.
- Investment projects needs to ensure compliance with National and local Environmental and Social legislation/regulation as well as World Bank safeguards policies (wherever applicable).

2.8. IMPLEMENTATION APPROACH

32. Recognizing that the investments under the previous river conservation programmes have not yielded commensurate results, a number of measures will be taken up under Namami Gange Programme to improve implementation and achieve better outcomes. These include;

- Tripartite Memorandum of Agreement between the Centre, the States and the Urban Local Bodies;
- Innovative approaches including decentralized treatment systems, in-situ treatment, etc.;
- Strong focus on technology and involvement of research institutions;
- An expanded, transparent and participatory water quality monitoring programme;
- Concurrent, third party evaluation; and
- Community mobilization;
- Citizen monitoring committees; and
- Special Purpose Vehicles for implementation, wherever feasible.

2.9. NAMAMI GANGE: INSTITUTIONAL STRUCTURE

33. As nodal Ministry for the Namami Gange program, the Ministry of Jal Shakti is the primary implementing agency for the project at the national level. The NMCG has a detailed implementation structure, supported by the GoI. A number of committees will provide technical and administrative support, and are as follows:

- Policy making Apex Council headed by the Prime Minister;
- Standing Committee under Finance Minister to regularly oversee implementation;
- Empowered Steering Committee to facilitate coordination with the Central and the State Government departments, and prioritize and sanction projects on a fast track basis;
- A Mission Director with a core team of professionals to be responsible for implementing the work programme of the Authority and to perform its day-today operations;
- State River Conservation Authorities under the Chief Ministers to coordinate and implement river conservation activities at the state level; and
- Implementation of projects through the states and urban local bodies. Special Purpose Vehicles (SPVs) will be set up wherever feasible.

Policy making Apex Council

Name of the Council: - National Ganga Council
Headquarter of the Council: - New Delhi

Table 2-2: Composition of the Council

(a)	Prime Minister	ex-officio Chairperson
(b)	Union Minister for Jal Shakti	ex-officio Vice Chairperson
(c)	Union Minister for Environment, Forests and Climate Change	ex-officio Member
(d)	Union Minister for Finance	ex-officio Member
(e)	Union Minister for Housing and Urban Affairs	ex-officio Member
(f)	Union Minister for Power	ex-officio Member
(g)	Union Minister for Science and Technology	ex-officio Member
(h)	Union Minister for Rural Development	ex-officio Member
(i)	Union Minister for Shipping	ex-officio Member
(j)	Union Minister of State for Tourism	ex-officio Member
(k)	Vice Chairman, NITI Aayog	ex-officio Member
(l)	Chief Minister, Bihar	ex-officio Member
(m)	Chief Minister, Jharkhand	ex-officio Member
(n)	Chief Minister, Uttarakhand	ex-officio Member
(o)	Chief Minister, Uttar Pradesh	ex-officio Member
(p)	Chief Minister, West Bengal	ex-officio Member
(q)	Secretary, Department of Water Resources, River Development and Ganga Rejuvenation	ex-officio Member
(r)	Secretary, Department of Drinking Water & Sanitation	ex-officio Member
(s)	Secretary, Ministry of Housing and Urban Affairs	ex-officio Member
t)	Secretary, Department of Agriculture and Farmers' Welfare	ex-officio Member
(u)	Director General, National Mission for Clean Ganga	ex-officio Member Secretary

Source: River Ganga (Rejuvenation, Protection and Management) Authorities (Second Amendment) Order, 2019

2.10. IMPLEMENTATION MODALITY UNDER NAMAMI GANGE

2.10.1. National Level

34. Based on extensive consultations with the stakeholders, an improved institutional structure was planned for effective and expeditious decision making and implementation of NMCG's mandate. At both central and state levels, dedicated entities were constituted to lead the implementation of the NMCG program on full time basis. NMCG acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA), 1986. NGRBA has since been dissolved and consequent to the constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) vide notification no. S.O. 3187(E) Dt. 7th October 2016 under EPA 1986. The states have similarly set up State Mission for Clean Ganga (SMCG) in the form of registered societies, to ensure effective implementation at state level. SMCGs have been constituted in Uttar Pradesh, Uttarakhand, Bihar and West Bengal. In Jharkhand, a dedicated Nodal Cell within the Department of Urban Development was set up. At the local level, specific Executing Agencies (EAs) are selected for implementation of various activities, including infrastructure investments under the Namami Gange program.

35. These implementing agencies are responsible for managing the World Bank-supported project and achievement of its PDOs; coordinating project activities on a full-time basis and directly executing some of the relevant project sub-components.

36. The Act envisages five tier structure at national, state and district level to take measures for prevention, control and abatement of environmental pollution in river Ganga and to ensure continuous adequate flow of water so as to rejuvenate the river Ganga as below:

(i). National Ganga Council under chairmanship of Hon'ble Prime Minister of India.

(ii). Empowered Task Force (ETF) on river Ganga under chairmanship of Hon'ble Union Minister of Water Resources, River Development and Ganga Rejuvenation,

(iii). National Mission for Clean Ganga (NMCG),

(iv). State Ganga Committees, and

(v). District Ganga Committees in every specified district abutting river Ganga and its tributaries in the states

37. NMCG aims to accomplish the two mandates i.e., (i) to ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral coordination for comprehensive planning and management and (ii) to maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

38. The main functions of NMCG include the following:

(i) Implement the work programme of Namami Gange

(ii) Implement the World Bank supported National Ganga River Basin Project.

(iii) Coordinate and oversee the implementation of projects sanctioned by Government of India under Namami Gange.

(iv) Undertake any additional work or functions as may be assigned by DoWR, RD &GJ, Ministry of Jalshaktiin the area of conservation of river Ganga.

(v) Make rules and regulations for the conduct of the affairs of the NMCG and add or amend, vary or rescind them from time to time.

(vi) Accept or to provide any grant of money, loan securities or property of any kind and to undertake and accept the management of any endowment trust, fund or donation not inconsistent with the objectives of NMCG.

(vii) Take all such action and to enter all such actions as may appear necessary or incidental for the achievements of the objectives of Namami Gange.

2.10.2. State Ganga Committees

39. State-level committees for Clean Ganga Project were set up in the States of Uttarakhand, Uttar Pradesh, Jharkhand and Bihar in 2017. The main objective of these committees is to streamline the work and fund along with execution on ground. Each State-level Committee is headed by The Chief Secretary (State Government) who acts as the ex-officio Chairperson. The ex-officio members of the committee include Principal Secretaries of the Departments of Finance, Urban Development, Environment & Forests, Irrigation and Drinking Water of the respective state governments. Principal Chief Conservator of Forests

(State Government) and Program Director of State Mission for Clean Ganga are also ex-officio members of the Committee. In addition to the ex-officio chairperson and ex-officio members, there are 4-5 nominated members in each State Ganga Committee who are distinguished personalities from renowned organizations. The Nominated Members of these committees hold office for a term of two years from the date of publication of the order.

40. The State Ganga Committee of Uttarakhand and Jharkhand comprises of 14 members each whereas, State Ganga Committee of Uttar Pradesh comprises of 16 members and the State Ganga Committee of Bihar comprises of 15 members. Further details are represented in **Appendix IV**.

41. The implementation arrangements for the NMCG program are summarized in Figure 2-1 .

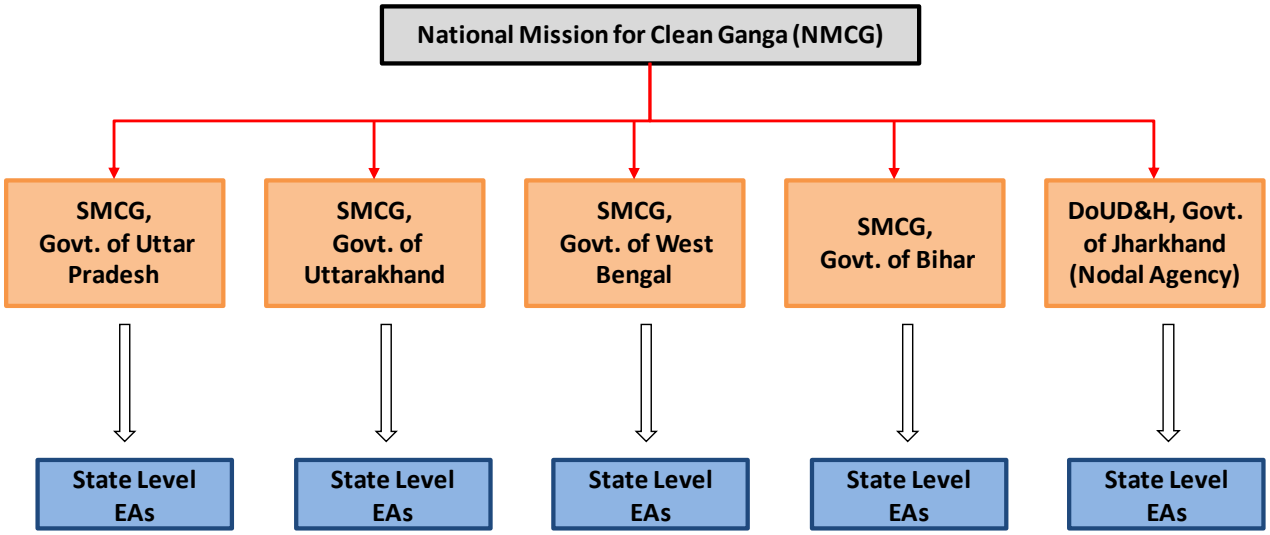


Figure 2-1: Implementation Arrangements for the National Mission for Clean Ganga

2.10.3. District Ganga Committees

42. River Ganga (Rejuvenation, Protection & Management) Authorities has issued an order on 7th October 2016, wherein 'Authorities under the provision of EP Act, 1986 have been constituted at the Center, State and District Level'. A notification related to the constitution of district Ganga Committee were issued 53 districts of five basin states of main stem of River Ganga. The Authority order includes in detail: (i) Constitution of District Ganga Protection Committee (Para 53); (ii) Function and power of District Ganga Committee (Para 55); (iii) Nomination of Nodal Officer (Para 56); (iv) Preparation of plans by District Ganga Committee for Protection of River Ganga and Tributaries (Para 57); and (v) Preparation of Budget and maintenance of Account of District Ganga Committee (para 58)

2.10.4. Implementation Process

43. NMCG and the state nodal departments have prepared and agreed detailed investment frameworks, implementation process flow (including planning, preparation, appraisal, implementation and monitoring and evaluation), Guidelines for investment preparation, Memoranda of Understanding, and Delineation of Functions and Powers of different implementing entities, which collectively define and form the basis of program implementation and performance monitoring. The main features of these are summarized in the following sections.

2.10.5. Investment Frameworks

44. Investment frameworks have been developed for selecting and implementing infrastructure investments in the four key sectors of intervention under the NMCG program - municipal wastewater, industrial pollution, solid waste management and river front management.

45. The frameworks prescribe criteria and quality assurance standards covering various aspects including eligibility, prioritization, planning, technical preparation, financial and economic analyses, environmental and social management, long term O&M sustainability, community participation, and local institutional capacity. The objective is to ensure that the investments are well-prepared and amongst the most effective in reducing the pollution loads and implemented in a manner that makes them sustainable.

46. Given the long-term nature of the Namami Gange program and the fact that universe of potential investments is large, the adoption of the framework approach effectively sets the “rules of the game” and will allow infrastructure investments to be selected on a dynamic and ongoing basis.

2.10.6. Implementation Process Flow

47. The step-by-step process along with roles and responsibilities of the entities involved in implementation of Namami Gange program have been agreed and documented. The implementation process covers the various aspects including annual planning, investment prioritization, a 2-stage (feasibility and detailed project report) preparation and appraisal process, execution, O&M, eventual assets transfer to local bodies, financial management, procurement, community engagement, social and environmental management, governance and monitoring and evaluation. In addition to the infrastructure investments (under Component 2 of the project), the implementation process has also been agreed for pre-identified activities related to Namami Gange Institutional Development (Component 1 of the project), innovative pilots, communications, and research and knowledge management.

2.10.7. Guidelines for Infrastructure Investments Preparation

48. A two-step process has been agreed for preparation and appraisal of investments, whereby investments would be appraised at both concept and detailed project report stage. Guidelines have been prepared and disseminated for preparation of concept stage and detailed project reports, including requisite contents, methodologies, and standards to be followed.

2.10.8. Model Agreements/MoUs

49. The following instruments were prepared to operationalize the agreed institutional model and implementation arrangements: (i) Tripartite MoU between NMCG, SMCG, and ULB for ensuring formal agreement on roles and responsibilities regarding expenditures (capital and O&M) and ownership of assets; (ii) MoU between SMCG, PEA and ULB for ensuring clarity on roles and responsibilities of various parties regarding execution, O&M, and eventual transfer of investments to local bodies (iii) MoA and by-laws, including functions and powers of the SMCG societies setup by the state governments, and the same for the NMCG.

2.10.9. Powers of Approvals

50. Powers and procedures for technical and administrative approvals of investments, for award of contracts for works/goods and services, and for making payments have all been well defined for each implementing agency and being documented in the FM and procurement manuals. To ensure efficiency in

implementation most of the powers have been delegated to the lowest appropriate levels, adopting the principle of subsidiarity. Most of the implementation related powers are vested with NMCG, SMCG and PEAs for their respective components. The only exceptions are the award of the high cost consultancy and works/goods contracts, which have been defined in the fiduciary manuals.

51. Other important documents guiding project implementation are:

- FM Manual: providing the details of funds flow, accounting, auditing and reporting, and the related control and accountability mechanisms
- Procurement Manual: containing the procurement strategy, methods and procedures to be adopted, along with draft documents to be used for bidding of typical works and goods and procurement of consultant services, along with powers of actors to award these works and consultancies
- Environmental and Social Management Assessment and Framework
- Governance and Accountability Action Plan
- Communication strategy and action plan

2.10.10. Institutional Development and Capacity Building

52. Detail cost implementation plans are being completed for the activities comprising the Institutional Development component of the project (operationalization of NMCG institutions, setting up of Ganga Knowledge Center, upgradation of Ganga Water Quality Monitoring System, Capacity-building of environmental regulators and ULB service providers, etc.).

2.10.11. Post-Implementation Management of Assets Created

53. The frameworks and implementation arrangements require that each DPR includes a detailed plan for operation and maintenance of assets that will be created under the NMCG. These plans must identify the institutional responsibilities as well as funding and other resources that would be required for their long-term sustainable operations. The observations during the implementation period of the program will be addressed by the SMCG and Executive Agencies of the respective basin states.

2.10.12. Monitoring and Reporting Arrangements for the ESMF

54. Within the above overall implementation framework of the NMCG, environmental and social due diligence will be carried out by the relevant agencies at each stage of the project cycle in accordance with the guidance provided in the ESMF.

55. A Social Development Officer and an Environmental Officer will be appointed for managing social and environmental issues (including safeguards issues) at both central level (NMCG) as well as in each of the project states (SMCGs/Nodal Agencies). These officers will assist and advise the Mission Director and interact with the Project Executive Agency (PEA) in implementation of ESMF provisions.

56. In the PEA, an officer will be designated as social and environment officer who will be responsible for the implementation of ESMF tasks at the field level with the assistance and participation of the local self-government. These officers will also have the responsibility of implementing resettlement along with other project components, and for co-ordination among different agencies, such as the local self-government, Revenue Department etc. During implementation, meetings will be organized by the SMCGs inviting all PEAs in the state for providing information on the progress of the project work.

57. Environment and Social Audit / Compliance Monitoring Consultants shall be appointed in each of the project states to regularly monitor the planning, design and construction and will confirm that actions taken at each stage of the sub project cycle are in compliance with agreed procedures and standards.

58. The project cycle for an investment under the N and the interface with the ESMF requirements are summarized hereunder.

2.10.13. Project Screening

59. Upon receipt of request for funding, SMCG will assess the eligibility of the sub-project in line with the agreed framework of the respective sector of the sub-project and the proposed safeguard categorization of the sub-project. Based on the above screening, the PEA would be advised on the appropriate DPR preparation toolkit that needs to be followed for the sub-project and the scope of ESA (for High Category sub-projects) to be carried out. In case of Low Category projects, the generic environmental management measures and the requirements of abbreviated resettlement plan will be agreed at the screening stage.

60. The PEA will prepare a Detailed Project Report (DPR) including GEMP tailored to the specific sub-project (for low category projects). For high category projects, the PEA will undertake preparation of ESA / EMP / RAP as relevant for high category projects in line with the requirements of ESMF. While initiating the ESA studies, the PEA shall interact with the Environmental and Social Specialists in the SMCG and seek guidance in the finalization of scope of work and the conduct of respective studies.

61. On receipt of the ESA reports, the respective specialists will evaluate the completeness of the studies and their compliance with the ESMF. Further actions, if any required, will have to be carried out by the PEA prior to the appraisal of the project.

2.10.14. Project Appraisal

62. During project Appraisal, the NMCG and SMCG will appraise the project preparation leading to the approval of the DPR. The safeguard aspects that will be appraised during the project appraisal will include the following aspects:

- Environmental and social suitability of site
- Adequacy of the ESA as per the ESMF including analysis of alternatives, if relevant
- Compliance with regulatory requirements and clearances
- Comprehensiveness of the EMP/SMP in light of the project specific environmental and social issues
- Integration of environmental and social mitigation measures in to the design, wherever relevant/required
- Arrangements for implementation of EMP/SMP/RAP, including institutional capacity and contractual provisions
- Inclusion of EMP/SMP budgets in the project cost and contract documents
- EMP/SMP monitoring and reporting arrangements
- Need for any legal covenant to address specific environmental risks including regulatory risks, if any
- Risk analysis / allocation
- environment and social enhancements (if any / applicable)

63. The Environment Management Plan (EMP) prepared for the project will form part of the bidding documents, in addition to the references to various acts relating to environment and labor, and the implementation of the same will be monitored by NMCG and SMCG.

2.10.15. Project Approval and Disbursement

64. Prior to the approval of the sub-project, all High Category - projects will be forwarded to the World Bank for clearance after the EMP and SMP has been cleared by the NMCG and SMCGs. The SMCGs will further ensure that all the comments/suggestions of the World Bank for all high category projects are adequately addressed, prior to approval of the DPR. The implementing agencies will also comply with the World Bank's policy on public disclosure.

65. After requisite approvals and concurrence are obtained, SMCG will discuss implementation of environmental and social management measures of the project with the PEA to ensure that these are suitably incorporated into the respective legal /contractual documents, for implementation by the PEA.

66. As far as resettlement issues are concerned, disbursement of entitlements shall be through the NGOs hired for the purpose of implementation of resettlement action plan (RAP). The civil works will be initiated only after the required land has been acquired and declared free from encroachments and other encumbrances and the PIU has the physical possession of the land. Before the start of civil works the compensation has to be disbursed to the landowners. During implementation, consultations with the communities shall be undertaken by the PEA / NGOs for providing information on the progress of the project work.

2.10.16. Monitoring and Reporting

67. The NMCG, through the respective SMCGs will monitor all the approved projects under the NGRBP to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of construction, operation and maintenance. The monitoring will be carried out through the environmental and social safeguard compliance reports that form a part of Quarterly Progress Reports for all projects and regular visits by the environmental and social specialists of the NMCG and SMCGs. In addition to the above, the NMCG will undertake an annual ESMF audit of all sub-projects in implementation and will review the status of ESMF compliance. The audit will include all high category projects and 25% of the low category projects.

68. The NMCG will review these audit reports and identify technical, managerial, policy or regulatory issues with regards to the compliance of the ESA reports. The identified technical issues will be duly incorporated in the subsequent projects. Policy and regulatory issues will be debated internally by the NMCG's internal review committee and the need for appropriate interventions will be determined. These interventions could include appropriate revision of ESMF document or suitable analytical studies to influence policy or programs of the state, if found necessary / warranted.

69. An external evaluation of the RAP implementation prepared under NGRBP will also be undertaken twice during the implementation of the project – mid-term and at the end of the implementation. **Table 2-3** below details out the mitigation measures for each impact type, monitoring measures, responsibility and timeline.

Table 2-3: Mitigation, Monitoring, Responsibility and Timeline for RAP Implementation

S. No.	Impact	Monitoring Measures	Responsible Agency	Timeline
1	Loss of land (agriculture)	Regular internal monitoring by the SDO of PEA and SMCG; third party ESMF audit; and periodic evaluation	PEA, ESMF Auditors; Evaluation consultants	12 months from the start date. Compensation to be paid before the start of civil works.
2	Loss of structure and land (residential and commercial)	Regular internal monitoring by the SDO of PEA and SMCG; third party ESMF audit; and periodic evaluation	PEA, ESMF Auditors; Evaluation consultants	
3	Loss of land value near landfill sites and /or STPs		PEA and supervision consultants	
4	Loss of access to private and / or common property	Regular internal monitoring by the PEA; third party ESMF Audit; midterm and end term evaluation	PEA, ESMF Auditors; Evaluation consultants	12 months from the start date of the activities of the priority investment. Assistance to be paid before the start of civil works.
5	Loss of livelihood or source of livelihood	Regular internal monitoring by PEA; third party ESMF Audit; midterm and end term evaluation	PEA, ESMF Auditors; Evaluation consultants	
6	Displacement of squatters and encroachers	Regular internal monitoring by the PEA; third party ESMF auditor; midterm and end term evaluation	PEA, ESMF Auditors; Evaluation consultants	

70. The overall ESMF implementation and monitoring arrangements are summarized in

71. **Table** 2-4.

Table 2-4: ESMF Implementation and Monitoring Arrangements

Mile Stones	Objectives	Process	Responsibility	Decision/Target/ Deliverable
1. Sub- Project Screening	To appraise the PEA about NMCG's policies, plan and priorities	a. Discussions with PEA to - assess eligibility of project based on NMCG's priorities in consonance with Mission Ganga - identify scope of project report b. Issue DPR preparation toolkit c. Appraise the PEA about ESMF requirements	NMCG • SMCG • PEA	• Decision to proceed or not • Issue appropriate Information Package for Preparation of DPR
2. Sub- Project Appraisal	Appraise ESA	a. Detailed appraisal of the ESA including site visit/investigation if necessary to assess - suitability of site - environmental and social assessment and adequacy of EMP/SMPs - risk analysis /allocation - regulatory clearances for the project	• SMCG followed by NMCG	• Review report with decision to - accept ESA - accept with modifications - reject and instruct to resubmit as per requirements
3. Approval	Approvals from authorities	a. Send ESA Report for approval	• SMCG and NMCG	• Approval of the project

Mile Stones	Objectives	Process	Responsibility	Decision/Target/ Deliverable
			- to WB for high category - Projects	
	Concurrence from WB	a. Obtain concurrence from WB for all high category projects	• WB • SMCG • State Govt. • ULB • PEA	• WB's concurrence on EA / SAR reports
4. Project Implementation Monitoring and Review	Ensure Implementation of agreed EMP/RAP	a. Prepare quarterly progress reports b. Schedule field visits as required	• NMCG • SMCG • State Govt. • ULB • PEA • Contractors • Supervision Consultants	• Quarterly Progress Report
	ESMF Audit project, if sampled	a. All E1 and S1 project will undergo ESMF audit b. Only 25% of the projects categorized as E2 and S2 will undergo ESMF audit	• NMCG • SMCG	• Audit report for all E1 and S1 category projects and sampled E2 and S2 projects

2.10.17. Social Accountability and Grievance Redress Mechanism

72. The social accountability mechanism has been established for all sub projects. The key approaches adopted for ensuring social accountability consists of any or a combination of participatory processes guiding social audit, citizen score card and report card to acquire feedback on performance of the sub projects and record citizens' recommendations for improvement. The social accountability mandate will be further strengthened through a strong grievance redress mechanism.

73. The project abides the RTI Act of 2005 and under provisions of Section 4 of the Act and commit itself for proactive disclosure and sharing of information with the key stakeholders, including the communities/beneficiaries. The project has a communication strategy focusing on efficient and effective usage of print and electronic media, billboards, posters, wall writing, and adoption of any other method suiting local context, logistics, human and financial resources.

74. Presently, one GRM officer has been appointed in NMCG to address all queries registered in the NMCG portal. The GRM officer is supported by one social expert who coordinates with all the SMCGs. At SMCG level, reporting of grievances are being monitored by environmental and social experts. All Executing Agencies have a GRM mechanism at each project site. The project manager and deputy project managers are in-charge of these GRMs. To register grievances, a register has been kept at all project site offices and sometime field team received grievances over mobile phones as well as on WhatsApp messages. To resolve the grievances, project manager from EAs side, contractor's project engineer and his team, work together sorted out at the earliest. If site team is unable to resolve the issue its own, the complaint/matter is brought up to senior management of EA as well as Contractor and discussed in monthly review meetings and escalated to the level of SMCG and NMCG. In continuation, Grievance Redress Committees (GRCs) has also been constituted in some of the basin States. The GRC discusses

grievances on weekly basis at their safety meetings[4].

75. A Grievance Redress Committee (GRC) should be set up at sub-project level consisting of project in-charge of the contractor, project in charge of PIU and Social Specialist of SMCG. Grievances could be submitted through various mediums, including in person, in written form to a noted address, through phone line or through direct calls to concerned officials, and online. All local contact information and options for complaint submission should be available on site on local information boards. Grievance registers and contact numbers of the GRC officers should be maintained at worksite in all the project states. The complaints received at different levels of the project (Contractor, PIU and EA) should be directed to the GRC to initiate the action and take the corrective measures as required. If the complainant is not satisfied, he/she can escalate the grievance by registering it in Centralized Public Grievances Redress and Monitoring System (CPGRAM) portal of NMCG.

[4] Draft Report on GBV-GRM in National River Ganga Basin project (NGRBA), June 2019, World Bank

3. ENVIRONMENTAL AND SOCIAL IMPACTS

3.1. GENERAL

76. The implementation of the river pollution mitigation investments may have environmental and social issues like pollution of surface and ground water bodies or other natural resources, issues related to air pollution or other environmental health and sanitation, inconvenience to public due to traffic diversions and construction activities, issues of land acquisition and rehabilitation and resettlement. The NMCG recognizes these environmental and social issues and prepares itself to address their mitigation through a set of management procedures elaborated in this Environmental and Social Management Framework (ESMF). NMCG, through state level SMCGs will ensure that policies and procedures described in the ESMF are applied to all investments.

77. To evolve its environmental and social management procedures, the NMCG has carefully examined the portfolio of investments previously executed under the river pollution mitigation investments under Ganga Action Plan (Phase I and II) along with similar other urban infrastructure investments implemented elsewhere in the country under various Government of India sponsored schemes, supplemented by detailed environmental and social analysis of Ganga Basin and field visits to existing and proposed sample investments.

3.2. PORTFOLIO OF INVESTMENTS

78. The portfolio of investments to be implemented is presented in **Table 3-1**. These investments in the first phase of program is spread across several cities and/or towns within the Ganga main stem states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal and may be extended to entire Ganga basin comprising of 11 states in later phases.

Table 3-1: Portfolio of Investments under Namami Gange Program

S.No.	Portfolio of investments	Possible Portfolio Components
1	Sewerage and Sanitation Systems/ Sewage Treatment Plants (New / Upgradation)	• Provision for an entirely new sewerage network including individual house connections • Extensions to existing sewerage networks in some parts of cities/towns to include areas which are un- sewered hitherto or to newly developed areas in the recent years • Entirely new sewage treatment plant/facility • Augmentation of capacities in existing sewage treatment plant/facility • Remodeling /Renovation of existing sewage treatment facilities, resulting in better effluent quality and augmented treatment capacity
2	Solid Waste Management	• Engineered landfills with leachate collection and treatment systems • Waste segregation and composting facilities • Waste Processing or Waste to Energy Facilities

S.No.	Portfolio of investments	Possible Portfolio Components
3	Industrial Pollution Control Initiatives	• Common Effluent Treatment Plant • Common Hazardous Waste Management Facilities • Pilot treatment facilities for various industrial sectors • Waste Minimization and Clean Technology Programs
4	River Front Management Investments	• River Front Management and beautification • Construction of Bathing Ghats • Development of Cremation grounds Improvement to existing crematoria situated on riverbanks

79. The Investments aims at preventing discharge of untreated sewage into River Ganga and thus aiding abatement of river water pollution and improvement in water quality. Consequently, this also contributes to the improvement in the status of environment health and sanitation for the citizens of the concerned cities and towns. The Investments, to be implemented, have its own beneficial as well as adverse impacts. The significance of these impacts depends on the individual project, its size and location. The likely beneficial impacts of the investments include the following.

- Improvement in sewerage collection and treatment within the cities/towns
- Prevention of storm drains carrying sanitary sullage or dry weather flow
- Prevention of ground water and soil pollution due to infiltration of untreated liquid waste
- Prevention of discharge of untreated sewage into River Ganga
- Improvement in water quality of River
- Improvement in environmental sanitation health and reduction in associated health hazards within the cities/towns
- Improvement in quality of life, human dignity and increased productivity
- Reduced nuisance of open defecation due to low cost sanitation and reduced malarial risks and other health hazards
- Improved community participation and sense of ownership

3.3. ENVIRONMENTAND SOCIAL IMPACTS

80. This section identifies the environmental and social impacts of the investments with a view to facilitate early evaluation of such impacts and integrate suitable mitigation measures during planning stage itself. Based on field visits and discussion with the potential executing agencies, the typical adverse impacts associated with the investments are summarized below:

3.3.1. Sewerage Schemes

81. The investments involve laying of sewers (both gravity and pressure lines), provision of sewer connections to individual houses, gravity based interception and diversion arrangements to drains carrying sanitary sullage/dry weather flow, construction of new sewage pumping stations including installation of electro- mechanical works, renovation and/or remodeling of existing sewage pumping stations among others. Most of these investments would be concentrated in one location except for laying of sewers (both gravity and pressure lines), which are linear investments and the sewers are largely buried below ground or sometimes may be laid on or above the ground depending upon the available/required slope or gradient.

82. Although there would not be any permanent negative or adverse environmental impacts, the potential environment issues associated with sewerage and sanitation investments are:

- surface and groundwater contamination due to leakage and/or improper joints in sewers

- severance of utilities and requirement for relocation due to sewer laying
- disruption due to local traffic diversion and congestion during sewer laying works
- impact on public/private properties and other sensitive receptors along the sewer alignment during construction
- disposal of excess excavated soil and construction debris
- Exploitation of water sources for meeting construction water demand.
- air and noise pollution from construction equipment's
- Health and safety concerns of workers, while laying or rehabilitating existing sewers.

3.3.2. Sewage Treatment Plants

83. The investments may involve construction of new sewage treatment plants, augmentation of treatment capacity in existing sewage treatment plants and renovation and/or re-modelling of existing sewage treatment plants, resulting in improved effluent quality and disposal as per prescribed standards. Most of these investments would be concentrated in one location and the requirement of land for these investments is small as compared to other infrastructure development investments.

84. Although there would not be any permanent negative environmental impacts, the potential environment issues associated with sewage treatment facility are:

- change in land use pattern, in case of proposed sewage treatment plants at new locations.
- change in channel hydraulics, triggering erosion and siltation problems, if sewage treatment plants are proposed in floodplains.
- change in hydrology and drainage patterns due to the construction activity, particularly, if sewage treatment facility is located in floodplains.
- health and safety issues associated with operation and maintenance of sewage treatment facility, particularly exposure to methane and other noxious gases, sludge contaminated with heavy metals etc.
- issues associated with the disposal of sludge, if sewage is likely to be contaminated with heavy metals due to mix of industrial waste with sewage.
- Emission of methane, if not utilized for power generation or any other gainful applications.
- water logging problems due to improper/ inadequate disposal of treated effluent or effluent not conforming to stipulated discharge standards during operation.
- Sludge from a waste treatment plant may constitute a hazardous and nonhazardous waste.

85. Most of the portfolio of infrastructure investment under Namami Gange programme belongs to sewerage infrastructure and River Front Development. A sample construction and operation stage impacts and management measures are given in **Appendix-III A** and **III B** Solid Waste Management Investments

86. These investments may involve construction of municipal waste receiving and segregation yards, composting yards, engineered landfills with leachate collection and disposal arrangements among others. Most of these works would be spread over in one location and the requirement of land for these investments is rather small as compared to other infrastructure development investments. Generally, the land for the solid waste treatment facility will be selected away from habitations.

87. Although there would not be any permanent negative environmental impacts, the **potential environment issues** associated with Solid Waste Management are:

- surface and ground water contamination due to unmanaged leachate collection and disposal

- change in channel hydraulics, triggering erosion and siltation problems, if solid waste management facility is proposed in floodplains
- change in hydrology and drainage pattern, if the facility is located in floodplains
- air quality, odor and fly nuisance due to the improper operation of waste disposal or processing facilities
- issues pertaining to siting of facility such as change in land use pattern, proximity to settlements, cultural properties and any other sensitive receptors
- air and noise pollution from construction equipment's
- Health and safety issues associated with operation and maintenance of solid waste treatment facility, particularly of workers manually handling wastes.

3.3.3. Industrial Pollution Control Initiatives

88. Investments under this component could involve development of common industrial effluent treatment plants or hazardous waste management plants, etc. However, implementation of these pollution control facilities may lead to certain **environmental impacts** such as the following:

- Pollution of water resources
- Soilcontaminationduetothedisposalofuntreated/partiallytreatedeffluentsand/ or hazardous wastes
- air quality, odor and fly nuisance due to the improper operation of treatment facilities
- health impacts on the neighboring communities
- Issues of leachate and loss of productivity to agriculture lands due to the disposal of sludge from the facilities.

3.3.4. River Front Management Investments

89. These works involve river front development schemes, beautification of river banks, construction of bathing *Ghats* along rivers, lakes and water bodies' improvement, redevelopment of cremation grounds among others. These works would be included under one investment. The requirement of land for these works is moderate and much lesser than that is required for the sewage treatment or solid waste treatment facility. Although, these facilities are frequently used by the citizens, the location of these investments will not generally involve displacement of people.

90. There would not be any permanent adverse or negative impacts due to these investments, if there are no major interferences in the river flow channel hydraulics, which can trigger erosion and siltation issues either *inset* or elsewhere along the course of the river. Impacts due to such investments could be minimized or mitigated by appropriate interventions and engineering designs.

91. The **environmental issues** that may arise due to investments like river front development schemes, beautification of river banks, construction of bathing *Ghats*, and development of cremation grounds are:

- change in land use, and drainage pattern
- change in channel hydraulics, triggering \erosion and siltation problems either at in situ or elsewhere along the course of river
- impact due to inadequate solid and liquid waste disposal arrangements
- impact due to inadequate sanitation, health and safety facilities
- impact on river water quality due to proposed amenities
- impact on environmental aesthetics and cultural value

92. **Health and Safety:** During construction stage, assurance of safe work environment and incident free execution of the project, health and safety of worker is significant in the Namami Gange projects. The measures to ensure worker's Health and Safety will be detailed out in sub project specific ESMAP.

93. The bid document of Namami Gange projects directs that the selected DBOT Operator/HAM Concessionaire shall ensure implementation of health and safety measure during the construction and operation stage as mentioned in sub project specific ESMAP including applicable legislations & World Bank's EHS Guidelines, projects and will be part of Bid documents. During construction & operation stage, project will develop a protocol to report and document any incident at the project location. The incident reporting will be part of progress report to be shared with SMCG & NMCG.

94. As regards to the **Social Impacts**, the requirement of land for all these investments is rather small. However, wherever there is displacement of titleholders/non-titleholders, it may involve resettlement issues and may result in temporary loss of access to private and common properties during construction. Social issues that may arise due to these kinds of investments are:

- Direct purchase of small land parcels for SPS/ Lifting station
- Land acquisition / taking for sewerage treatment plant leading to loss of livelihood / displacement of non-titleholders /titleholders
- Temporary land taking causing economic displacement
- Temporary loss of common grazing area

95. So far, in most cases, SPS and STPs have been designed in existing government land that is free of encroachment and other encumbrances. In case of requirement of private land, EAs have preferred direct purchase based on willing buyer – willing seller. Wherever, government land has been taken, non-titleholders have been compensated for assets and assisted in relocation (e.g., Patna RFD).

96. Most of these investments would be concentrated in one location and the requirement of land for these investments is rather small as compared to other infrastructure development investments. Hence, the social impacts would be minimal but in case of displacement Resettlement Action Plan[5] need to be prepared.

3.4. EXPERIENCE IN IMPLEMENTING ESMF

97. As per part of Implementation, monitoring and reporting arrangement of ESMF, an independent Environmental and Social audit was conducted by a Third Party (independent consultant hired by NMCG) in year 2018 and being conducted in 2019. The audit was conducted as per the ESMF guidelines. The mandate for conducting the audit was as per **Appendix V** of this report. The Audit was conducted in all the five basin states to verify/ witness the corrective action taken by the SMCG/ nodal agencies in addressing the Non-compliance identified during the Environmental and Social Audit. The major findings/ outcomes of the E&S Audit are as under:

a) Good Practices: as part of Audit procedure, discussions with various stakeholders at Central and State levels were conducted and reviewed the relevant documents which revealed number of good practices as follows:

[5]e.g. places where Government land is available, and no displacement is involved a Generic ESMP is prepared/to be prepared. Places where private land acquisition is involved /physical displacement or displacement of Non-title holders is required (e.g. cases like Patna RFD and Begusarai WWT), an abbreviated RAP /RAP is prepared/to be prepared.

(i) As per Audit findings, it is intimated that overall institutional framework to implement NMCG projects is complied with the NGRBA/Namami Gange Programme Framework, wherein SMCGs/Nodal Agency dedicatedly facilitated the implementation with support from Executing Agencies at respective project locations.

(ii) As part of internal monitoring within dedicated agencies under the project, the monitoring and supervision by NMCG was found appreciative. It is stated in the Audit report that the safeguards officials of NMCG frequently visited project locations and also regularly communicated to SMCG as well as to EA insisting upon (i) appropriate implementation of various ESMP compliances including inclusion of ESMP in Bid/Contract document and EMP budget in BoQ, (ii) deployment of safeguards officials along with necessary directions for their consistent inspection of project site, (iii) formulating project specific ESMP for inclusion in future projects, and (iv) formulating robust grievance redress mechanism. In addition to this, Dynamic monitoring system was found in place for making use of freeware messaging system. The day-to-day progress, grievances and site photographs were exchanged in WhatsApp groups for constant monitoring of the projects and immediate action.

(iii) Liaising of SMCG with local governing bodies was observed to be good. The efforts taken by the States in creating an enabling environment in close coordination with District Administration, especially sub-divisional office was found noteworthy in the E&S Audit.

(iv) With regard to selection of feasible site, Audit finding insights that the available government land was preferably utilized for establishing various project components in all the project sites as option 1 under Namami Gange Projects. In cases, where government land was not available, the SMCG/EA in coordination with respective district administration has purchased land following mutual negotiation process.

(v) Biometric system has been adopted for construction labourers by few of the Contractors, which is appreciative. Also, the wages for the labourers were reported bank transferred.

(vi) Environmental and Social Due Diligence was carried out by NMCG in Prayagraj and Buxar (information based on the public-disclosed documents) which is appreciative. Similar Due Diligence exercise to be done in other project locations.

(vii) **Health and Safety at worksite:** Site visits undertaken during E&S Audit of Implemented and under construction project envisaged that Health and Safety Officer in the Contractor's team has been mobilized in all the project sites. Based on the proposed design, the safety aspects were well taken care. Site-specific Health and Safety Plan has been developed and implemented, provided PPEs to workers, Training Provisions, Documentations etc. Markings and signboards were given near energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Safety equipment such as helmet, safety Shoves, Gloves, masks was observed on labourers. Contractors were equipped with health safety aspect during construction workers.

b) Recommendations: Audit observed following key environmental and social issues which has been addressed at various levels of implementation in Ganga 1 and will continue for Ganga 2:

Table 3-2: Audit observations and measures adopted

S.No.	Key E&S audit observations	Adopted Measures
1	According to E&S Audit, it was reported that, Sample EMP's included in the ESMF with respect to various components of the project, was generally used as a replica by the SMCG/EA and does not reflect sub-project-specific site features, therefore, Preparation of sub-project specific EMP has been suggested and the same need to be followed for the proposed Hybrid Annuity based Contracts and in other new Contracts.-	The screening process has been strengthened, that will help in identifying issues and prepare site specific EMP.
2	Preparation of respective Sludge management Plans should be made mandatory. Sludge Disposal Plan is not provided by the Contractor. States (Jharkhand, as of now) which have plans for Solid Waste Management, is reportedly integrating the sludge generated from respective STPs.	In the new contracts of Ganga 2, safe disposal of sludge is the responsibility of DBOT operator/ HAM concessionaire in consultation with EA & ULB.
3	Regulatory requirements should be fully complied. All the required permissions should be obtained before commencement of civil works. Permission like Ground Water Extraction, outdated fire-safety equipment placed at site; DG with inadequate emission standards use at site; Use of high-capacity DG set without obtaining permission from SPCB need to be improved at active project sites.	As mentioned in the institutional arrangement, SMCG will conduct regular monitoring to ensure safeguards compliance & provide necessary guidance to EA & DBOT Operator/HAM concessionaire.
4	It is reported in E&S audit that, Capacity building of respective E&S personnel of EA and Contractors is lacking. Safeguards Officers requires to take pro-active role in ensuring compliance to ESMF.	Section 6.5 on Training and Capacity Building has been strengthened accordingly.
5	With respect to public consultation and outreach, it is reported that, consultation at various stages of the project needs to be expedited. Deployment of safeguard officials to be consistently done. Public consultation and outreach is observed to be weak. People are concerned about the lack of prior information regarding the civil work schedule in respective localities.	Mechanism for continued participation added in section 7.3 in this report.
6	Related to land related grievance: Appropriate consultation to be carried out with aggrieved party. If found entitled, should be accordingly assisted following the provision of Resettlement Policy and Land Acquisition Framework given in ESMF.	Both GRM & consultation mechanism have been strengthened (Section 7.3 & 6.4).
7	Environmental Monitoring Formats should be included in the Bid / Contract document.	The format has been included in the Bid document.
8	The supervision of ESMP by the EA is need more attention, during audit it was observed limited to fulfilling the periodic progress reporting requirements of SMCG/NMCG.	• The safeguard staff in SMCGs has been appointed. • The requisite institutional arrangement has been updated in Section 2.10, para 54, for effective monitoring and reporting at EA level.

S.No.	Key E&S audit observations	Adopted Measures
9	Designated area for storing construction materials is not provided. This was observed that the Contractor is making use of the land provided by the EA/District Administration, wherever possible. However, the Contractor also stores the construction materials in private land without formal agreement with the landowner.	As mentioned in the institutional arrangement, SMCG will conduct regular monitoring to ensure safeguards compliance & provide necessary guidance to EA & DBOT Operator/HAM concessionaire.
10	Grievance redress mechanism is informal and there is no toll-free number is provided as envisaged in the ESMF.	Section 6.4 on GRM has been strengthened, toll-free number added by SMCGs as part of GRM.
11	Labour Contract was reported as widely practiced and the hired labours or their employers have inadequate awareness about the environmental and social safeguard measures. Contractors do not have any capacity building plan for the hired labourers	As part of GBV, two rounds of, intensive awareness campaign and consultations with contractors and labourers has been undertaken that apart from GBV issues also includes Health and Safety, Labour management & regular health checkups. These issues are now part of daily Tool Box Talk.

98. **Budget for implementing ESMF:** As per finding of Audit conducted in year 2018 for 30 STPS & Sewerage schemes implemented in five basin states i.e. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, majorly budget for ESAMP has been considered as ranges from 0.5% to 1% of the total basic capital cost, while Communication and Public Outreach, GAAP expected as 0.1% to 1% of the basic Capital Cost of the project. Post World Bank funding till the approved O&M period, any activity under ESMF will be funded by NMCG.

Table 3-3: Budget for Implementing ESMF

S.No	Item	Unit	Unit Cost		Total Cost		Source of financing
			Rupee	US$	Rupee	US$	
1	Preparation of specific ESIA/ESDDR for Ganga-1	38	550000	7857	20900000	298571	World Bank
2	Preparation of ESIA and ESDDR for Ganga-2	30	617000	8814	18510000	264429	
3	Capacity Building##	5	10000000	142857	50000000	714285	
4a	Implementation of specific ESMP*/RAP	68	8000000	114286	54400000	7771428	
4b	Implementation of GRM and GBV	68	20000000	28571	13600000	1942857	
5	Annual ESMF Auditing#	10	7000000	100000	70000000	1000000	
	Total				839410000	11991570	
	Total (Say)				850 Million	12.5 Million	

*This include cost of implementation of ESAMP/RAP including land purchase cost on an average
Annual ESMF audit cost for 10 years starting from 2018 till 2028
The capacity building cost is lump sum for training and other purposes for 5 basin states SMCG and NMCG

4. ENVIRONMENT AND SOCIAL REGULATORY FRAMEWORK

4.1. GENERAL

99. The national, state and local environmental and social regulatory requirements that are applicable to the investments proposed are given in this section. As the applicability of these legal requirements would depend on the nature of the specific investments, the exact applicability cannot be determined at this stage. SMCGs and the State level executing agencies (EA) would ensure compliance of these requirements by all concerned.

100. NMCG would verify whether the investments are in compliance with these regulatory requirements prior to granting approval to the investments and disbursement of funds. During implementation, NMCG would ensure that SMCGs monitor the ESMF compliance in all investments on an on-going basis.

4.2. APPLICABLE LAWS AND REGULATIONS -ENVIRONMENTAL

101. The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the respective State Governments
- Legislations applicable to construction activities
- World Bank Safeguard Policies
- EHS Guidelines

4.2.1. Legal Framework of Government of India

102. The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 is umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests & Climate Change (MoEF&CC) and the Central Pollution Control Board (CPCB)/State Pollution Control Boards (SPCBs).

4.2.2. Key Environmental Laws and other related Regulations

103. The key environmental laws and regulations as relevant to the investments under the NGRBP/Namami Gange are given in **Table 4-1**. The key environmental regulations can also be accessed at *www.MoEF&CC.nic.in/rules-and-regulations*

Table 4-1: Environmental Regulations and Legislations

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
1	Environment Protection Act,1986	To protect and improve overall environment	Yes	As all environmental notifications, rules and schedules are issued under this act.	MoEF &CC, GoI, DoE, State Govt. CPCB, SPCBs
2	Environmental Impact Assessment Notification 14th Sep-2006	Mandatory environmental clearance to certain category of new development activities following environmental impact assessment	Yes	This notification is applicable only for Sewage Treatment Facility and Solid waste Treatment facility investments	MoEF &CC, EIAA
3	Municipal Wastes (Management and Handling) Rule s, 2000	To manage collection, transportation, segregation, treatment, and disposal of municipal solid wastes	Yes	This notification is applicable only for Municipal Solid waste Treatment facility investments	MoEF &CC, EIAA, CPCB, SPCBs
4	Coastal Regulation Zone (CRZ) Notification 1991(2011)	Protection of fragile coastal belt	No	If Project location is located along coastal belt	
5	Land Acquisition Act, 1894 (As amended)	Sets out rules for acquisition. of land by government	Yes	applicable in case of acquisition of land for investments	Revenue Department, State Government
6	The Forest (Conservation) Act,1980	To check deforestation by restricting conversion of forested areas into non- forested areas	Yes	applicable if there is diversion of forest land for non-forest activities i.e. forest land required for any of the investments	Forest Department, State Government and Ministry of Environment and Forests, Government of India.
7	Wildlife (Protection) Act, 1972	To protect wildlife through National Parks and Sanctuaries	No	This act will be applicable, if there are any points of wildlife crossings in proximity to project locations	Chief Conservator Wildlife, Wildlife Wing, State Forest Department and Ministry of Environment and Forests, Government of India
8	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by controlling emission of air pollutants as per the prescribed Standards.	Yes	This act will be applicable during construction;	SPCBs
9	Water Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This act will be applicable during construction	SPCBs
10	The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been promulgated by the MoEF &CC for various land uses.	Yes	This act will be applicable for all construction equipment deployed at worksite	SPCBs

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
11	Ancient Monuments and Archaeological Sites and Remains Act, 1958	Conservation of cultural and historical remains found in India	Yes	This act will be applicable, only if any of the investments is in proximity to any Ancient Monument, declared protected under the act.	Archaeological Dept. GoI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).
12	Public Liability and Insurance Act, 1991	Protection from hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	SPCBs
13	Explosive Act, 1984	Safe transportation, storage and use of explosive material	Yes	For transporting and storing diesel, Oil and lubricants etc.	Chief Controller of Explosives
14	Minor Mineral and concession Rules	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	District Collector
15	Central Motor Vehicle Act, 1988	To check vehicular air and noise pollution.	Yes	This rule will be applicable to vehicles deployed for construction activities and construction Machinery.	Motor Vehicle Department
16	National Forest Policy, 1988	To maintain ecological stability through preservation and restoration of biological diversity.	No	This policy will be applicable if any eco sensitive feature exists in and around the investments	Forest Department, State Government and Ministry of Environment and Forests, Government of India
17	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	The construction activities for investments will require aggregate. These will be procured through mining from approved quarries	Department of Mining, State Government
Note: the applicable world bank policies are included in section 4.5.					

4.3. APPLICABLE LAWS AND REGULATIONS -SOCIAL

104. All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalize the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice. This section includes the National policies and Acts as detailed under:

Table 4-2: Relevant Social Policies and Acts

Acts/Rule/Policy	Year	Objective	Applicability to this project	Responsible Agency
National Social Policies and Acts				
Right to fair compensation and transparency in land acquisition, rehabilitation	2013	Fair compensation for acquisition of Immovable assets; Resettlement of displaced population due to	Yes. as some subprojects will be acquiring private land	Revenue Department of respective state governments.

Acts/Rule/Policy	Year	Objective	Applicability to this project	Responsible Agency
and Resettlement Act		LA and economic rehabilitation of all those who are affected due to land acquisition.		
Seventy Third Constitution Amendment Act,	1992	The Act enables participation of Panchayat level institutions in decision- making by broadening the village level functions, supporting implementation of development schemes. The Act provides for involvement of the PRIs especially, the Gram Sabha/Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.	Yes, as some sub projects may come in panchayat areas	Department of Panchayat Raj of respective state governments.
State Specific laws				
Bihar Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014.	2014	To assist implementation of National Act on land acquisition and R&R. Fair compensation for acquisition of immovable assets; Resettlement of displaced population due to LA and economic rehabilitation of all those who are affected due to land acquisition.	Yes, as some sub projects will be acquiring private land	Revenue department and requiring body
Bihar Rayati Land Lease Policy	2014	Allows government to take land on perpetual lease from landowners by paying four times of the minimum value registered in rural areas and two times in urban areas.	Yes, if land acquisition is not necessary and landowner agrees to give land on lease.	Revenue department and requiring body
Uttar Pradesh Land Direct Purchase Policy (through Mutual Consent)	2015	Allows government to directly purchase land from landowners through mutual consent. The policy apart from land cost also provides for R &R assistance	Yes, as private land will be required for the purpose of the project	Revenue department and requiring body

4.4. OTHER LEGISLATIONS APPLICABLE TO CONSTRUCTION ACTIVITIES

105. Construction stage generally involves equity, safety and public health issues. The construction agencies therefore will be required to comply with laws of the land, which include inter alia, the following:

- Workmen's Compensation Act 1923 (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- Payment of Gratuity Act, 1972 (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- Employees PF and Miscellaneous Provision Act 1952(the Act provides for monthly contributions by

the employer plus workers);

- Maternity Benefit Act, 1951 (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- Contract Labor (Regulation and Abolition) Act, 1970 (the Act provides for certain welfare measures to be provided by the contractor to contract Labour);
- Minimum Wages Act, 1948 (the employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act);
- Payment of Wages Act, 1936 (it lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers);
- Equal Remuneration Act, 1979 (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- Payment of Bonus Act, 1965 (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- Industrial Disputes Act, 1947 (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- Industrial Employment (Standing Orders) Act; 1946 (the Act provides for laying down rules governing the conditions of employment);
- Trade Unions Act, 1926 (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- Child Labour (Prohibition and Regulation) Act, 1986 (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);
- Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);
- The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- The Factories Act, 1948 (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
- Hazardous Wastes (Management and Handling) Rules, 1989 (the Rules govern handling, movement and disposal of hazardous waste);
- Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, amended 1994 and 2000 (the Rules provide indicative criteria for hazardous chemicals and require occupiers to identify major accident hazards and prepare on-site and off-site emergency plans).

4.5. APPLICABLE WORLD BANK POLICIES

106. The Operational Policies of World Bank that are applicable in the project are as under:

1.3-3: Safeguard Policies of World Bank

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
OP/BP4.01: Environment Assessment	The objective of this policy is to help in ensuring that the projects proposed for World Bank financing are environmentally sound and sustainable through Environment Assessment (EA).EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation.	Applicable for all infrastructure projects under Namami Gange programme. The scale and detailing of the EA report depends largely upon the project categorization.	EA report and ESMP (combined with social report) for projects under DBOT/EPC mode. Environment and Social Due Diligence (ESDD) for projects under PPP mode followed by a detailed EIA report during the detailed design stage. For High category projects
OP 4.04: Natural Habitats	The objective of this policy is to protect the natural habitats including the forest areas and wildlife in order to protect and enhance the environment which is essential for long-term sustainable development. World Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.	Applicable on case to case basis where disturbance to forest areas/natural habitats are envisaged to be impacted from the projects.	Necessary requirement include permission from competent authorities in the state government as well preparation of documents for necessary action plan to protect the surrounding natural habitats/forest areas.
OP 4.36: Forestry	The OP/BP 4.36 aims management, conservation, and sustainable development of forest ecosystems and their associated resources are essential for lasting poverty reduction and sustainable development. This is also to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.	Applicable on case to case basis where disturbance to forest areas are envisaged to be impacted from the projects.	Necessary requirement include permission from competent authorities in the state government as well preparation of documents for necessary action plan to protect the surrounding forest areas.
OP/BP 4.12: Involuntary Resettlement	The objective of this policy is to avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. Furthermore, it intends to assist displaced person in improving their former living standards; community participation in	There will be need for limited land acquisition for some sub projects such as wastewater	Resettlement Action Plan in consultation with the community and project authorities.

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
	planning and implementing resettlement; and to provide assistance to affected people, regardless of the legality of title of land	treatments or river front development resulting in relocation or loss of shelter for non-titleholders; loss of assets or access to assets; loss of income sources or means of livelihood.	
OP 7.50: International Waterways	The objective of this policy is to recognize the cooperation and goodwill of riparian for the efficient use and protection of the waterway.	This policy is triggered as River Ganga and its tributaries are considered as international waterways.	OP 7.50 attaches great importance to riparians' making appropriate agreements or arrangements for these purposes for the entire waterway or any part thereof. The Bank stands ready to assist riparians in achieving this end. In cases where differences remain unresolved between the state proposing the project (beneficiary state) and the other riparians, prior to financing the project the Bank normally urges the beneficiary state to offer to negotiate in good faith with the other riparians to reach appropriate agreements or arrangements.
OP 4.11: Physical Cultural Resources	The objective of this policy is to avoid or mitigate adverse impacts on physical cultural resources.	This policy is triggered due to the presence of number of historic and heritage structure in the project area, if found.	Management plan and mitigation measures will be prepared in consultation with the community and project authorities.

107. Furthermore, the World Bank's Environmental, Health, and Safety (EHS) Guidelines is also applicable for the proposed project. This guideline will provide guidance on EHS issues; principally occur during the construction, operation and maintenance phases. This can be made available as a part of bidding document.

5. ENVIRONMENT AND SOCIAL MANAGEMENT FRAMEWORK

5.1. OBJECTIVES

108. There may be adverse impacts that have to be effectively managed during the planning, design, construction and operational phases of Namami Gange investments. These impacts may have the potential to cause major and minor, and reversible and irreversible societal/community damage; as well as result in project delays, incomplete implementation, partial achievement of the project development goals and, reputation risks to various stakeholders. Proper management is therefore necessary for smoot hand effective project implementation.

109. The Objective of Environment and Social Management Framework (ESMF) is to ensure environmentally sustainable development in NGP's endeavor of Mission Clean Ganga by effective management of environmental and social issues in all the investments with a special focus on the following:

- ensure that all investments adhere to the national, state and local regulatory requirements during the design, implementation and operation stages
- ensure that best environmental and social practices are mainstreamed/ integrated during design, implementation and operation of the investments
- strive to enhance environmental conditions wherever feasible
- undertake to develop communication strategy, capacity building and training initiatives for all stakeholders such as the SMCG, EAs, ULBs, NGOs and common citizens.

5.2. PURPOSE OF THE ESMF

110. The purpose of the ESMF is to facilitate the management of environmental and social issues of the river pollution mitigation investments. At this stage, although the portfolio of investments has been broadly identified, the specific investment projects, i.e. their size, type and location, are yet to be identified. Therefore, at this stage it is not possible to develop specific environment and social management plans for each of the specific investments. The specific project identification will be a need based/ demand-driven process, consistent with the overall objectives of 'Mission Clean Ganga'. The Environment and Social Management Framework (ESMF), therefore, would be used as an umbrella by the Namami Gange program (the NMCG and SMCGs) and all implementing agencies while preparing and/ or appraising, approving and executing the investments.

111. **Environmental impacts:** There may be adverse environmental impacts for which mitigation plans are essential. These impacts include direct, indirect, cumulative, and induced impacts in the project's area of influence. Each project needs to be scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Environmental impacts include those related to the natural environment (air, water, and land); human health and safety; and trans-boundary and global environmental aspects. Environmental guidelines – policies and requirements – seek to avoid, minimize, or mitigate adverse environmental impacts.

112. **Social impacts:** Project-related social impacts include displacement impacts and impacts to vulnerable groups. Broadly, this includes physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources or means of

livelihood). If a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of SC/ ST/ BPL groups or affects the territories or natural or cultural resources. Social management plan seeks to avoid, minimize or mitigate these adverse impacts. Related to displacement impacts, if these adverse impacts cannot be avoided, then affected people should receive assistance/compensation so that they are at least as well off as they were in the absence of the project.

113. Through the ESMF, the SMCGs and the NMCG will also be implementing international good practices for managing social and environmental issues.

5.3. SCREENING AND CATEGORIZATION OF INVESTMENTS (DURING THE FEASIBILITY STUDY STAGE)

114. Each project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. The extent of assessment required to identify and mitigate the impacts largely depends upon the complexities of project activities. The scrutiny and screening will be based on a detailed Environment and Social Screening exercise, summarized in the following Format:

Table 5-1: Screening Format

Environment and Social information format for screening				
	Project Title: Implementing agency: Project cost: Project components: Project location (Area/ district)			
	Screening Criteria	**Yes/No**	**Assessment of Impact Category (High/Low)**	**Explanatory note for categorization**
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.			
2	Will the project create significant/ limited/ no social impacts? • Involuntary land taking resulting in loss of income from agricultural land, plantation or other existing land-use. • Involuntary land taking resulting in relocation of title holder or non-titleholder households. • Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood). • Any specific gender issues.			
3	Will the project create significant / limited / no environmental impacts during the construction stage? (Significant / limited / no impacts) • Clearance of vegetation/tree-cover • Direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes. • Flooding of adjacent areas • Improper storage and handling of substances leading to contamination of soil and water • Elevated noise and dust emission • Disruption to traffic movements • Damage to existing infrastructure, public utilities, amenities etc.			

Environment and Social information format for screening				
	• Failure to restore temporary construction sites • Possible conflicts with and/or disruption to local community • Health risks due to unhygienic conditions at workers' camps • Safety hazards during construction			
4	Will the project create significant / limited / no environmental impacts during the operational stage? (Significant / limited / no impacts) • Flooding of adjacent areas • Impacts to water quality due to effluent discharge • Gas emissions • Safety hazards			
5	Do projects of this nature / type require prior environmental clearance either from the MOEF&CC or from a relevant state Government department? (MOEF&CC/ relevant State Government department/No clearance at all)			
6	Does the project involve any prior clearance from the MOEF&CC or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/ No). If yes, which?			
7	Please attach photograph sand location maps along with this completed Environmental Information Format For Screening.			

**Detailed explanation/ justification for arriving at specific category (high/ low) to be provided in the specified column*

115. Further, below table can be referred for the overall rating and assessment (high/low) of the project.

Table 5-2: Rating Index

Sl.no.	Categorization Criteria	Applicability (Yes/No)	Remarks
1	Is the treatment plant of the project is located within Eco Sensitive Zone as per the Wildlife (Protection) Act, 1972		
2	Is the treatment plant of the project is located within Ecological Sensitive Area (ESA) as per the Environmental (Protection) Act, 1986		
3	Is treatment plant of the project is located within notified Forest Area as per the Indian Forest Act 1927		
4	Is the treatment plant of the project is located within Critically Polluted Area (CPIA) as per Environmental (Protection) Act, 1986		
5	Does the treatment plant of the project attract the 14th September 2006 EIA Notification & further amendments		
6	Is the treatment plant of the project is located within the Notified zone Coastal Regulation Zone (CRZ) notification 2016		
7	Is the treatment plant of the project is located within the area as notified under Wetlands (Conservation and Management) Rules, 2017		
8	Is the treatment plant of the project is located within the regulatory zone of area as per The Ancient Monuments and Archaeological Sites and Remains Act 1958.		
9	Is Resettlement / displacement /permanent loss of		

Sl.no.	Categorization Criteria	Applicability (Yes/No)	Remarks
	livelihood involved? (more than 200 persons)		
	Overall Rating in percentage		
Note: If any of these indicators is answered yes, the project will be considered as high impact sub project.			

116. The level of impact category (high/ low) shall be determined through a process of environmental and social screening as described above and shall be provided as part of the Feasibility Report and has to be agreed by the SMCG.

117. The NGRBA program as per World Bank safeguard policies is categorized as A. However, sub-projects are categorized as high / low impact categories where high impact category project will correspond to Category A and low impact corresponds to Category B projects as per World Bank's safeguard operational policy 4.01.

5.3.1. Addressing safeguard issues in projects for PPP Projects:

118. Under the NGRBA framework, National Mission for Clean Ganga (NMCG) under Namami Gange programme shall finance commercially viable projects under PPP model. Viable projects may also include those projects that will become viable after receiving viability gap funding under a government scheme. The necessary procedures for preparation of safeguard documents with respect to PPP mode of projects are included in the **Addendum-I**.

5.4. ADDRESSING ENVIRONMENTAL AND SOCIAL IMPACTS (DURING PREPARATION OF THE DPR)

5.4.1. High impact categories

119. A proposed investment will be classified as High impact category, if it is likely to impact (adverse or moderate) the environmental and social aspects of the investments. The High Category investments will also include all those investments which require the mandatory environmental clearance as per the EIA notification SO1533 (E) dated Sept 2006, published by Ministry of Environment and Forests.

120. The investments categorized as 'High' would require conducting an Environmental and Social Assessment (ESA) by an independent agency (other than the agency designing the project) and the scope of the assessment will be decided based on the nature of the investment and the environmental and social sensitivity of the area. The ESA shall examine all the potential negative and positive environmental and social impacts of the investment, compare them with those of feasible alternatives (including the "without investment" situation), and recommend any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

121. The ESA may include (a) a detailed description of the environmental and social condition of the project area; (b) an assessment of the potential impacts; (c) formulation of mitigation measures; and (d) preparation of an Environment and Social Management Plan. The ESA report will contain the following chapter scheme: (1) Introduction; (2) Description of the project; (3) Description of the environment; (4) Alternatives; (5) Anticipated environmental and social impacts and mitigation measures; (6) Socio-economic assessment; (7) Environmental and Social Management Plan; (8) Public consultation and disclosure; and (9) Conclusions.

5.4.2. Gender Assessment and Development

122. Gender Development plan is being designed under the project as part of ESMF which will help analyze gender issues during the preparation stage of sub project and design interventions. At the sub project level, gender analysis will be part of the social assessment and the analysis will be based on findings from gender specific queries during primary data collection process and available secondary data. The quantitative and qualitative analysis will bring out sex disaggregated data and issues related to gender disparity, needs, constraints, and priorities; as well as understanding whether there is a potential for gender based inequitable risks, benefits and opportunities. Based on the specific interventions will be designed and if required gender action plan will be prepared. The overall monitoring framework of the project will include sex disaggregated indicator and gender relevant indicator

123. The participation of beneficiaries and focus on poverty reduction are two other key determinants of the effectiveness and sustainability of any project. Any project must address the constraints on women's participation in project design, construction, operation and maintenance (O&M), training, and monitoring and evaluation (M&E). The project must also focus on the linkage between gender and poverty, by identifying, for example, households headed by females and those households' special needs. An adaptive, learning, and process-oriented approach works better than a blueprint approach; continuous dialogue between the EA and the beneficiaries is therefore important. Project beneficiaries are likely to have a stronger sense of ownership when the project gives them enough time, design flexibility, and authority to take corrective action. In this way, they find it easier to incorporate their earlier learning and negotiate with project staff and service providers. Therefore, a mechanism must be built into the project to allow such two-way interactions between the beneficiaries and the service providers.

124. Gender analysis will be an integral part of the initial social assessment at the screening stage itself. The issues identified can be scaled up during the feasibility and detailed analysis can be carried out during the DPR stage.

125. The project designs should be gender responsive based on the gender analysis, and should be included in the DPR The findings and recommendations from the gender analysis during project planning and feedback from beneficiaries during implementation must be discussed thoroughly to determine the need for further action. Listed below are the key action points:

126. Develop a feedback mechanism in which both male and female have a voice. Identify organizations that could facilitate women's participation during implementation and M&E.

127. Document the gender-responsive design features in the DPR and include covenants in the loan agreement to ensure gender-sensitive project design mechanisms to be complied by the executing agency

5.5. LABOUR MANAGEMENT PROCEDURE

128. Since sub projects involves construction work that will demand a constant supply of labourers, the influx of migrant workforce will put additional pressure on existing resources. The workforce normally consists of solitary migrant males and that can be a potential risk for the host population. However, in many cases, the migrant male member of the family might relocate his family with him. Specifically, the influx of labour force can lead to:

- Risk of conflict and social unrest due to cultural differences between the labour force and local community

- Risk of spread of communicable diseases due to interaction of the labour and the local community
- Risk of gender-based violence
- Risk of violation of child-safety measures
- Health hazard for host community due to lack of sanitation facilities and waste management
- Additional pressure on the local resources and social infrastructures

5.5.1. Construction Labour Management Plan

129. Since the construction activities are mostly labour intensive by nature, therefore, it is also envisaged that many of the labourers will be employed from outside the State and hence, accommodation will be provided. These migrant labourers will be accommodated in a temporary campsite within the project area.

5.5.2. Objectives

130. The influx of migrant labour will have both negative and positive impacts on the nearby community and local environment. The labour will be accommodated in a temporary campsite within the project area which can have a significant interface with the host community. The influx of migrant workers would lead to a transient increase of population in the immediate vicinity of the project area for a limited time. This would put pressure on the local resources such as roads, fuel for cooking, water, etc. Hence, a plan has been designed to demonstrate the:

- Potential impacts associated with influx on the host population and receiving environment are minimized;
- Provision of safe and healthy working conditions, and a comfortable environment for migrant labour; and
- To ensure compliance with the national labour laws.

5.5.3. General Requirements

131. All migrant workers are envisaged to be accommodated in a proper temporary campsite within the project area. If migrant workers are accompanied by their families, provisions should be made accordingly. As per the National Acts, the inclusion of requirements for labour camp to be established by contractors during construction phase of the project. Contractor(s) shall ensure implementation of the following measures to minimise the potential negative impacts of worker accommodation and workers on local communities:

- Employment of child Labour is prohibited in Building and Construction Industry. No child labour[6] shall be utilized at any of project or subproject site (during planning, construction or O&M phases). The contractor will be sensitized on issues related to child labour. All sub project sites will display child helpline number on information board and prohibition of child labour use will be part of daily Tool Box Talk (TBT). The Bid document clearly mentions prohibition of child labour employment.
- Cleanliness: Pest extermination, vector control, and disinfection are to be carried out throughout the living facilities in compliance with local requirements and/or good practice.
- Complaints and incident reporting: A formal Complaints Procedure will be implemented to ensure

[6] Child Labour (Prohibition and Regulation) Act, 1986 (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes.

timely and transparent response to complaints as received from labour.

- Labour education: The workforce will be sensitized to local social and cultural practices through the provision of an induction course for all employees that stipulates expected behaviour;
- Labour behaviour in the campsite provided: A Code of Behaviour governing appropriate behaviour in the accommodation facilities to be kept in place and to be strictly enforced. The contractor shall ensure implementation of the "rules of engagement" between labourers living in campsite and community and shall be implemented by construction contractors for all engaged labourers.
- Labour Compensation and Accommodation: The client shall ensure that labourers are provided with benefits such as leave, weekly rest day, etc. Accommodation to be provided for the construction labour which covers facilities (including catering facilities, dining areas, washing and laundry facilities, etc.) and supporting utilities.

5.5.4. Hiring and Recruitment Procedure

132. The manpower contractor shall, wherever possible, locally recruit the available workforce and shall provide appropriate and requisite on job and EHS training as necessary. The following general measures shall be considered for the workforce during their employment tenure:

- The implementing agency in consultation with the PMU will include a code of conduct relating to the accommodation to be signed with the contract document of contractors.
- The contractor shall not employ any person below the age of 18 years nor will have any forced labour;
- The construction labourers will be provided with documented information regarding their rights under national labour and employment law such as but not limited to Factories Act, Minimum Wages Act, Trade Unions Act, and Workmen's Compensation Act;
- First priority for employment of labour should be given those impacted by the project such as landowners who have lost land / donated land;
- No discrimination shall be done by the construction contractor with respect to recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, termination of employment or retirement, and disciplinary practices;
- The contractor to ensure that work hours are set at eight hours a day, 48 hours a week, with a weekly rest day for all engaged labour;
- Every labour is entitled to a maximum of only two hours a day as Overtime (OT) work. OT pay is twice the hourly remuneration;
- The project will ensure that equal wages for male and female workers for work of equal nature or value is maintained;
- A grievance redress mechanism for workers will be put in place by the contractor to raise workplace concerns. The workers will be informed about the grievance mechanism at the time of recruitment; and
- The Contractor will ensure that they develop and implement a procedure to review the performance of their sub-contractors.
- The procedure developed should include regular inspection of the camp sites, maintaining information pertaining to labour sourced by sub-contractors;

5.5.5. Worker's Accommodation

133. The Contractor will supervise and monitor the activities performed by their contractor and accommodation facilities provided in the campsite. The following measures shall be provided:

- The labour will be provided with accommodation made of insulating material and locally available building material, etc.;
- The migrant workers with families will be provided with individual accommodation comprising bedroom, sanitary and cooking facilities;
- The units will be supported by common latrines and bathing facilities duly segregated for male and female labour;
- Adequate number of toilets will be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided;
- The contractor shall provide a canteen facility for the construction workers and the food will be of appropriate nutritional value and will consider religious/cultural backgrounds;
- All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy;
- Facilities for the storage of personal belongings for workers shall be provided within the campsite only;
- Dustbins shall be provided for collection of garbage and will be removed on a daily basis;
- It is also required to provide first aid box in adequate numbers; and
- Ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

5.5.6. Security

134. The contractors shall put in place the following security measures to ensure the safety of the workers. The following measures shall be incorporated:

- Access to the campsite shall be limited to the residing workforce;
- The contractor shall be responsible for deploying an adequate number of guards;
- Adequate, day-time night-time lighting shall be provided;
- The security personnel shall be provided with training to respect the community traditions and in dealing with, use of force, etc.; and
- The rental accommodation shall be provided with firefighting equipment and portable fire extinguishers.

5.5.1 Provisions for Drinking Water

135. Access to an adequate and convenient supply of free potable water is a necessity for workers. The domestic water supply shall be made available by the contractor.

- Safe drinking water conforming to the IS 10500:2012 for drinking water shall be provided;
- Private tanks can be utilized for provision of drinking water for the migrant labours;
- The direct usage of water from bore well should not be allowed and water shall be adequately treated;

- The Contractor(s) should regularly monitor the quality of drinking water available. In case of non-compliance with the Drinking Water Specifications, additional treatment shall be provided, or alternative sources of water supply shall be arranged; and
- All tanks used for the storage of drinking water are constructed and covered to prevent water stored therein from becoming polluted or contaminated.

5.5.7. Cooking Arrangements

136. The construction phase will involve the engagement of a large number of migrant labourers in the project area for a limited time. Hence, there shall be a requirement of the provision of cooking facilities (kitchen) as listed below:

- Places for food preparation are designed to permit good food hygiene practices, including protection against contamination between and during food preparation;
- Adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water; and
- All kitchen floors, ceiling and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials;
- Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials.
- To ensure that the fuel need of labourers in the project area does not interfere with the local requirements, necessary arrangements for supply of fuel to the labourers shall be done by the contractor.

5.5.8. Wastewater Generation

137. There will of generation of wastewater from the campsite. About 80% of water used shall be generated as sewage/wastewater. Contractors shall ensure that the campsite is equipped with the septic tank and soak pit for disposal of sewage. It is also recommended that the storm water and sewage system should be separate. The surface water drainage shall include all necessary gutters, down pipes, gullies, traps, catch pits, manholes, etc. Sanitary and toilet facilities are constructed of materials that are easily cleanable. Sanitary and toilet facilities are required to be cleaned frequently and kept in working condition.

5.5.9. Solid Waste Management

138. The municipal solid waste generated from the campsite will mostly comprise compostable wastes like vegetable (kitchen waste) and combustible waste like paper, cans, plastic and some non-degradable waste like glass/glass bottles. Improper disposal of solid waste will lead to health hazards to labourers as well as the nearby communities.

139. The following measures shall be adopted by contractors for ensuring effective management of solid waste:

- The solid wastes of domestic nature generated shall be collected and stored separately in appropriate containers with proper sealing on them;
- Separate bins with proper markings in terms of recyclable or non-recyclable waste shall be provided in the houses and kitchen premises in sufficient numbers for collection of garbage;
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation; and

- The contractor shall identify the nearest municipal solid waste storage facility and tie up with the concerned urban local body for disposal of waste at frequent intervals.

5.5.10. Medical Facilities

140. Effective health management is necessary for preventing the spread of communicable diseases among labour and within the adjoining community. The following medical facilities shall be provided by contractors for the construction workers:

- A first aid center shall be provided for the labour within the construction site equipped with medicines and other basic facilities;
- Adequate first aid kits shall be provided in the campsite in an accessible place. The kit shall contain all type of medicines and dressing material;
- Contractor shall identify and train an adequate number of workers to provide first aid during medical emergencies;
- Regular health check-ups shall be carried out for the construction labourers every six month and health records shall be maintained;
- Labours should have easy access to medical facilities and first aider; where possible, nurses should be available for female workers;
- First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available;
- An adequate number of staff/workers is trained to provide first aid; and
- Information and awareness of communicable diseases, AIDS, etc. shall be provided to workers.

5.5.11. Recreation Facilities

- Basic collective social/rest spaces are provided to workers.
- Facilities like a common television can be provided in labour camps

5.5.12. Impact of influx of migrant labourer

- The contractor will preferably engage the local labour force except for the labourer's requiring special skills and the non-availability of such skilled labourers from the local area.
- Awareness of labourers/ workers on societal norms, taboos, and other cultural practices.
- Organise awareness creation and educational programmes for all workers and the general public on the behavioural changes required to prevent the spread of HIV/AIDS and other STDs.
- The 'Labour Influx and Construction Workers Campsite Management Plan' will be implemented.
- Project to assess and manage labour influx risk based on risks identified in the ESIA. Depending on the risk factors and their level, appropriate site-specific Labour Influx Management Plan and/or a Workers' Camp Management Plan.
- The project will incorporate the ESMP into the civil works contract. The responsibilities for managing these adverse impacts will be clearly reflected as a contractual obligation, with a mechanism for addressing non-compliance.
- Employment of any person less than 18 years of age will be strictly prohibited. The contractor will maintain a labour register with name, age, and sex with supporting document (preferably copy of Aadhar card or voter's ID card). This will be monitored by the Environmental and Social office of contractors.
- Contractor and labourer will sign a code of conduct to maintain good manners with the

community and avoid GBV.

- Project will undertake awareness raising program for the workers and community on the risk of labour influx.

5.5.13. Avoiding Gender Based Violence

- Contractor will prepare and implement robust measures to address the risk of gender-based violence that include:
  - mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
  - informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
  - introducing a Worker Code of Conduct as part of the employment contract and including sanctions for non-compliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence.

- Additional measures can aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses, and friends, or to visit nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel.

5.5.14. Contractor's responsibility

141. Within 30 days from the appointed date, the Contractor shall prepare and submit 4 hard copies and 1 soft copy of Labour Influx and Worker's Camp Management Plan to the concerned PEA that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, training programs on HIV/AIDS, etc. A Workers' Camp Management Plan addresses specific aspects of the establishment and operation of workers' camps.
This Labour Influx and Worker's Camp Management Plan will include:

(i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
(ii) informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
(iii) introducing a Worker Code of Conduct as part of the employment contract and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups;
(iv) Contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence;
(v) training programs on HIV/AIDS and other communicable diseases;
(vi) workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the Local Body/ Executing Agency is unable to cater to the demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments, etc.; and
(vii) complaint handling mechanism at the project level

142. Additional measures that aim to reduce incentives to engage with the local community by

providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses, and friends, or to visit nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further, it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel.

5.6. GENDER BASED VIOLENCE (GBV)

143. The gender-based violence (GBV) risk rating for the National Ganga River Basin Project (P119085) is Low. Although risk is low, a list of activities is proposed to ensure the risk does not increase during the course of the project. The National Ganga River Basin Project (P119085) is the parent project for the National Ganga River Basin Project (P169111). The geographical spread, broad project interventions and associated risks and impacts are expected to be similar to the parent project at this stage.

144. To start the GBV retrofitting process, the World Bank team organized a workshop in line with requirements of the GBV Taskforce of the World Bank (2017). The emerging discussions also referred to the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redress) Act, 2013 and subsequently, constitution and functionality of Vishakha Committees. Further, the Bank team conducted an extensive mapping exercise of service providers in the state to strengthen the referral system for a potential victim. The Bank team put forth the context and internal risk assessment based on review of project documents and estimates of labor influx and scale of on-going construction. The risk rating for the parent project [National Ganga River Basin Project (P119085)] was evaluated to be 'Low'. However, given the specific context of some of the states such as Uttar Pradesh[7] and potential presence of women-headed households near construction sites in Madhya Pradesh, Uttar Pradesh, Bihar and West Bengal (plains topography - states) the following actions were recommended and agreed upon with the client:

- Sensitization of contractors and laborers by nodal officers
- Constitution and functionality of Vishakha Committee
- Strengthening of Grievance Redress Mechanism
- Strengthening of infrastructure on camp sites from a safety perspective.

145. The GBV assessment and action plan prepared in 2019 had identified several actions to be taken for GBV prevention and risk mitigation in NGRBP. Women help line numbers have been displayed at the sub- project level in all the states. In addition, Bihar and Jharkhand have displayed names and numbers of nodal persons identified for GBV GRM at all project sites. Furthermore, sensitization and awareness on GBV for labourers during tool box talks and safety induction training's is being done in Bihar and Jharkhand. A Public Grievance Redress System (PGRS), an online app developed by BUIDCO includes tabs for complaints on GBV which would be directed to the social specialist responsible for GBV grievance redress. So far, no GBV incident has been reported from any of the states. Signing of CoCs by all labour has already been done in Uttarakhand and others are in the process of translating CoC in local language and getting it signed by workers. SPMG Uttarakhand has translated the CoC into the local language and displayed at all project sites. Separate toilets and bathing facilities for women labourers have been provided in all labour camps. Awareness programmes for adjoining community members with the support of local counselors have been conducted in some sub-projects in Bihar, Jharkhand and West Bengal.

[7] Uttar Pradesh had the highest number of crimes against women. While the state recorded 14.5% of the total cases of crimes against women, it accounted for 12.4% of the total number of rape cases, second only to Madhya Pradesh, which recorded 12.5% of the total rape cases in 2016.

5.6.1. Legal and policy environment for women's safety

146. Some of the key policies and laws pertaining to gender-based violence in India include the following:

- National Policy for the Empowerment of Women[8] Year of adoption: 2001.
- India has signed and ratified Convention on Elimination of Discrimination against Women (CEDAW)[9]. Since then, the national policy for Women 2016 and other policies and amendments on acts has been reflecting the principles highlighted in the related international conventions. The goal of this Policy is to bring about the advancement, development and empowerment of women.
- The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redress) Act, 2013, is introduced to prevent and provide redress of complaints of sexual harassment. One of the main provisions in this act is that it calls for constituting an Internal Complaints Committee at each office or branch with 10 or more employees/workers.
- The Protection of Women from Domestic Violence Act, 2005[10] defines domestic violence, describes the powers and duties of protection officers, service providers and lists the procedures for obtain reliefs.
- The Dowry Prohibition Act, 1961 makes giving and demanding dowry as a punishable offence. Section 8B identifies Dowry Prohibition Officers who are appointed not only to prevent the offence but also to collect evidence and perform additional functions that are deemed to serve the purpose of the act.
- The Protection of Children from Sexual Offences Act, 2012[11] has been framed to strengthen the legal measures for protecting children from any kind of sexual offences. Despite having sexual offences covered under different sections of Indian Penal Code, those existing sections do not entirely cover similar offences against children. Recognizing the children as a person of 18 years or below, the various offences have been clearly defined under this Act. The Act also defines the gravity of certain offences carried out against children and suggests stringent punishments accordingly.
- The Convention on the Rights of the Children[12] lays out a universal definition of 'child'. It articulates how children should be treated in a non-discriminatory manner and calls for action that considers the best interests of the child.
- India ratified the Convention for the Suppression of the Traffic in Persons and of the Exploitation of the Prostitution of Others[13] and following that, the country enacted The Immoral Traffic (Prevention) Act in 1956 and punishes trafficking in relation to prostitution.

5.6.2. State-level mitigation measures

- Registration of laborers: The state agencies have undertaken registration of laborers in collaboration with the labor department across the five states. This initiative covers migrant laborers as well and is beneficial for them to access health benefits, pension and several other safety nets deployed by the government. Additionally, it helps the state agencies keep track of

[8] "Draft National Policy for Women 2-16_0.pdf" on http://wcd.nic.in/sites/default/files
[9] http://treaties.un.org/
[10] "TheProtectionofWomenDomesticViolenceAct2005.pdf" on http://ncw.nic.in/acts
[11] "childprotection31072012.pdf" on http://wcd.nic.in/sites/default/files
[12] http://www.unicef.org/crc/files/Rights_overview.pdf
[13] http://www.ohchr.org/en/professionalinterest/pages/trafficinpersons.aspx

laborers on-site.

- Separate toilets: While all camp-sites had separate toilet facilities for men and women laborers, it was noticed that several sites might not have adequate facilities to match the number of laborers staying and working on sites. A screening checklist will be created to monitor adequate provision of infrastructure at camp sites and ensure safety of women laborers.
- Grievance redress mechanism on-site: An established procedure to address complaints is being rolled-out across sites.
- Safety information on-site: Project sites will be required to prominently displayed safety related information for laborers.
- Awareness amongst communities: Across the five states, the project will undertake community level consultations and prominently display information related to the general helpline number, as well as contact details of junior/field engineers in case instances involving laborers come to the forefront.

5.7. ENVIRONMENTAL REGULATORY COMPLIANCE

147. In addition to the above, the investments should also comply with all the applicable environmental regulations and should secure required clearances / authorizations. **Table 5-3 Error! Reference source not found.**and **Table 5-4** provide a summary of such clearances and permissions.

Table 5-3: Environmental Regulatory Requirements for Namami Gange investments

S. No.	Type of Clearance	Applicability	Project Stage	Responsibility	Time Required
1	Environmental Clearance from MoEF&CC/SIAA	Applicable for select investments	Pre-Construction	EA	Not Applicable
2	Forest Clearance for land diversion	For forest land acquisition	Pre-Construction	EA	6-8 Months
3	Tree felling permission	For roadside tree cutting, incase sewers are to be laid	Pre-construction	EA	15 days
4	NOC and consents under Air, Water & Environment Act and noise rules from SPCB	For establishment of construction camp.	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months
5	NOC and consents under Air, Water & Environment Act and noise rules from SPCB	For operating construction plant, crusher, batching plant etc.	Construction stage (Prior to initiation of any work	Contractor	1-2 Months
6	Explosive License from Chief Controller of Explosives	For storing fuel oil, lubricants, diesel etc. at construction camp	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months
7	Permission for storage of hazardous chemical from CPCB	Manufacture storage and Import of Hazardous Chemical	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months
8	Quarry Lease Deed and Quarry License from State Department of Mines and Geology	Quarry operation (for new quarry)	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months

S. No.	Type of Clearance	Applicability	Project Stage	Responsibility	Time Required
9	Permission for extraction of ground water for use in road construction activities from State Ground Water board	Extraction of ground water	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months
10	Permission for use of water for construction purpose from irrigation department	Use of surface water for construction	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months
11	Labour license from labour commissioner office	Engagement of Labour	Construction stage (Prior to initiation of any work)	Contractor	2-3 Months

Table 5-4: Environmental Regulatory Compliance during Construction and Operation of Namami Gange Investments

S. No	Project Portfolio	Applicable Legislations	Obligations	Responsibility
A Sewerage & Sanitation Investments				
1.	Laying entirely new sewer Net Work or extension to existing network including providing house connections and gravity based interception and diversion arrangements to drains carrying sanitary sullage/dry weather flow	None	• Ensure Air and Noise Quality is within stipulated limits of SPCB's • Ensure minimum hindrance to traffic, pedestrians and minimum interruption to services	• Contractor during construction and operating agency during operation & maintenance • ULB/EA/Contractor
2.	Sewerage Network and Pumping Stations	Air Act, 1981 & Noise Rules as per EP Act, 1986	• Ensure Air and Noise Quality is within stipulated limits of SPCB's	• Contractor during construction and operating agency during operation & maintenance • ULB/EA/Contractor
3.	Sewerage Network, Pumping Station and Treatment Plant	Water Act, 1974 Hazardous Wastes (Management and Handling) Amendment Rules, 2000	• Secure Consent to establish and Operate for sewage treatment plant from SPCBs and Ensure Air and Noise quality is within the stipulated limits of SPCB and CPCB	• Contractor during construction and operating agency during operation & maintenance • ULB/EA/Contractor
4.	Low Cost Sanitation	None	• Ensure Air and Noise Quality is within stipulated limits of SPCB's • Ensure minimum hindrance to traffic, pedestrians and minimum interruption to services	
5.	Generators at Sewage Pumping Stations and Sewage Treatment Plant	Air Act 1981 & Noise Rules as per EP Act, 1986	• Secure Consent to establish and Consent to Operate for sewage treatment plant from SPCBs	ULB/EA/Contractor
			• Ensure Air and Noise quality is within the stipulated limits of SPCB and CPCB	
B Industrial Pollution Control Investments				
1.	Common Effluent Treatment Plants	Hazardous Wastes (Management and Handling) Amendment Rules, 2000	• Secure the Consent to Establish and Consent to Operate from SPCBs • Obtain Environmental Clearance from MOEF&CC • Ensure Air, water(surface and ground)and	ULB/ EA/ Contractor

S. No	Project Portfolio	Applicable Legislations	Obligations	Responsibility
			Noise Quality is within stipulated limits of SPCB's/CPCB	
2.	Hazardous Waste Receiving, Treatment, Storage and Disposal Facilities	Hazardous Wastes (Management and Handling) Amendment Rules, 2000	• Secure the Consent to Establish and Consent to Operate from SPCBs • Obtain Environmental Clearance from MOEF&CC • Ensure Air, water(surface and ground)and Noise Quality is within stipulated limits of SPCB's/CPCB	ULB/ EA/ Contractor
C Solid Waste Management Facilities				
A.	Engineered Landfill Sites	MSW Rules, 2000 Air, Act, Water Act and EPA	• Secure the Consent to Establish and Consent to Operate from SPCBs • Obtain Environmental Clearance from MOEF&CC • Ensure Air, water(surface and ground)and Noise Quality is within stipulated limits of SPCB's/CPCB	ULB/ EA/ Contractor
B.	Composting Facilities	MSW Rules, 2000 Air Act Water Act and EPA	• Secure the Consent to Establish and Consent to Operate from SPCBs • Obtain Environmental Clearance from MOEF&CC	ULB/ EA/ Contractor
			• Ensure Air, water(surface and ground) and Noise Quality is within stipulated limits of SPCB's/CPCB • Ensure no odor and fly nuisance in and around the waste segregation units within the compost yard through appropriate mitigation measures	
D River Front Development Schemes				
A.	River front development and beautification schemes	None	• Ensure Air and Noise Quality is within stipulated limits of SPCB's • Ensure minimum hindrance to traffic, pedestrians and minimum interruption to services	ULB/ EA/ Contractor

S. No	Project Portfolio	Applicable Legislations	Obligations	Responsibility
B.	Construction of Bathing Ghats	None	• Ensure Air and Noise Quality is within stipulated limits of SPCB's • Ensure minimum hindrance to traffic, pedestrians and minimum interruption to services	ULB/ EA / Contractor
C.	Redevelopment of cremation grounds situated along river banks	None	• Ensure Air and Noise Quality is within stipulated limits of SPCB's • Ensure minimum hindrance to traffic, pedestrians and minimum interruption to services	ULB/ EA/ Contractor
D.	Modification of electric /CNG crematoriums situated along river banks	Air Act, 1981	Secure No Objection Certificate from SPCB • Consent to establish • Consent to Operate • Ensure Water, Air and Noise quality is within the stipulated limits of SPCB.	ULB/EA/ Contractor

148. The Operational Policies of World Bank that are applicable for the project has been detailed out in **Table 5-3.**

6. RESETTLEMENT POLICY AND LAND ACQUISITION FRAMEWORK (RPLAF)

6.1. INTRODUCTION

149. River Ganga has significant economic, environmental and cultural value in India. Rising in the Himalayas and flowing into the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of north and eastern India. The Ganga basin – which also extends into parts of Nepal, China and Bangladesh – accounts for 26 per cent of India's landmass, 30 per cent of its water resources and more than 40 per cent of its population. The Ganga also serves as one of India's holiest rivers whose cultural and spiritual significance transcends the boundaries of the basin.

150. Despite its importance, extreme pollution pressures pose a great threat to the biodiversity and environmental sustainability of the Ganga, with detrimental effects on both the quantity and quality of its flows. Increasing population in the basin and haphazard urbanization and industrial growth has significantly impacted the water quality of River Ganga, particularly during the dry season.

151. The previous attempt to clean the river, such as Ganga Action Plan (GAP) launched in 1985 have provided some gains in arresting rate of water quality degradation, but lot more needs to be done. The lessons drawn from this prior experience indicate that improving water quality in the Ganga three-pronged approach has been adopted as mentioned below:

(iv). Establishing a basin-level, multi-sectoral framework for addressing pollution in the river (including national/state policies and river basin management institutions);
(v). Making relevant institutions operational and effective (e.g. with the capacity to plan, implement and manage investments and enforce regulations); and,
(vi). Implementing a phased program of prioritized infrastructure investments (with emphasis on sustainable operations and mobilization of community support)

152. As a major first step in this direction, the Government of India (GoI) has established the National Ganga River Basin Authority (NGRBA) in 2009 and National Council for River Ganga (Rejuvenation, Protection and Management) in 2016, as an Authority has been created for comprehensive management of the river. The NGRBA was established through Gazette notification of the Government of India S.O. No. 521 (Extraordinary) dated 20 February 2009 under section 3 of the Environment Protection Act, 1986, as an empowered planning, financing, monitoring and coordinating authority for the Ganga River.

153. The Namami Gange Programme launched in 2015 has adopted a river-basin approach and has been given a multi- sectoral mandate to address both water quantity and quality aspects. Under Namami Gange Programme, diverse set of interventions for cleaning and rejuvenation of river Ganga have been taken up. These include pollution abatement activities including sewage, industrial effluent, Solid Waste etc., River Front Management, Aviral Dhara, Rural Sanitation, Afforestation, Biodiversity Conservation, Public Participation etc. The programme covers short term, medium term and long-term activities.

154. The pace of these projects has gathered momentum and all efforts are being made to complete these projects well within the respective timelines.

155. National Ganga River Basin Project (NGRBP) started in 2011 and funded by World Bank has now been included as a part of Namami Gange Programme.

6.2. NATIONAL MISSION FOR CLEAN GANGA (NMCG)

156. The National Mission for Clean Ganga was established in the form of a national level Program Management Group (PMG) in 2011, for seeking $1bn assistance from World Bank. Cabinet Committee on Economic Affairs (CCEA) accorded approval on 28.04.2011 for the World bank assisted National Ganga River Basin Project (NGRBP) at an estimated cost of Rs. 7000 crore to be implemented by NMCG as a registered Society under the Societies Registration Act 1860, to act as an implementation arm of NGRBA (External Funding).

157. With change in Allocation of Business Rules, 1961 vide Gazette Notification dated 31.07.2014, the work related to Ganga & its tributaries was transferred to Ministry of Water Resources, River Development & Ganga Rejuvenation (Now Ministry of Jal Shakti) from the Ministry of Environment & Forests. The next major development in the evolution of NMCG was launch of Namami Gange Programme on 13th May 2015 with the approval of Cabinet as a Central Sector Scheme (100% central assistance), with components including all objectives of NGRBA. The non-lapsable fund of Rs 20,000 crore was earmarked for five-year period, 2015-2020.

158. The Namami Gange Program with a definite timeline of five year required a truly empowered implementing body. This realization led to reconstitution of NMCG as an Authority on 7th October 2016. With simultaneous dissolution of NGRBA, the present form of NMCG as an Authority is the designated body to take all necessary decisions and actions for pollution abatement and rejuvenation of River Ganga.

159. Later in 2019, **Ministry of Jal Shakti** was formed by merging Ministry of Water Resources, River Development & Ganga Rejuvenation and Ministry of Drinking Water and Sanitation. Now, NMCG falls under the Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti.

6.3. BRIEF PROJECT DESCRIPTION

160. The earlier NGRBP programme usually has 70% central share and 30% state share at the sub-project levels and support for 5 years of Operation and Maintenance. After launching of Namami Gange programme almost all the new projects sanctioned under Namami Gange Programme would have 100% funding from the Central Government for the entire life cycle cost of the assets created, which includes 15-year Operation & Maintenance cost as well. Namami Gange Programme has been segregated into three different components:

- **Component 1**: **Institutional Development:** This component will support to the national, state and municipal governments to strengthen implementation and financing arrangements and develop a framework to improve Ganga river basin management.
- **Component 2: Infrastructure Development:** Pertains to the initiatives to be undertaken under National Ganga Plan in 5 major sectors i.e. Infrastructure Development (Sewage Treatment, River Front Development, and Industrial Wastewater Treatment & Solid Waste Management), Ecological Sustainability and Research & Development and Communication & Public Outreach.
- **Component 3: Program communication and management:** NMCG conducts a range of vibrant communication activities ranging from ground-level community engagement exercises, social and traditional media outreach, public debates and lectures, to a flagship mass media campaign.

161. The Ganga-2 project is basically a continuation of Ganga-1 project with a portfolio of investment of US$400 million under Ganga-2. The portfolio of river pollution mitigation projects to be implemented under the Namami Gange and its components areas under.

162. As regards to the **Social Impacts**, the requirement of land for all these investments is rather small. However, wherever there is displacement of titleholders/non-titleholders, it may involve resettlement issues and may result in temporary loss of access to private and common properties during construction. Social issues that may arise due to these kinds of investments are:

- Direct purchase of small land parcels for SPS/ Lifting station
- Land acquisition / taking for sewerage treatment plant leading to loss of livelihood / displacement of non-titleholders /titleholders
- Temporary land taking causing economic displacement
- Temporary loss of common grazing area

163. So far, in most cases, SPS and STPs have been designed in existing government land that is free of encroachment and other encumbrances. In case of requirement of private land, EAs have preferred direct purchase based on willing buyer – willing seller. Wherever, government land has been taken, non-titleholders have been compensated for assets and assisted in relocation (e.g., Patna RFD).

164. Most of these investments would be concentrated in one location and the requirement of land for these investments is rather small as compared to other infrastructure development investments. Hence, the social impacts would be minimal but in case of displacement Resettlement Action Plan[14] need to be prepared.

165. NMCG has developed an Entitlement Matrix, which is in line with Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement 2013 other applicable laws and Acts of the Government of India to address the issues related with affected persons.

166. R&R will be undertaken as per the entitlement matrix or State R&R policy where applicable, to address the issues related to the resettlement and rehabilitation of the affected persons.

167. This aims to resettle and rehabilitate the affected persons on account of its investments in a manner that they do not suffer from adverse effects and shall improve or at the minimum retain their previous standard of living, earning capacity and production levels. It is also the endeavor of the Namami Gange program that the resettlement shall minimize dependency and be sustainable socially, economically and institutionally.

168. Special attention will be paid for the improvement of living standards of marginalized and vulnerable groups.

169. The broad principles of the R&R policy are as below:

- The adverse impacts on persons affected by the project would be avoided to the extent possible.
- Where the adverse impacts are unavoidable, the project-affected persons will be assisted in improving or regaining their standard of living. Vulnerable groups will be identified and assisted to

[14]e.g. places where Government land is available and no displacement is involved a Generic ESMP is prepared/to be prepared. Places where private land acquisition is involved /physical displacement or displacement of Non-title holders is required (e.g. cases like Patna RFD and Begusarai WWT), an abbreviated RAP /RAP is prepared/to be prepared.

improve their standard of living.

- All information related to resettlement preparation and implementation will be disclosed to all concerned, and community participation will be ensured in planning and implementation.
- Private negotiations will also be used for land acquisition as required.
- The persons affected by the project who does not own land or other properties but who have economic interest or lose their livelihoods will be assisted as per the broad principles brought out in this policy.
- Before taking possession of the acquired lands and properties, compensation and R&R assistance will be made to those who are available and willing to receive the entitlements in accordance with this policy.
- There would be no/or minimum adverse social, economic and environmental effects of displacement on the host communities but if needed specific measures would be provided.
- Broad entitlement framework of different categories of project-affected people has been assessed and is given in the entitlement matrix. Provision will be kept in the budget. However, anyone moving into the project area after the cut-off date will not be entitled to assistance.
- Appropriate grievance redress mechanism will be established at project level to ensure speedy resolution of disputes.
- All activities related to resettlement planning, implementation, and monitoring would ensure involvement of women. Efforts will also be made to ensure that vulnerable groups are included.
- All consultations with PAPs shall be documented. Consultations will continue during the implementation of resettlement and rehabilitation works.
- Cut of Date shall be preliminary notification under RFCTLAR&R Act 2013 for titleholders and in case of Non-title holder's end date of socio –economic survey.

170. As required, a Resettlement Action Plan will be prepared including a fully itemized budget and an implementation schedule.

6.4. PREPARATION OF RESETTLEMENT ACTION PLANS

171. Having identified the potential impacts of the relevant investments, the next step is to develop action plans to mitigate the impacts. The RAPs will provide the link between the impacts identified and proposed mitigation measures to realize the objectives of involuntary resettlement. The investment specific RAP will consider magnitude of impacts and accordingly prepare a resettlement plan that is consistent with this framework before the sub-project is accepted for Namami Gange program financing. Any affected person will be assisted as provided in the National Policy or State Policy where applicable on resettlement and rehabilitation.

a) The above RAP plan will be prepared as soon as subproject is finalized, prior to NMCG/SMCG's approval of corresponding civil works bid document.

b) Investments that are not expected to have any land acquisition or any other significant adverse social impacts; on the contrary, significant positive social impact and improved livelihoods are exempted from such interventions.

6.5. SUB PROJECT APPROVAL

172. If a sub-project involves land acquisition against compensation or loss of livelihood or shelter, the implementing agency shall:

a) not approve the subproject until a satisfactory RAP has been prepared and shared with the affected person and the local community; and

b) not allow works to start until the compensation and assistance has been made available in accordance with the framework.

6.6. PROCEDURE TO BE FOLLOWED FOR SOCIAL IMPACT ASSESSMENT (SIA)

173. The EA will undertake a survey for identification of the persons and their families likely to be affected by the project. Every survey shall contain the following municipality or ward / village-wise information of, the project affected families:

i. Members of families who are residing, practicing any trade, occupation or vocation in the project affected area;

ii. Project Affected Families who are likely to lose their house, commercial establishment, agricultural land, employment or are alienated wholly or substantially from the main source of their trade occupation or vocation or losing any other immovable property.

iii. Agricultural labourers and non-agriculture labourers.

iv. Families belonging to scheduled caste categories

v. Vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above the age of 50 years of age, who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise covered as part of a family;

vi. Families that are landless (not having homestead land, agriculture land or ether homestead or agriculture land) and are below poverty line, but residing continuously for a period of not less than three years in the affected area preceding the date of declaration of the affected area;

vii. Losing access to private property or common property resources

174. The EA on completion of the survey will disseminate the survey results among the affected community. Based on the social impact assessment survey, EA will prepare an action plan to mitigate or minimize the adverse impacts as identified during the survey. The draft mitigation plan in form of resettlement action plan (RAP) will be again disseminated among the affected individuals/ community. The feedback received from the affected groups will be incorporated to the extent possible before finalization of the RAP.

175. Every-draft Resettlement Action Plan (RAP) prepared shall contain the following:

a) The extent of area to be acquired for the project, the name(s) of the corresponding village(s)/ municipality area and the method employed for acquiring land with the relevant documentation.

b) village wise or municipality wise list of affected families and likely number of displaced persons by impact category

c) family-wise and the extent and nature of land and immovable property in their possession indicating the survey numbers thereof, held by such persons in the affected zone;

d) Socio-economic survey of affected people including income/asset survey of PAPs;

e) a list of agricultural labourers in such area and the names of such persons whose livelihood depend on agricultural activities;

f) a list of persons who have lost or are likely to lose their employment or livelihood or who have been alienated wholly and substantially from their main sources of occupation or vocation consequent to the acquisition of land and / or structure for the project;

g) information on vulnerable groups or persons for whom special provisions may be made;

h) a list of occupiers, if any;

i) a list of public utilities and Government buildings which are likely to be affected;

j) a comprehensive list of benefits and packages which are to be provided to project affected families by impact category;

k) details of the extent of land available which may be acquired in settlement area for resettling and allotting of land to the project affected families;

l) details of the basic amenities and infrastructure facilities which are-to be provided for resettlement;

m) the entitlement matrix;

n) the time schedule for shifting and resettling the displaced families in resettlement zones;

o) grievance redress mechanism;

p) institutional mechanism for RAP implementation;

q) monitoring and evaluation indicators and mechanism;

r) budget; and

s) Any other particulars as the Administrator for Resettlement and Rehabilitation may think fit to include for the information of the displaced persons.

6.7. LAND ACQUISITION, R&R BENEFITS FOR AFFECTED FAMILIES

176. In case land/house is acquired, as per Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLAR&R) Act, 2013 the compensation will be paid to the land holders/house owners and the resettlement and rehabilitation (R&R) benefits shall be extended to all the affected families as per provisions of the Act or state R&R Policies, where applicable and entitlement framework of this ESMF. Any affected and/or displaced family/person will be assisted as per the provisions of the RFCTLAR&R Act 2013 and/or state R&R Policies wherever applicable.

177. Value of land to be determined as per various sections of the RFCTLAR&R Act, 2013 namely:

- Section 11 (1) publication of preliminary notification
- Section 26 (Market value of the land)
- Section 28 (parameters to be considered for market value)

- Section 29 (determination of value of attached things to the land).
- Section 30 (award of solatium)
- Project will be guided by First Schedule of RFCTLAR&R Act, 2013 for determination of land value.
- In case of land purchase through private negotiation, section 46 of RFCTLAR&R Act 2013 will be applicable. Project may also use any state specific instrument for direct purchase of land.

178. Provisions for R&R at the community level will be as follows:

- The common property resources and the community infrastructure shall be relocated in consultation with the community.
- During construction phase alternative access shall be provided in case of loss of access to private land / or common resource property.

179. Any unforeseen impacts shall be document and mitigated based on the principles agreed upon in policy Guideline.

180. The following is the entitlement matrix, as per RFCTLAR&R Act, 2013. The comparative analysis of RFCTLAR&R Act, 2013and World Bank's Operational Policy 4.12 is at **Appendix V**.

Table 6-1: Entitlement Matrix

Type of Impact/Loss	Unit of Entitlement	Entitlements as per Policy
1. Agricultural Land		
Acquisition of agricultural land	Land Holder	• Cash compensation as defined in First Schedule of RFCTLAR&R Act, 2013 or any state policy. • Where jobs are created through the project, after providing suitable training and skill development in the required field, make provision for employment at a rate not lower than the minimum wages provided for in any other law for the time being in force, to at least one member per affected family in the project or arrange for adjoin such other project as may be required; or one- time payment of five lakhs rupees per affected family; or(c) annuity policies that shall pay not less than two thousand rupees per month Per family for twenty years with appropriate indexation to the Consumer Price Index for Agricultural Labourers (**RFCTLARR Act, 2013, Second Schedule – clause 4**). • In case of a project involving land acquisition on behalf of an acquiring body, each affected family which is involuntarily displaced shall get a monthly subsistence allowance equivalent to three thousand rupees per month for a period of one year from the date of award. (**RFCTLARR, 2013 – Second schedule; clause 5 para1**) • Each affected family that is displaced and has cattle, shall get financial assistance of such amount as the appropriate Government may decide but not less than Twenty-Five thousand rupees, for construction of cattle shed. ***(RFCTLAR&R Act, 2013 Second Schedule clause)*** • Each affected family shall be given a one-time resettlement allowance of fifty thousand rupees only (**RFCTLARR,2013 – Second schedule; clause 10**) • In case of a project involving land acquisition on behalf of

Type of Impact/Loss	Unit of Entitlement	Entitlements as per Policy
		an acquiring body, the stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the acquiring body. The land for house allotted to the affected families shall be free from all encumbrances. The land or house allotted may be in the joint names of wife and husband of the affected families **(RFCTLAR&R Act, 2013. Second Schedule – clause 11)**.
2. House		

Type of Impact/Loss	Unit of Entitlement	Entitlements as per Policy
i) Acquisition of House	Affected Family	• If a house is lost in rural area, a constructed house shall be provided as per the Indira Awas Yojana specifications. If a house is lost in urban area, a constructed house shall be provided, which will be not less than 50 sq.mts. in plinth area (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para 1**). • Provided that any such family in urban areas which opts not to take the house offered, shall get a one-time financial assistance for house construction, which shall not be less than one lakh fifty thousand rupees (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para3**). • Provided further that if any affected family in rural areas so prefers, the equivalent cost of the house may be offered in lieu of the constructed house (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para 4**). • Each affected family which is displaced from the land acquired shall be given a monthly subsistence allowance equivalent to three thousand rupees per month for a period of one year from the date of award (**RFCTLARR, 2013 – Second schedule; clause 5 para1**). • Right to salvage material from the demolished structures • Three months' notice to vacate structures • One-time financial assistance of such amount as the appropriate Government may decide but not less than fifty thousand rupees, for shifting of the family, building materials, belongings and cattle. (**RFCTLARR, 2013 – Second schedule; clause 6**) • Each affected family that is displaced and has cattle, shall get financial assistance of such amount as the appropriate Government may decide but not less than Twenty Five thousand rupees, for construction of cattle shed. (**RFCTLARR, 2013 – Second schedule; clause7**) • Each affected person who is rural artisan, small trader or self-employed person who has been displaced shall get a one-time financial assistance of such amount as the appropriate Government may decide but not less than (Rs. 25,000/-) twenty-five thousand rupees, for construction of working shed or shop. (**RFCTLARR, 2013 – Second schedule; clause 8**) • Each affected family shall be given a one-time resettlement allowance of fifty thousand rupees only (**RFCTLARR,2013-Second schedule; clause 10**) • In case of a project involving land acquisition on behalf of an acquiring body, the stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the acquiring body. The land for house allotted to the affected families shall be free from all encumbrances. The land or house allotted may be in the joint names of wife and husband of the affected families **(RFCTLAR&R Act, 2013. Second Schedule – clause 11)**.
iii)BPL without homestead land and residing in the area for not less than three years	Affected Family	• Has been residing in the affected area continuously for a period of not less than three years preceding the date of declaration of the affected area and which has been involuntarily displaced from such area, shall be entitled • If a house is lost in rural area, a constructed house shall be provided as per the Indira Awas Yojana specifications. If a house is lost in urban area, a constructed house shall be

Type of Impact/Loss	Unit of Entitlement	Entitlements as per Policy
		provided, which will be not less than 50 sq.mts. in plinth area (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para1**). • Provided that any such family in urban areas which opts not to take the house offered, shall get a one-time financial assistance for house construction, which shall not be less than one lakh fifty thousand rupees (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para 3**). • Provided further that if any affected family in rural areas so prefers, the equivalent cost of the house may be offered in lieu of the constructed house (**RFCTLAR&R Act, 2013. Second Schedule – Clause 1 para 4**). • Right to salvage material from the demolished structures • Three months' notice to vacate structures • One-time financial assistance of such amount as the appropriate Government may decide but not less than fifty thousand rupees, for shifting of the family, building materials, belongings and cattle. (**RFCTLARR, 2013 – Second schedule; clause 6**)
3. Livelihood losses		
i) Rural artisan, small trader or self-employed Person displaced	Each affected person	• Will get a one-time financial assistance of such amount as the appropriate Government may decide but not less than (Rs. 25,000/-) twenty-five thousand rupees, for construction of working shed or shop.**(RFCTLAR&RAct,2013.Second Schedule – clause 8**)
ii) Employment Assistance	Affected Family	• Where jobs are created through the project, after providing suitable training and skill development in the required field. make provision for employment at a rate not lower than the minimum wages provided for in any other law for the time being in force, to at least one member per affected family in the project or arrange for a job in such other project as may be required **(RFCTLAR&R Act 2013, Second Schedule, Clause4(a).)**; • The acquiring body shall give preference to the affected persons or their groups or cooperatives in the allotment of outsourced contracts, shops or other economic opportunities coming up in or around the project site; and • The acquiring body shall give preference to willing landless labourers and unemployed affected persons while engaging labour in the project during the construction phase.
4. Other Benefits		
i) Additional assistance for Scheduled Caste families	Affected Family	Appropriate level in Scheduled Areas under the Fifth Schedule to the Constitution, as the case may be, shall be obtained. in all cases of land acquisition in such areas, including acquisition in case of urgency, before issue of a notification under this Act, or any other central Act or a state Act for the time being in force **(RFCTLAR&R Act, 2013 section 41(3)).** • In case of a project involving land acquisition on behalf of a Requiring Body which involves involuntary displacement of the Scheduled Castes families, a Development Plan shall be prepared, in such form as may be prescribed. Laying down the details of procedure for settling land rights due, but not settled and restoring titles of the Scheduled Castes on the alienated land by undertaking a special drive together with land acquisition **(RFCTLAR&R Act, 2013 section 41 (4)).** • Where the affected families belonging to the Scheduled

Type of Impact/Loss	Unit of Entitlement	Entitlements as per Policy
		Castes are relocated outside of the district then, they shall be paid an additional twenty-five per cent rehabilitation and resettlement benefits to which they are entitled in monetary terms along with a one-time entitlement of fifty thousand rupees **(RFCTLAR&R Act, 2013 section 41(11)).** • Provided that in every project those persons losing land and belonging to the Scheduled Castes will be provided land equivalent to land acquired or two and a one- half acres, whichever is lower **(RFCTLAR&R Act 2013, Second Schedule; clause2**) • In addition to subsistence allowance of INR 50,000, the Scheduled Castes displaced shall receive an amount equivalent to fifty thousand rupees. (**RFCTLAR&R Act, 2013, Second Schedule,** **, clause 5, para2**)
ii)One time Resettlement allowance	Any Affected family not already covered under clause 2 (iii)	• Shall be entitled to one-time resettlement allowance of fifty thousand rupees **(RFCTLAR&R Act 2013, Second Schedule clause10**).
5. Exemptions from stamp duty etc.		
		In case of a project involving land acquisition on behalf of an acquiring body, the stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the acquiring body. The land and house allotted will be in the joint names of wife and husband of the affected families. The land for house allotted to the affected family shall be free from all encumbrances (**RFCTLAR&R Act, 2013 clause 11**)
6. Trees and standing crops		
Trees on land being acquired	Land holders	• Market value of the trees to be computed as per the provisions of Horticulture and Forest Department.
Standing crops at the time of acquisition, if any	Land holders	• Advance notice to harvest crops • Market value of standing crops to be computed as per provisions of Agriculture Department.

Please note that this is bare minimum and Project should also consider the additional R&R provisions given in state specific policy / rules.

181. According to the assessment of the preliminary list of prioritized works, there may be need for private land acquisition in some cases which could result in involuntary displacement and loss of livelihood. However, project involuntary resettlement is likely to be of small scale and would not trigger the need for a full resettlement action plan. Nevertheless, as a precaution, the classification of subprojects of the ESMF describes actions and procedures to be followed in case any involuntary displacement does occur. If involuntary displacement takes place, the principles and procedures defined in the Framework will apply.

182. Once the location of the works is known during project implementation, individual resettlement or land acquisition plans will be prepared for each sub-project. The Resettlement Action Plans will be reviewed and approved by SMCG/ NMCG before being implemented.

183. During DPR preparation, analysis of alternatives will be carried out to avoid or reduce involuntary acquisition of private land.

184. Immediately after FR approval and in parallel with DPR preparation, the EA along with the ULB would initiate land acquisition process for the project. This would facilitate identification of the land, its survey and preliminary cost estimation so that the State Govt. is in readiness to issue the appropriate

notification under prevalent LA Act upon approval of DPR for speedy acquisition of the land.

6.8. CONSULTATION AND INFORMATION DISCLOSURE

6.8.1. Consultation

185. The Consultation process envisages involvement of all the stakeholders at each stage of project planning and implementation. The EA /SMCG will be responsible for ensuring participation of the community at sub-project level. Involvement of the community is not limited to interactions with the community but also disclosing relevant information pertaining to the project tasks. Community participation shall be undertaken at the following stages:

- Sub Project identification stage-to sensitize the community about the project and their role;
- Planning Stage-for disseminating information pertaining to the project, work schedule and the procedures involved; finalization of project components with identification of impacts, entitled persons, mitigation measures; and Grievance Redress; and
- Implementation Stage - for addressing temporary impacts during construction and monitoring for transparency in the project implementation

6.8.2. Identification Stage

186. Dissemination of project information to the community and relevant stakeholders is to be carried out by the EA at this stage of the project initiative. The community at large shall be made aware of the project alternatives and necessary feedback is to be obtained. This should include the process being followed for prioritization of the identified investments. Community and other stakeholders should be involved in the decision making to the extent possible. Information generated at this stage should be documented for addressal of queries arising out of the Right to Information Act, 2005.

6.8.3. Project Planning Stage

187. Sub-project information is to be distributed amongst the community towards increasing their awareness and their roles and responsibilities. Planning stage is intended to be an interactive process with the community at least in two stages. Initially while finalizing the best fit alternative to a sub-project and second at the finalization of the detailed designs. This would be a joint responsibility of the consultants undertaking the design if not carried out by the EA in house and the EA itself.

188. Consultations with Project Affected Persons and their profiling are mandatory as per the requirements of SIA and preparation of RAP. This needs to be done as socio- economic and census surveys as part of the detailed designs. Consultations with respect to and cultural aspects are to be carried out as part of the Social Impact Assessments for all alternatives and the selected alternative sub-project option.

6.8.4. Implementation Stage

189. Consultations as part of the implementation stage would be direct interactions of the implementation agency with the Project Affected Persons. These would comprise of consultations towards relocation of the PAPs, relocation of cultural properties, and towards addressal of impacts on common property resources (CPRs) such as water bodies, places of religious importance, community buildings, trees etc.

190. With the implementation of the R&R provisions in progress, consultations and information dissemination is to be undertaken to let the affected persons informed of the progress. Implementation

stage also involves redress of grievances in case of R&R aspects as well as relocation of common property resources through the grievance redress mechanisms. These would usually be one to one meeting of PAP or community representatives with the grievance redress committees established for the project.

6.8.5. Information Disclosure

191. The mechanism of information dissemination should be simple and be accessible to all. Two of the important means that have been followed until now include briefing material and organization of community consultation sessions. The briefing material(all to be prepared in local language) can be in the form of (a) brochures (including project information, land requirements and details of entitlements including compensation and assistance to be given to the PAPs)that can be kept in the offices of local self-government (municipal office in case of urban area and gram panchayat office in case of rural area) and EA;(b) posters to be displayed at prominent locations and (c) leaflets that can be distributed in the impacted zone of the sub project. Consultation meetings should also be organized at regular intervals by the EA to acquaint the PAPs of the following:

- Timeline and progress of the project;
- Information on compensation and entitlements;
- Information on land acquisition and market valuations of property;
- Time line for acquisition.

192. Also, opinion and consensus of the community needs to be sought for common and cultural property relocation. Information disclosure procedures are mandated to provide citizen centric information as well as all documentation necessary for addressing any queries under Right to Information Act that came into effect from October 2005. Disclosure of information will enhance governance and accountability specifically with respect to strengthening of monitoring indicators to help Namami Gange program.

193. This Information Disclosure Policy is intended to ensure that information concerning the Namami Gange program, activities will be made available to the public in the absence of a compelling reason for confidentiality. Information shall be provided in a timely and regular manner to all stakeholders, affected parties, and the general public. Access by the public to information and documentation held or generated by NMCG and EAs will facilitate the transparency, accountability, and legitimacy as well as operations overseen by it. As a part of its disclosure policy, all documents shall be made available to the public in accordance with relevant provisions of the RTI Act, except when otherwise warranted by legal requirements. A designated Information Officer shall be responsible for ensuring timely and complete dissemination in accordance with this policy.

6.8.6. Information to be disclosed

194. The Table **6-2** below specifies the type of additional information and frequency of dissemination for investments which are financed either from domestic or donors' funds. In addition to the information specified in the table, the following information shall also be displayed / disseminated, wherever applicable.

- Project specific information need to be made available at each contract site through public information kiosk
- Hard copy of the ESAMP and RAP shall be placed at construction site and also at SMCG office. Community will be informed about the same during finalization of RP / ESMP and through social intermediation process".

- Project Information brochures shall be made available at all the construction sites as well as the office of implementation agency and the office of Engineer in charge.
- Reports and publications, as deemed fit, shall be expressly prepared for public dissemination e.g., English versions of the SIA and RAP and Executive Summary of SIA and RAP in local language.
- Wherever civil work will be carried out a board will be put up for public information which will disclose all desired information to the public, for greater social accountability.
- All information will be translated into local language and will be disclosed to the public through the Panchayat, District Magistrate's office, concerned EA offices, websites of NMCG and SMCGs.

Table 6-2: Information to be disclosed

Topic	Documents to be disclosed	Frequency	Where
Resettlement, Rehabilitation and Land Acquisition	Resettlement Action Plan (RAP).	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	On the website of NMCG, SMCG and EAs The client would make the RAP available at a place accessible to displaced persons and local NGOs, in a form, manner, and language that are understandable to the PAPs in the following offices: DM's Office State and District Libraries Local municipal and *gram panchayat* office Office of the contractor Office of the EA
	Resettlement & Rehabilitation Policy translated in local language	Once in the entire project cycle.	Distributed among Project Affected Persons (PAP)
	Information regarding impacts and their entitlements in local language	Once at the start of the project and as and when demanded by the PAP.	Through one-to-one contact with PAPs. Community consultation List of PAPs with impacts and entitlements to be pasted in the EA office and website of SMCG and EAs
	R&R and LA monthly progress report.	10th day of every month	Website of EA. Hard copy in the office of EA and contractor in local language
	RAP Impact Assessment Report	At midterm and end of the RAP implementation	NMCG, SMCG and EA's Website in local language.
	Land Acquisition notifications	As required under the LA Act	SMCG and EA's website. Hard copy in the office of EA and contractor in local language
	Grievance redress process.	Continuous process throughout the project cycle.	On the web sites of NMCG, SMCG, EAs Hard copies in local language in the following offices: DM's Office Local municipal and gram panchayat office, Office of the contractor Office of the EA; Also PAPs to be informed on one to one contact by EAs

Topic	Documents to be disclosed	Frequency	Where
Public Consultation	Minutes of Formal Public Consultation Meetings	Within two weeks of meeting	On the web sites of NMCG/SMCG, EAs Hard copies in local language in the following offices: DM's Office Local municipal and *gram panchayat* office Office of the contractor Office of the EA
Other Documents	Environment and Social Management Framework (ESMF)	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	On the website of EA, SMCG, NMCG and World Bank
	Environment and Social Due Diligence Report (ESDDR)	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	On the website of EA, SMCG, NMCG and World Bank
	Environment and Social Management Plan (ESMP)	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	On the website of EA, SMCG, NMCG and World Bank
	Environment and Social Impact Assessment (ESIA)	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	On the website of EA, SMCG, NMCG and World Bank

6.8.7. Stakeholder mapping

195. Through the formal and informal consultation, stakeholder mapping has been done, identifying their interests concerned with the project activities, refer **Table 6-3**.

Table 6-3: Stakeholder Mapping

Stakeholder Category	Interests	Potential/Probable impacts
Primary stakeholders		
Project affected people	Access to the facility, Project entitlement, Time-bound delivery of benefits, enhanced quality of life	(+/-)
Beneficiaries	Access to the facility, Project entitlement, Time-bound delivery of benefits, enhanced quality of life	(+/-)
Secondary stakeholders		
NMCG; SMCG; Municipalities; EAs (For e.g., Uttarakhand Peyjal Nigam, UP Jal Nigam, Bihar Urban Infrastructure Development Corporation, Urban Development Department, Kolkata Metropolitan Development	Project implementation, Contracting; Project management, Monitoring and evaluation	(+/-)

Stakeholder Category	Interests	Potential/Probable impacts
Authority)		
NGOs, CSOs, Research institutes (GB Pant Institute of Himalayan Environment and Development, PSI, Shree Hari Ganga Samiti, IIT Kanpur, Ganga Sewak Samaj, WWF, CEE, Centre for flood management studies, Krishi Gram Vikas Kendra, IIT Kharagpur, Calcutta University, Ramakrishna Mission)	Development, Community participation, and Community welfare	(+/-)

196. This is a tentative mapping is likely to change during the project implementation. Each of these stakeholders will be part of the consultation process and their views will be incorporated into the project design. The key stakeholders in can be grouped into two categories viz., primary and secondary. Their respective roles are presented below:

6.8.8. Primary Stakeholders

197. Project Affected Persons (PAPs) have the following roles:

i) Participate in public meetings and identify alternatives to avoid or minimize displacement

ii) Assist DPR consultants and NGOs in developing and choosing alternative options for relocation and income generation

iii) Participate in census survey and meetings with host population

iv) Provide inputs to entitlement provisions, thus assisting in preparation of the resettlement action plan

v) Participate in grievance redress as members of grievance redress cells(GRC)

vi) Decide on relocation and management of common properties

vii) Labour and other inputs in the project

viii) Members of implementation committee

198. Beneficiaries and Host Population has the following roles:

i) Assist DPR consultants and NGOs in data collection and design

ii) Provide inputs to site selection

iii) Identify possible conflict areas with PAPs

iv) Identify social and cultural facilities needed at resettlement sites

v) Assist in identification and design inputs for IG schemes

vi) Help develop consultation process between hosts and PAPs.

vii) Manage common property

viii) Participate in local committees.

ix) Assist PAPs in integration with hosts.

6.8.9. Secondary Stakeholders

199. NMCG, SMCGs, EAs, Municipalities have the following roles:

i) Establish separate cell for social development

ii) Notification at various stages for land acquisition and joint measurement of land to be acquired along with the revenue department

iii) Design and approval of resettlement policy

iv) Coordinate with line departments such as telephone, state electricity board, public health engineering department and forest department for shifting of utilities and cutting of trees

v) Participate with NGOs in verification survey of PAPs and categorization of PAPs

vi) Participate in consultations with PAPs and beneficiaries

vii) Designing and distribution of ID cards along with NGO

viii) Coordinate and facilitate relocation of displaced persons including designing and construction of resettlement colony / vendor market; provision of basic amenities; distribution of plots / houses / to residential and/or commercially displaced persons

ix) Coordinate with NGO in identifying land for relocation of common property resources

x) Coordinate with civil construction contractor to relocate common property resources

xi) Permission and liaison with line departments for provision of basic amenities in resettlement colonies, land acquisition and income restoration schemes;

xii) Coordinate with revenue department for facilitating disbursement of compensation and resettlement and rehabilitation assistances

xiii) Monitoring of physical and financial progress

xiv) Approval of micro plans

xv) Participate in training programs for income restoration organized by NGOs

xvi) Consult with panchayat and block office to facilitate inclusion of PAPs' name for poverty alleviation schemes of government of India.

200. **NGOs have following roles:**

i) Develop rapport with PAPs and between PAPs and EAs;

ii) Verification of PAPs;

iii) Consultations with the community;

iv) Assess the level of skills and efficiency in pursuing economic activities, identify needs for training and organize programmes either to improve the efficiency and/or to impart new skills;

v) Assist PAP in receiving rehabilitation entitlements due to them;

vi) Motivate and guide PAP for proper utilization of benefits under R&R policy provisions;

vii) Assist PAPs in obtaining benefits from the appropriate development programmes;

viii) Help PAPs in increasing their farm income through provision of irrigation facility or improving farm practices;

ix) Ensure marketing of produce particularly those under self-employment activities;

x) Complete the consultation at the community level and provide support by describing the entitlements to the entitled persons (EPs) and assisting them in their choices;

xi) Accompany and represent the EPs at the Grievance Redress Committee meeting;

xii) Assist EPs to take advantage of the existing government housing schemes and employment and training schemes that are selected for use during the project;

xiii) Promote location specific Community Based Organizations (CBOs) of PAPs to handle resettlement planning, implementation and monitoring; and

xiv) Create awareness among PAPs of HIV/AIDS, trafficking of women and child, child labour, health and hygiene

6.9. LOW IMPACT CATEGORIES

201. Low impact category investments are those which are likely to cause minimal or no adverse environmental impacts on human populations or the physical environment. The impacts in case of low category investments are largely localized and are temporary in nature. In such cases, detailed ESA would not be required.

202. These investments would require the preparation of an Environmental and Social Mitigation Plan as a part of the DPR either as a separate chapter or a volume (as needed), analyzing the environmental and social issues and providing the corresponding mitigation measures. There will also be a separate section in the summary of the document mentioning the key mitigation measures proposed through the ESMP.

203. A Guidance Note for carrying out ESA is provided in **Appendix II**, and an outline Environment and Social Management Plan for low impact category investments is provided in **Appendix II**. However, during the project preparation, these measures shall be validated with actual site conditions and updated to make these more project-specifics.

204. All ESAs, ESMPs, and RAPs of all investments will be shared with the SMCGs for review and clearance. The NMCG and SMCGs may obtain expert opinion as necessary for reviewing environmental and social screening, ESAs, ESMPs and RAPs.

205. The EA/DPR consultant will prepare the ESMP in accordance with the specifications and conditions included in the bid documents. The generic terms of reference for the scope of DPRs would be suitably amended in each case in accordance with the screening and assessment provided in the FR.

6.10. STAKEHOLDER CONSULTATIONS AND DISCLOSURE OF ESA

206. Planning and design of all the investments will include adequate consultations with the project-affected groups and other stakeholders and will specifically focus on the project's environmental and social impacts. For High impact category investments, the consultation with these groups shall be carried out at least twice: (a) shortly after screening and before the terms of reference for the ESA are finalized; and (b) once a draft ESA report is prepared. In addition, such groups will be consulted throughout project implementation as necessary to address ESA-related issues that affect them. This will enable to elicit and address the concerns of the stakeholders and address them upfront in the project feasibility and design of the project.

207. In order to facilitate meaningful consultations and also effective participation of the stakeholders in the project, all the project related information will be shared with the likely project-affected groups and local NGOs, in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted.

208. In case of High impact category investments, a summary of the proposed project's objectives, description, and potential impacts will be provided for the initial consultation. For consultation after the draft ESA report is prepared, a summary of the ESA's conclusions will be provided. In addition, the draft ESA report will be made available at all relevant public locations, accessible to project-affected groups and the stakeholders. The ESA report will also be disclosed in website of the SMCGs and NMCG.

209. Consultations were done in ESA prepared under Namami Gange: Stakeholder and public consultation were undertaken at various stages at the local, regional and district levels, so as to incorporate the various environmental concerns and needs of the community and the relevant stakeholders (SMCG, EA, other departments irrigation department, forest department etc.). Specific attention has been paid to Project Affected Persons, habitations or livelihoods will be directly impacted by the proposed sub-project, shopkeepers, Students etc. The minutes of consultations undertaken at various stages along with attendance has also been presented in the ESA reports prepared under Namami Gange Program. As per ESMF guideline, stake holder and public consultations were undertaken at following level:

- SMCG Office: Consultations with concerned Environmental, Social personal, GRM officer, Land and revenue officer, Project Director and other concerned staff.
- District Level: Consultations were majorly undertaken with respective District collector, Development officer (District Level), Sub divisional Magistrate (SDM), District Education officer, District Transport Officer etc.
- Implementation level (Execution Agency): Majorly discussions were held with Project coordinator, Project Manager, respective Assistant & Junior engineer who are responsible at field level execution and plan.
- Community level: Panchayat Officer, Area representative of respective Town, NGOs
- Household level: Majorly project affected people, households who' s habitation or livelihood are getting affected due to investment, local beneficiaries
- Sensitive locations of local community: Temple, School, any gathering area fairground etc.

7. IMPLEMENTATION, MONITORING AND REPORTING ARRANGEMENTS

7.1. GENERAL

210. Namami Gange program provides financial assistance for implementation of river pollution abatement/mitigation investments in Ganga main stem states. In addition to complying with various technical and performance standards, the investments to be supported under this program shall comply with the Environmental and Social Management Framework. The implementation, monitoring and reporting arrangements for the ESMF have been worked out within the overall institutional structure for implementation of the Namami Gange program, as described in the sections below.

7.2. NAMAMI GANGE INSTITUTIONAL ARRANGEMENTS

211. As nodal Ministry for the Namami Gange program, the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD&GR) through NMCG is the primary implementing agency for the project at the national level. The implementing agencies at the state level are the State Mission for Clean Ganga (SMCGs). At the local level, specific Executing Agencies (EAs) will be selected for implementation of various activities, including infrastructure investments under the Namami Gange program. EAs may include parastatal organizations, Special Purpose Vehicles and Joint Ventures (SPVs/JVs), Urban Local Bodies (ULBs), appropriate state-level departments, NGOs, or public institutions.

212. The main functions of the various agencies with regard to the Namami Gange program include the following:

- The NMCG will be responsible for overall project planning and management at the national level; direct implementation of the national level activities; ensuring satisfactory implementation of the state-level investments and activities; providing guidance, support and approvals to the SMCGs where needed; and monitoring implementation performance;
- The SMCGs will be responsible for project planning and management at state level, ensuring satisfactory implementation of the state-level investments and Activities; direct implementation of some of the state-level activities; providing guidance, support and approvals to the state EAs where needed; and monitoring implementation performance of the EAs;
- The EAs will plan and implement the activities/investments and put in place arrangements for satisfactory and sustainable operation and maintenance of the assets created. The EAs will be responsible for all contract management, including preparation of feasibility reports and DPRs, and seeking the necessary approvals.

7.3. IMPLEMENTATION, MONITORING AND REPORTING ARRANGEMENTS FOR THE ESMF

213. Within the above overall implementation Guideline of the Namami Gange program, environmental and social due diligence will be carried out by the relevant agencies at each stage of the project cycle in accordance with the guidance provided in the ESMF.

214. A Social Development Officer and an Environmental Officer are appointed for managing social and environmental issues (including safeguards issues) at both central level as well as in each of the project

states. These officers assist the EAs in implementation of ESMF provisions.

215. In the EA, an officer each are designated as social and environment officer who are responsible for the implementation of ESMF tasks at the field level with the assistance and participation of the local self-government. These officers also have the responsibility of implementing safeguard activities along with other project components, and for co-ordination among different agencies, such as the local self-government, Revenue Department etc. During implementation, meetings will be organized by the SMCGs inviting all EAs in the state for providing information on the progress of the project work.

216. An independent Environment and Social/Compliance Monitoring Audit will be conducted by third party inspection agency for each of the sub projects. A sample terms of reference for the audit is presented in **Appendix VI**.

217. The project cycle for an investment under the Namami Gange program and the interface with the ESMF requirements are summarized hereunder.

7.3.1. Project Screening

218. Upon receipt of request for funding, SMCG will assess the eligibility of the sub-project in line with the agreed framework. The scope of the project would be discussed and the guidelines for project preparation would be shared. The screening criteria and categorization of sub-projects on that basis would also be explained. Once the FR is approved and the categorization of the sub-project has been agreed upon, the EA would be advised on the appropriate DPR preparation toolkit that needs to be followed.

219. The EA will prepare a Detailed Project Report (DPR) including Environment and Social management plan (ESMP) tailored to the specific sub-project (for Low impact category investments). For High impact category investments, the EA will engage external agencies to undertake preparation of the ESMP (including RAP as relevant) in line with the requirements of ESMF. While initiating the ESMP (including RAP, as relevant), the EA/ external agency will be guided by the model Terms of Reference appended and shall interact with the Environmental and Social Specialists in the SMCG to seek guidance in the finalization of scope of work and the development of the plans. Once the ESIA & ESMP is approved by SMCG, it will be forwarded to NMCG. The Environmental and Social Specialists of NMCG will review the document and will forward the same to World Bank with their comments.

220. On receipt of the ESIA & ESMP (including RAP, as relevant), the World Bank and NMCG specialists will evaluate the completeness of the documents and their compliance with the ESMF. Further actions, if any required, will have to be carried out by the EA prior to the appraisal of the project.

7.3.2. Environment and Social Assessment for the HAM based PPP Projects:

The agreed action for Environment and Social assessment of projects under HAM projects include:

- ESDDR along with Environment and Social Management Action Plan (ESMAP) will be prepared at the DPR stage;
- The ESDDR will cover the basis nature of the projects, a very brief description of the environment and present status along with screening checklist and an analysis of environmental and social issues associated with the project.
- The ESDDR (carried out by the project) will describe the future action plan to be taken during the

detailed design stage by the Concessionaire[15] like:

- Various regulatory clearances (e.g. environmental clearance, forest clearance, NOC etc. as applicable)
- Preparation of Environmental and Social Assessment (ESA)/EIA
- Resettlement Action Plan (RAP), as applicable
- other actions, and management measures to be implemented by the Concessionaire

221. ESDDR can become part of the bidding document. The public consultation and disclosure process will continue during project implementation. The draft EIA/EMP/RAP etc. for the specific sub-projects will be discussed with the affected communities and the final documents will be placed on the websites of the NMCG and the SMCGs. The copies of the EMP and RAP will also be placed at the offices of the executing agencies, district magistrate and contractor's office. The executive summary of the EIA and RAP will also be translated into local language and placed in the office of the Gram Panchayat of the affected villages.

222. The details of the ESDDR process including approval are in **Addendum I**.

7.3.3. Project Appraisal

223. During project Appraisal, the SMCG will appraise the project preparation leading to the approval of the DPR. The aspects that will be appraised during the project appraisal will include the following aspects:

- Environmental and social suitability of site
- Adequacy of the ESMP (including RAP, as relevant) as per the ESMF including analysis of alternatives, if possible
- Compliance with regulatory requirements and clearances
- Comprehensiveness of the ESMP (including RAP, as relevant) in light of the project specific environmental and social issues
- Integration of environmental and social mitigation measures into the design, wherever relevant/required
- Arrangements for implementation of ESMP (including RAP, as relevant), including institutional capacity and contractual provisions
- Inclusion of ESMP (including RAP, as relevant) budgets in the project cost and contract documents
- ESMP (including RAP, as relevant) monitoring and reporting arrangements
- Need for any legal covenant to address specific environmental risks including regulatory risks, if any
- Risk analysis /allocation
- environment and social enhancements (if any /applicable)

224. The Environment and Social Management Plan (ESMP) prepared for the project will form part of the bidding documents, in addition to the references to various acts relating to environment and labor, and the implementation of the same will be monitored by SMCG and NMCG.

[15] Concessionaire is a company who signs the concession agreement with the owner (NMCG/SMCG/Executive Agency) to complete the investment under Hybrid Annuity Mode (HAM).

7.3.4. Project Approval and Disbursement

225. After requisite approvals and concurrence are obtained, SMCG will discuss implementation of environmental and social management measures of the project with the EA to ensure that these are suitably incorporated into the respective legal/contractual documents, for implementation by the EA.

226. The civil works will be initiated only after the required land has been acquired and declared free from encroachments and other encumbrances and the EA has the physical possession of the land. Before the start of civil works the compensation must be disbursed to the landowners. During implementation, consultations with the communities shall be undertaken by the EA / NGOs for providing information on the progress of the project work. The roles and responsibility of each of the Agency/Official involved are further detailed in **Appendix VII**.

7.3.5. Monitoring and Reporting Arrangements

227. The NMCG, through the respective SMCGs will monitor all the approved investments under the Namami Gange program to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of construction, operation and maintenance. The monitoring will be carried out through the environmental and social safeguard compliance reports that form a part of Quarterly Progress Reports for all investments and regular visits by the environmental and social specialists of the NMCG and SMCGs. In addition to the above, the NMCG will undertake an annual ESMF audit and will review the status of ESMF compliance, as per the sample terms of reference provided in **Appendix VI**.

228. The NMCG will review these audit reports and identify technical, managerial, policy or regulatory issues with regards to the compliance of the ESA reports. The identified technical issues will be duly incorporated in the subsequent investments. Policy and regulatory issues will be debated internally by the NMCG's internal review committee and the need for appropriate interventions will be determined. These interventions could include appropriate revision of ESMF document or suitable analytical studies to influence policy or programs of the state, if found necessary / warranted.

229. An external evaluation of the RAP implementation prepared under Namami Gange program will also be undertaken twice during the implementation of the project – mid-term and at the end of the implementation. **Table 7-1** below details out the mitigation measures for each impact type, monitoring measures, responsibility and timeline.

230. During implementation, meetings will be organized by the SMCGs inviting all EAs in the state for providing information on the progress of the project work. The project cycle for an investment under the Namami Gange program and the interface with the ESMF requirements are summarized **Table 7-1** and **Table 7-2.**

Table 7-1: Mitigation, Monitoring, Responsibility and Timeline

S. No	Impact	Indicators to be Monitored	Monitoring Measures	Responsible Agency	Timeline
1	Land acquisition	• Land acquired (in ha.) • Number of project affected persons. • Number of project affected persons paid compensation for land • Timely disbursement of land compensation. • Amount paid as land	Regular internal monitoring by the EA and SMCG and periodic evaluation	EA	12 months from the start date. Compensation to be paid before the start of civil works.

S. No	Impact	Indicators to be Monitored	Monitoring Measures	Responsible Agency	Timeline
		compensation. • Dissemination of information to affected persons on benefits/entitlement. • Number of grievance received and resolved			
2	Acquisition of house/ structure	• Number of house/ structures affected by the project. • Number of project affected persons whose house/ structure has been affected. • Dissemination of information to affected persons on benefits/entitlement. • Timely disbursement of house/structure compensation. • Amount paid as house/structure compensation. • Number of grievances received and resolved.	Regular internal monitoring by the EA, SMCG and periodic evaluation	EA	
3	Loss of livelihood or source of livelihood	• Number of project affected persons who have lost their livelihood or source of livelihood. • Number of affected persons received R&R assistance. • Number of families provided alternative resettlement house/ arrangement. • Number of vulnerable project affected people received R&R assistance/additional support. • Amount paid as R&R assistance. • Number of grievances received and resolved.	Regular internal monitoring by EA; midterm and end term evaluation	EA	12 months from the start date of the activities of the priority investment. Assistance to be paid before the start of civil works.
4	Loss of access to private and / or common property	• Number of private/common property affected. • Number of private/common property relocated. • Amount spent on private/common property. • Number of grievances received and resolved.	Regular internal monitoring by the EA; midterm and end term evaluation	EA, ESMF Auditors	12 months from the start date of the activities of the priority investment. Assistance to be paid before the start of civil works.
5	Displacement of Non-Titleholders	• Number of affected persons (informal/ non-titleholders) received R&R assistance. • Number of families provided alternative resettlement house/ arrangement. • Number of vulnerable people	Regular internal monitoring by the EA; midterm and end term evaluation	EA, ESMF Auditors	

S. No	Impact	Indicators to be Monitored	Monitoring Measures	Responsible Agency	Timeline
		received R&R assistance/additional support. • Amount paid as R&R assistance. • Number of grievances received and resolved.			
6	Gender Action Plan	• Improvement in perception of safety among women. • Number of gender sensitization workshops held for staff and implementing agencies. • Number of women PAPs whose sources of livelihoods/ income will be affected by project. • Number of women PAPs who received resettlement assistance. • Number of women employed at the construction site. • Number of facilities in construction and camp site for women and men (toilets, crèches, temporary housing, medical aid, etc.). • Number of women members on the GRC or related group that has been constituted. • Number of grievances received and resolved	Regular internal monitoring by the social development professional of EA along with NGO; mid-term and end term evaluation	EA, ESMF Auditors	12 months from the start date of the activities of the priority investment, followed by annual audit
7	ESAMP Implementation	• Ambient Air quality (SOx, NOx, PM 10, PM 2.5, other Volatile Organic Compounds, at project site STP, MPS etc. • Treated water discharged as per agreed standard • Noise level at project site (STP, MPS etc.) • Soil Quality at project site	Regular internal monitoring by the Project concessionaire /DBOT operator/ EA; midterm and end term evaluation	Project concessionaire, EA/SMCG/NMCG; Third party ESMF Audit	During O&M phase
8	Sludge Disposal mechanism	• Quantity of sludge generated • Quantity of sludge disposed • Quantity of Sludge disposed to a designated disposal site	Regular internal monitoring by the Project concessionaire /DBOT operator/ EA; midterm and end term evaluation		
9	Survival of Plantation	• Survival of plants provided in buffer zone of STP, SPS, MPS, Lift Stations	Shall be ensured by Project concessionaire; third party Audit/		

S. No	Impact	Indicators to be Monitored	Monitoring Measures	Responsible Agency	Timeline
			NGO		
10	Occupational Health and Safety (as per World Bank group's General EHS guideline)	• Accidents and injuries reported • Zero incidents period	Regular internal monitoring by the Project concessionaire /DBOT operator/ EA; midterm and end term evaluation		
11	Annual Environmental and Social Audit	• Implementation of ESMF provisions as provided in the Site specific ESMP for HAM Project/ ESMAP for DBOT projects	Annual Audit	Third Party E&S Audit	Various stages of the project development

Table 7-2: ESMF Implementation and Monitoring Arrangements

Milestones	Objectives	Process	Responsibility	World Bank 'Role	Decision/Target/ Deliverable
1. Sub- Project Screening (at the FR stage)	To approve categorization of proposed sub-projects into high/ low impact investments	a. Discussions with EA to - assess eligibility of project based on Namami Gange's priorities in consonance with Mission Clean Ganga - identify scope of project report b. EA to submit FR along with proposed impact categorization c. SMCG may seek expert opinion	• NMCG • SMCG • EA	• For the projects which are to be funded by the World Bank, the requisite documents (like ESDDR, RAP, ESMAP etc.) shall be shared with the bank for further review and finalize for disclosure. After approval of ESDDR and ESAMP they will be implemented as per the approved ESMF and apart from the monitoring of SMCG, NMCG, World Bank will also monitor these projects once in six months during their mission visit.	• Decision to proceed or not • Identification of impact category
2. Sub- Project Appraisal (at the DPR stage)	To ensure satisfactory compliance with ESMF	a. Detailed appraisal of the ESMP (including RAP, where relevant), including site visits/investigations if necessary, assess suitability of site, adequacy of ESMPs, risk analysis and regulatory clearances b. EA to submit ESMP as part of DPR for approval	•SMCG •NMCG		• Review report and decide to - accept - accept with modifications - reject and instruct to resubmit DPR
3. Approval	Approvals from SMCG/ NMCG/ World bank	a. SMCG to recommend to NMCG b. NMCG to recommend to Empowered Committee and World Bank (wherever applicable) c. Review of Sub Project EAs and ESAMPs by the World Bank including review and clearance of EA TORs for High Impact projects by the Bank	• SMCG • NMCG • World Bank		• Approval of DPR
4. ESMP Implementation Monitoring and Review	Ensure Implementation of agreed ESMP (including RAP, where applicable)	a. Prepare quarterly progress reports b. Schedule field visits as required c. Third party audit	SMCG, EA, Contractors		• Quarterly Progress Report

7.4. SOCIAL ACCOUNTABILITY AND GRIEVANCE REDRESS MECHANISM

231. The Ganga River Basin Project primarily involves laying sewerage network and pumping stations, sewerage treatment plant, common effluent treatment plants, river front development, and low cost toilets. Though possibility of land taking is minimal, the civil works may create temporary adverse impact on community in terms of dust, loss of access to residential and commercial properties, traffic congestion, etc. In order to address these impacts, project, project has developed resettlement policy framework. That apart, project has also proposed three tier grievance redress mechanisms. The project will have three tier grievance redress mechanisms. The audit mechanism will be established for the project. The key approaches that would be adopted for ensuring accountability would be a combination of participatory processes guiding investment level third party audit, community's feedback on performance of the project and record citizens' recommendations for improvement and a strong grievance redress mechanism. The project will have a communication strategy focusing on efficient and effective usage of print and electronic media, billboards, posters, wall writing, and adoption of any other method suiting local context, logistics, human and financial resources.

232. Presently, one GRM officer has been appointed in NMCG to address all queries registered in the NMCG portal. The GRM officer is supported by one social expert who coordinates with all the SMCGs. At SMCG level, reporting of grievances are being monitored by environmental and social experts. All Executing Agencies have a GRM mechanism at each project site. The project manager and deputy project managers are in-charge of these GRMs. To register grievances, a register has been kept at all project site offices and sometime field team receives grievances over mobile phones as well as on WhatsApp massages. To resolve the grievances, project manager from EAs side and contractor's project engineer and his team work together to sort out the grievances at the earliest. If site team is unable to resolve the issue on its own, the complaint/matter is brought up to senior management of EA and also discussed in monthly review meetings and escalated to the level of SMCG and NMCG. In continuation, Grievance Redress Committees (GRCs) has also been constituted in some of the basin States. The GRC discusses grievances on weekly basis at their safety meetings[16]. The complaints received at different levels of the project (Contractor, PIU and EA) should be directed to the GRC to initiate the action and take the corrective measures as required. If the complainant is not satisfied, he/she can escalate the grievance by registering it in Centralized Public Grievances Redress and Monitoring System (CPGRAM) portal of NMCG. The State-wise grievance mechanism is at **Appendix VIII**.

233. The three tiers GRM of the project includes:

i. **First Tier at Investment level**: The representative of PEA at the investment level will be the first level contact for any aggrieved person. The individuals / community can approach the representative to register their grievance or to give feedback. Each project site will have feedback register. The community / individual will have the right to register their feedback. The feedback register will be monitored every fortnight by Social Development Officer of SPMG. The SDO along with the PEA representative will be responsible for addressing the grievances registered if any or will forward the same to the SPMG. Scanned copy of the feedback register will be forwarded to the SPMG which will be part of the overall grievance database. Monthly report will be generated from the scanned copies. That apart, the project sties will have information board with the (i) name of the PEA; (ii) investment type and brief

[16] Draft Report on GBV-GRM in National River Ganga Basin project (NGRBA), 2019

information on the civil works, and implementation timeframe ; (iii) name of the concerned representative; social development specialist at SPMG and NMCG and their cell phone numbers; (iv) the toll free number to register grievances. The PEA will prepare a monthly report on these cases and submit to the SPMG.

ii. **Second Tier: SPMG and NMCG Level**: An *Integrated Grievance Redress Mechanism* (IGRM) will be established at the SPMG level that will register user complaints using combination of various mediums (e.g. a dedicated toll free phone line, web based complaints, written complaints in feedback register and open public days) and address them in a time bound system. The project will appoint a grievance redress officer solely responsible for handling phone and web-based complaints. The person will be responsible for directing the aggrieved person to the concerned official through e-mail. On receiving any phone call or web based or email, a unique number will be generated which will be the reference number for the caller and he can trace the progress of his grievance / query through that number. Any complaint lodged will be addressed within 15 days of receiving the complaint. System will have escalation matrix i.e. if grievance / query remains untended or there is no response from the concern officer for specified period then system will escalate the grievance / query to next level through email. The toll-free line will be monitored between 10 AM to 5.30 PM on all working days. Any call made before or after the stipulated time, will get recoded and from the voice mail an e- mail will be generated addressed to the grievance officer. The grievance officer will then direct that mail to the concerned official and follow-up. The recorded message will be responded back the next day. The project will also commit itself for proactive disclosure and sharing of information with the key stakeholders, including the communities/beneficiaries. The website of NMCG and SPMGs will have the name and number of social development officer of SPMGs and NMCG. The website of PEAs will have the number of the concerned site representative responsible for addressing grievances / feedback.

234. As part of IGRM, a Grievance Redress Cell (GRC) will be set up at the project level to deal with the safeguards related grievances. The staffing of GRC will include the followings:

- Chairperson: District Collector / Magistrate/Deputy Commissioner or his / her representative
- Convener: District Social Coordinator
- Members: Representative from the community and PAPs if any, Representative from the executing agency, Community mobilizer of the concerned village

- The GRC will have its own bye laws. The functions of the GRC will redress grievances of the community towards the safeguards issue such as loss of land and/or livelihood, resettlement, relocation assistance, etc. The GRC will only deal/hear the issues related to individual grievances and will give its decision/verdict within 15 days after hearing the aggrieved PAPs. The final verdict of the GRC will be given by the Chairman/Head of GRC in consultation with other members of the GRC and will be binding to all other members.
- The list of GRC members should be on the website of PEA, SPMG and NMCG. All grievances recorded in GRC and responses given should be part of the total grievance database and should be accessible through web.

iii. **Third tier at Mission Director's Level**: In case grievance is not addressed at the first two levels,

the aggrieved person can approach the Mission Director of NMCG. The contact person for the aggrieved person in NMCG will be Social Development Specialist who will be responsible to prepare all background documentation for the Mission Director to consider the case with all required information. The SD Specialist in SPMG and representative of PEA at the investment level will be responsible to inform the aggrieved person the process of contacting NMCG. All grievances recorded with NMCG and responses given should be part of the total grievance database and should be accessible through web.

7.5. TRAINING AND CAPACITY BUILDING

235. Being a new entity, the NMCG & SMCGs staff will need additional training in the management of environmental and social issues of the program. The training program for various relevant stakeholders will include an orientation program on the ESMF, Project Management, Engineering and Public Health. Course outline for various modules, the duration and the participation envisaged has been illustrated in **Table 7-3**.

236. The training program along with exposure visits is to be coordinated and anchored by NMCG with the support from agencies / individuals experienced in safeguard aspects of urban infrastructure investments for developing courses on conducting training programs. The trainers will be identified from expert agencies such as ASCI, TERI, TISS, CSE, Water Aid, etc. NMCG will prepare an annual training / exposure visit calendar with respect to Environment and Social Safeguard and related subjects such as Solid Waste Management, Fecal Sludge Management, Circular Economy, etc.

237. The training will focus on the relevant World Bank Safeguard policies, EHS guidelines as well as environmental and social issues. The contents will basically focus on the ESMF, concept, regulatory requirements, Environment and Social priority issues, project cycle of Namami Gange program investments, outline of EA / SA and report formats in respect of the Environmental aspects. In respect of social aspects the course content will focus on the R & R policies and procedures, Land Acquisition process, identification of PAPs, Social entitlement frameworks, social assessment, RP techniques, and Risk Assessment and management skills. The generic training program is elaborated in **Table 7-3**.

238. In addition to the above, Namami Gange program will make a conscious effort to mainstream the environmental and social issues within the training programs of NMCG. The program will be structured in such a way that it clearly brings out the value addition and enhancement benefits of proper management of environmental and social issues.

239. As part of the capacity building exercise, NMCG also aims at developing decentralized local capacity on managing environmental and social issues associated with various investments. In order to achieve the above objective, the specialists will develop a network of technical manpower resources such as staff from universities / research institutions, civil society organizations, etc. These persons will be trained during the course of Namami Gange program, so that they can provide support to the ULBs in implementing ESMP (including RAP, as relevant) recommendations and also offer support on an on-going basis.

Table 7-3: Generic Training Programme

Programs	Contents	Duration / Schedule	Participants	Programs	Contents
Program 1 Orientation Program / Workshop for Project Development agency	**Module 1 - ESMF Profile** • Namami Gange Concept • ESMF Concept • Regulatory Requirements-E&S Priority Issues • Sub project types of Namami Gange program • ESA and SESA Process Outline • Reports &Formats • Relevant World Bank Operational Policies and EHS guidelines	**Module 2 Environmental Assessment Process** • Environmental Laws &Regulations • EIA process • Identification of Environmental Impacts • Impact Identification Methods • Identification Mitigation Measures • Formulation of Environmental Management Plan • Implementation and Monitoring • Institutional Mechanism	**Module 3 Social Assessment Process** • Social Assessment process • Description of Namami Gange program R&R and gender frameworks and procedures and National requirements • LA process • Necessity for RAP and its preparation process	1½day (1st , 3rd and 5th year of the project)	• Environment and social staff of NMCG and SMCG • Heads of Statutory Boards and other monitoring agencies
Program - 2 Orientation Program / Workshop for Project Implementing agency	**Module 1 - ESF Profile** • Namami Gange Concept • ESMF Concept • Regulatory Requirements-E&S Priority Issues • Sub project types of Namami Gange program • ESA and SESA Process Outline • Reports &Formats • Relevant World Bank Operational Policies and EHS guidelines	**Module 2 Environmental Assessment Process** • Environmental Laws &Regulations • EIA process • Identification of Environmental Impacts • Impact Identification Methods • Identification Mitigation Measures • Formulation of Environmental Management Plan • Implementation and Monitoring • Institutional Mechanism	**Module 3 Social Assessment Process** • Social Assessment process • Description of Namami Gange's R&R and gender frameworks and procedures and National requirements • LA process • Necessity for RAP and its preparation process	1½day (1st, 3rd and 5th year of the project)	• Municipal Commissioners of the ULBs and Heads of EAs • Engineering/Public Health personnel from the ULBs and social and environment staff of EAs • Engineering personnel from Statutory Boards, and environment and social staff of potential private operators / consultants.

Programs	Contents				Duration / Schedule	Participants
Program-3 Workshop on Sectoral Environmental and Social Assessment	**Module 1– Water supply, sewerage and sanitation** • ESMF Concept • Relevant World Bank Operational Policies and EHS guidelines • Regulatory Requirements-E&S Priority Issues • Outline of ESA Process • Identification of Environmental and Social Impacts • Developing Mitigation Measures including entitlement frameworks • Formulation of Environmental and Social Management Plan including preparation of Resettlement Action Plan • Implementation and Monitoring arrangements • Budget preparation for implementation of ESMP • Case Studies	**Module 2– Solid waste management** • ESMF Concept • Relevant World Bank Operational Policies and EHS guidelines • Regulatory Requirements- E&S Priority Issues • Outline of ESA Process • Identification of Environmental and Social Impacts • Developing Mitigation Measures including entitlement frameworks • Formulation of Environmental and Social Management Plan including preparation of Resettlement Action Plan • Implementation and Monitoring arrangements • Budget preparation for implementation of ESMP • Case Studies	**Module 3– River Front Development** • ESMF Concept • Relevant World Bank Operational Policies and EHS guidelines • Regulatory Requirements-E&S Priority Issues • Outline of ESA Process • Identification of Environmental and Social Impacts • Developing Mitigation Measures including entitlement frameworks • Formulation of Environmental and Social Management Plan including preparation of Resettlement Action Plan • Implementation and Monitoring arrangements • Budget preparation for implementation of ESMP • Case Studies	**Module 4 – Open Forum** • Feedback and comments from the Participants.	1½ days (every alternate years) (Introduction will be common to all and participants will be split according to their respective sectors)	• Municipal Commissioners of the ULBs and heads of other EAs. • Engineering/Public Health personnel from the ULBs and other EAs. • Engineering personnel from Statutory Boards, and potential private operators / consultants. • Environment and social staff of NMCG; SMCGs; and EAs

8. PUBLIC CONSULTATIONS AND DISCLOSURE

8.1. GENERAL

240. The development of the ESMF is based on a consultative process that engaged key stakeholders at the national, state, and local levels and sought their feedback. Key government agencies have been consulted at the various levels to obtain their consent on the ESMF in general and specially on the land acquisition process and resettlement framework.

241. National level consultations on ESMF were held as follows:

i. April 17, 2010: A meeting on the international River clean-up experiences was held at Scope Complex, Lodi Road, New Delhi where MoEF&CC, World Bank, States, ULBs, NMCG expert members, and some NGOs participated. Consultations on broad outline of ESMF were conducted.

ii. Sept.1, 2010: A meeting was organized in MoEF&CC with States and PIAs–It was first consultant meeting on ESMF where MoEF&CC made a presentation and draft of ESMF was shared with the States.

iii. Oct. 25-26, 2010: A workshop for consultation on Investment frameworks and ESMF was organized in the World Bank where States, PIAs, NMCG and World Bank participated and agreed on the broad contours of the ESMF. It was agreed that States would conduct the public consultations at important towns where projects are likely to be implemented under the program.

242. Following the national level consultations, public consultations have been carried out in sample sub project areas in each of the five participating states to get feedback and suggestions from the affected community on the ESMF. The dates of these consultation meetings were announced in the local newspapers in advance so that all interested parties could participate and provide suggestions. The ESMF was translated into local languageanddisclosedonthewebsitesandplacedwiththeofficesofthenodalagencies prior to the consultation meetings. Representatives of the State Nodal Agencies facilitated the public consultation meetings. The consultants preparing the ESMF attended the public consultation meetings in all the states to note the stakeholder suggestions and feedback. The minutes of the meeting was prepared highlighting the key discussions and issues raised by the stakeholders.

243. The schedule of the public consultations at the state level is provided in **Table 8-1**.The minutes of the meetings are given in the sections that follow.

Table 8-1: Details Of The Public Consultations Held at The Five Selected States

S.No	State	State Nodal Agency	Venue	Date	Time
1	Uttarakhand	Uttarakhand Peyjal Nigam	Nagar Pallika Bhawan, Haridwar, Uttarakhand	10th December 2010.	2:30 pm to 5:00 pm
2	West Bengal	Urban Development Department	Kolkata, West Bengal	21st December 2010	2:00 pm to 4:00 pm
3	Jharkhand	Urban Development Department, Jharkhand)	Vikash Bhawan D.C. Office,	23rd December 2010	11:00 am to 2:00 pm

S.No	State	State Nodal Agency	Venue	Date	Time
			Sahibganj, Jharkhand		
4	Uttar Pradesh	Ganga Pollution Control Unit, U.P Jal Nigam	Nagar Nigam, Guest House, Kanpur, Uttar Pradesh	28th December, 2010	3:00 pm to 5:30 pm
5	Uttar Pradesh	Ganga Pollution Control Unit, U.P Jal Nigam	Sadan Hall, Nagar Nigam, Prayagraj, Uttar Pradesh	29th December 2010	3:00 pm to 5:00 pm
6	Bihar	Department of Urban Development	Patna, Bihar	4th January 2011	3:00 pm to 5:00 pm

8.2. PUBLIC CONSULTATION MEETINGS

244. Public Consultation on Environment and Social Management Framework (NGRBA Program) was held at various locations from December 2010 to August 2017. The public consultations were conducted with State Nodal Agency, consultancy team, NGOs, project affected persons and other stakeholders. The issues and suggestions of the public consultations is at **Appendix IX.**

245. The public consultations was conducted wherein the details about the Environment and Social Management Framework, starting from the current status of river Ganga, future government plans, possible assistance by World Bank, overall significance of ESMF, stake-holder participation during the project, etc. was discussed and explained with the respective government officials. Various agencies involved in implementing the current programme were also explained in detail to the gathering. The guidelines were translated to vernacular and made available to public and all the documents related to NGRBA program has been uploaded in the MoEF&CC/NMCG website.

Table 8-2: Summary of the Public Consultations

S.No.	Date of consultations	Details of Consultation	Issues discussed
1	10th December 2010	Public consultation on Environment and Social Management Framework, held at Haridwar, Uttarakhand	• Education and awareness among PAPs especially youth, to keep river Ganga clean. • Provision of sanitation facilities along with O&M for tourists and pilgrims. • Ensure active participation from NGOs, local communities and panchayats in the various stages of the project. • Efforts to minimize negative impacts on socio cultural beliefs and traditions regarding river Ganga during sub project implementation. • Regular O&M for sustainable management of facilities provided during the project. • Lack of Solid Waste Management Plan. • Time gap between planning and implementation of the project needs o be minimized. • All safety and precautionary measures must be taken to avoid accidents during construction phase. • Ensure proper coordination between Government agencies/ departments.
	21st December 2010	Public consultation on Environment and Social Management Framework, held	• Ensure treated sewerage wastewater to only flow into the river. • Need of ladies' changing room (as part of the RFD

S.No.	Date of consultations	Details of Consultation	Issues discussed
		at Kolkata, West Bengal	sub-project) and the need of low-income scheme (as part of the sewerage and sanitation subproject). • O&M cost for the first five years will be included within the project cost. • Efforts to be exerted for installation of WSP for treatment of city sewage. • House connections in the sewerage system need guarantee from the municipal authorities. • Recycling and reuse of treated wastewater must receive serious attention. • One must conceive ecologically balanced wastewater treatment system for abatement of river pollution. • The small industries need to be shifted to the common location so that their wastewater is managed in an efficient manner (through the CETP). • To adhere to the untreated sewage from various point and non- point sources fall into the river, municipal engineers should be involved in the decision-making process.
	23rd December, 2010	Public Consultation on Environment and social management Framework (NGRBA Program), held at Sahibganj, Jharkhand	• Slum areas need to be considered and sensitized while planning any projects/schemes. • Projects must be location specific and the paying capacity of the community has to be considered while planning the projects. • Anti-erosion projects/ works, which is currently under CWC, should be included in the Ganga main stem project. • Dead animals are disposed in river Ganga as there are no burial places for animals. Nagar Palika also does not have any disposal place for dead animals.
	28th December, 2010	Public Consultation on Environment and Social Management Framework (NGRBA Program), held at Kanpur, Uttar Pradesh	• Disposal of unburnt or half burnt dead bodies into the river Ganga should be prohibited. • More crematoriums should be built, and existing ones should be renovated to cater to the need of growing population. • Proper sanitation facilities during religious occasions and other festivals. • Inclusion of social development projects in the projects portfolio proposed by NGRBA program. • Promotion of awareness generation at community and school levels especially in the fields of better solid waste disposal (idols, calendar, flowers, polythene), promote usage of crematoriums, etc. • Involvement of local communities (Pandits) for maintaining the river ghats to curbs pollution. • Facilitate reuse of treated wastewater for agricultural practices, parks, firefighting, etc. • Facilitate usage of this buffer zone for afforestation or flower plantation). • Creation of Ganga Heritage Zone to focus development and protection against pollution. • Adopt bioremediation techniques for treating wastewater until the new STPs become functional. • Facilitate proper solid waste management along

S.No.	Date of consultations	Details of Consultation	Issues discussed
			with the provision of utilization of compost in agricultural/gardening activities. • Prohibition of reverse boring of wastewater by the industries which are likely to pollute groundwater. • Ensure proper coordination between Government agencies/ departments.
	29th December, 2010	Public Consultation on Environment and Social Management Framework (NGRBA Program), held at Prayagraj, Uttar Pradesh	• Continuous and regular mechanism of creating awareness among community and school children's through street plays, public and religious gatherings (Mela), displaying banners, etc. • Proper sanitation facilities along with efficient operation and maintenance systems during religious occasions and other festivals. • Community involvement needs to be ensured during the project initiation and implementation stage of the project. • implementation activities of the projects must be completed in time to avoid the problems of traffic diversions, public congestions, and commercial displacement especially during Maha Kumbh Mela. • Promote reuse of treated wastewater for irrigation and gardening purposes. • Mechanism for proper solid waste management along the banks of both river Ganga and Yamuna. • Provision of wastewater treatment facility at Dhobi Ghat for caustic soda-based effluents. • Imposing strict regulation on upcoming new colonies to establish their own STPs. • Ensure proper site selection for pumping stations along with efficient operation and maintenance of pumping stations in order to avoid back flow or clogging of sewers. • Request to start sewer and drainage projects simultaneously and completed in time to avoid mixing of wastewater with drainage water. • Ensure technically feasible solutions while designing the alignment of sewer lines and dimensions of the sewer to cater the needs of growing population. • Request to maintain minimum size of the sewer more than 150mm to avoid clogging of sewers.
	4th January, 2011	Public Consultation on the Environmental and Social Management Framework (ESMF) for the National Ganga River Basin Authority (NGRBA Program) held at Patna, Bihar	• Awareness about the program projects and sub-projects must be generated to a large extent in order to ensure implementation and effectiveness. • Documents and messages delivered to the public must be made in simple language and easily comprehendible. • Ensure proper coordination between Government agencies/ departments. • 'Livelihood links' that exist with the Ganga River and the related projects should be highlighted. • Before implementation of projects, the location of projects must be consulted with the local people of the project-affected area. • Local institutional support could be taken for project planning and development.

S.No.	Date of consultations	Details of Consultation	Issues discussed
			• Encroachment of lands and construction of residential complex should not take place in the River Catchment areas. • Solid Waste Management related projects must implement a door–to–door collection system. • Effluent discharge limits for slaughterhouses along the riverbanks should also be established. • Various check dams could be built on the tributaries of the river Ganga in order to achieve better flood and disaster management. • 'Arsenic-zones' adjacent to the riverbanks that must be addressed. • Technical trainings should be provided to concerned officials and elected members for better implementation of the projects.
	4th August, 2017	Consultation with the SMCGs and EAs on the revised ESMF for Namami Gange Programme held at New Delhi	• At the DPR stage Environment and Social Due Diligence Report (ESDDR) along with Environment and Social Management Action Plan (ESMAP) to be prepared. • ESDDR to cover the basis nature of the projects, a very brief description of the environment and present status along with screening checklist and an analysis of environmental and social issues associated with the project. • ESDDR to describe the future action plan to be taken during the detailed design stage by the Concessionaire.

8.3. MECHANISM FOR CONTINUED PARTICIPATION

246. The effectiveness of the ESMF implementation is directly related to the degree of continuing involvement of the community. Participation of community and PAPs in the planning and implementation of the sub project will ensure that investment and mitigation measures are suited to the needs of the community as well as adversely impacted population. Their continued involvement and participation during implementation will both increase the probability of successful implementation of both the sub project as well as ESMAP.

247. **Plan for Continued Participation:** The following set of activities is required for effective implementation of ESMF.

248. **Information Disclosure:** For the benefit of the community in general and PAPs in particular, EMSF and other safeguard instruments will be translated in local language and kept at SMCG, EA's office, operator/concessionaire's office and sub project site.

249. **Community Participation:** For effective implementation of ESMF, it is essential to provide scope of involving communities and PAPs in the process. The mechanism of involving communities is suggested below in **Table 8-3**.

Table 8-3: Mechanism for Continued Participation

Project Stage	PAPs	EAs	Commuity	Project & Local Officials
Planning	• Participate in public meetings • Identify alternatives to avoid or minimise displacement • Assist in developing and chosing alterantive options for relocation and income generation • Help to choose resettlement sites. • Participate in survey • Participate in meeting with host population • Provide inputs to entitlement provisions • Assist in preparation of action plan • Suggest mechanism for grievance redress conflict resoultion and participate in grievance redress Participate in coordination committees	• Assist in impact assessment • Assist in census and SE survey • Participate in coordination committee • Participate in group meetings • Design and implement an information campaign • Support group formation, problem identification and planning forPAPs and hosts, • Design and Participatory process • Suggest mechanism for grievance redress of conflict resoultion. Assist in preparation of action Plan	• Provide information or various aspects of host communities • Assist in data collection and design • Provide inputs to site selection • Identify possible conflict areas with PAPs • Identify social and cultural faclities needed at resettlement sites • Assist in identification of IG schemes • Provide inputs for design of IG schemes • Help develop a process of consultation between hosts and PAPs. Suggst mechanism for grievance redress and conflict resolution.	• Provide information on PAP skills etc. • Suggest ways to minimise impacts • Indicate local staff and budget capacity for relocation. • Assist NGO in information dissemination • Participate in consultations • Examine the feasibility of IG schemes and discuss with PAPs. Help document and consultations.
Implementation	• Participate in implementation support activitives • Participation in local decision making activities. • Decide on management of common properties • Participate in grieviance redress mechanism. • Monitor provision of entitlements • Labour and other	• Provide ongoing information for PAPs and hosts • Provide support in group management • Monitor entitlement provision by implementation of IG schemes. • Assist implementing live deptts. • Provide support to RAP	• Assist APO in relocation • Manage common property at site • Participate in local committees. • Assist PAPs in integration with Hosts. • Assist PAPs in useof new production systerm. Use established mechanisms for grievance redress.	• Process IG proposals • Participate in grievance redress • Provide assistance under local schemes. Participate as member of I mplementation committee.

Project Stage	PAPs	EAs	Commuity	Project & Local Officials
	inputs of site • Labour and other inputs at site • Credit and other group scheme management • O&M of sites and project inputs • Members of implementation committee	implementtion . • Training to eligible PAPs • Support to vulnerable groups • Evaluate community process and social preparation • Provide advice on grievance redress. Be an interface between PAPs and PWD for grievance redress, especially for vulnerable groups, and those will low levels of literacy.		
M&E	• Participate in grievance tribunals • Report to project on IG schemes • Report on service quality of sites	• Provide information to project staff on vulnerable groups • Act as M&E agency for project • Act as external monitors for project (where not previously involved)	Provide inputs to M&E of R&R	• Ongoing interaction with PAPs to identify problems in IG programme. • Participants in correctional strategies.

End Notes

Definitions

The following definitions are used in the documents:

- **Cut-off date:** In the cases of land acquisition affecting legal titleholders, the cut-off date would be the date of issuing the preliminary notice u/s 11(1) of the RFCTLARR Act, 2013. In cases where people lack title, the cut-off-date shall be the date of completion of the Census survey undertaken by the project authority.
- **Project Affected Person:** Affected persons are those who stand to lose all or part of their physical and non- physical assets including homes, productive land, community resources, commercial properties; livelihood; and socio-cultural network.
- **Project Displaced person:** A displaced person is a person who is compelled to change his/her place of residence and/or workplace or place of business, due to the project.
- **Affected family means:**

  (i) A family whose land or other immovable property has been acquired;

  (ii) a family which does not own any land but a member or members of such family may be agricultural labourers, tenants including any form of tenancy or holding of usufruct right, share-croppers or artisans or who may be working in the affected area for three years prior to the acquisition of the land, whose primary source of livelihood stand affected by the acquisition of land;

  (iii) family whose primary source of livelihood for three years prior to the acquisition of the land is dependent on forests or water bodies and includes gatherers of forest produce, hunters, fisher folk and boat-rent and such livelihood is affected due to acquisition of land;

  (iv) a member of the family who has been assigned land by the State government or the Central Government under any of its schemes and such land is under acquisition;

  (v) a family residing on any land in the urban areas for preceding three years or more prior to the acquisition of the land or whose primary source of livelihood for three years prior to the acquisition of the land is affected by the acquisition of such land.

- **Definition of Family:** "family" includes a person, his or her spouse, minor children; minor brothers and minor sisters dependent on him: Provided that widows. Divorcees and women deserted by families shall be considered separate family.
- **Displaced Family:** "displaced family" means any family, who on account of acquisition of land has to be relocated and resettled from the affected area to the resettlement area;
- **Wage Earner:** A person who is working with a commercial establishment or working as a labour in an agriculture land, which is being affected by the project.
- **Non-Title Holder:** A person, who has trespassed Government land, adjacent to his/her own land or asset, to which he/she is not entitled, and deriving his/her livelihood prior to the cut-off date.

  Or a person who is landless and has settled on publicly owned land without permission and has been occupying publicly owned building without authority prior to the cut-off date.

- **Below Poverty Line (BPL):** A family whose annual income from all sources is less than a designated sum as fixed by the concerned State Government, in which the project falls, will be considered to be below Poverty Line.
- **Vulnerable Person:** Unless otherwise specifically mentioned in this document, a person who has been designated under 'Below Poverty Line' category as identified by the concerned State Government will be considered a vulnerable person. Disadvantaged persons belonging to SC, ST, disabled/handicapped, and woman heading the household are also recognized as vulnerable persons. Also vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women ,or persons above fifty years of age; who are not provided or cannot immediately be provided with alternative livelihood , and who are not otherwise covered as part of family;
- **Entitled Person:** person adversely impacted by the project and is entitled to some kind of assistance as per the project entitlement framework
- **Titleholders (THs):** Persons who possess legal documents in support of claims made towards ownership of structure or land are titleholder.
- **Sharecroppers:** Persons who cultivate land of a titleholder on certain conditions
- **Landowner**: "land owner" includes any person -

  (i) whose name is recorded as the owner of the land or building or part thereof, in the records of the authority concerned; or

  (ii) under any other law for the time being in force; or who is entitled to be granted Patta rights on the land under any law of the State including assigned lands: or

  (iii) any person who has been declared as such by an order of the court or Authority

- **Interested Person**: "person interested" means-

  (i) all persons claiming an interest in compensation to be made on account of the acquisition of land under this Act;

  (ii) a person interested in an easement affecting the land;

  (iii) persons having tenancy rights under the relevant State laws including share- croppers by whatever name they may be called; and

  (iv) any person whose primary source of livelihood is likely to be adversely affected;

Appendices

Appendix I: Guidance on EIA of High impact category Sub-Project

(To be finalized by SMCG with inputs from NMCG/ MoWR, RD&GR as applicable)

Introduction

High impact category investments require a full EA to be done by environmental consultants, separate from any evaluation performed by the design consultants. The environmental consultants must closely interact with the design consultants in order to obtain the necessary data, information, reports and support as required. The EA process must be carried out, and the EA&EMP reports must be prepared. This guidance includes a typical term of reference and suggests the structure and content of the EA & EMP report. The terms of reference are general in content. As it is likely that there are some specific environmental issues that require to be addressed and these are known in advance, these need to be informed to the environmental consultants.

Terms of reference

The following terms of reference should be used:

Description of Project

- To provide a full description of the project, with details on specific sites, populations impacted, project design, implementation schedule, number / types of connected industries, details of any pre-implementation activities (i.e. public education and/or involvement, pilot studies, etc.), operation and maintenance activities, required off-site investments, project life span, etc. Project description should also include any and all required information as stipulated below.

Policy and legal Guideline

- To collect information on the prevailing World Bank Safeguard policies, national, state and local laws and EHS Guidelines pertinent to environmental quality, health and safety, waste management guidelines, air and water quality regulations, protection of sensitive areas, land uses control and others. Manner of complying with relevant laws, such as the appropriate avenue for submission of required materials, should be described in detail.
- To convey to the contractor / relevant implementing actor the manner in which the enforcing body will conduct its monitoring / enforcement activities, as well as information as to what government assistance (e.g. technical assistance) government bodies can provide to the actor so as to facilitate the actor's compliance.
- To determine its applicability of all laws to the proposed sub-project and to include the specific clearances/approvals that must be obtained by the SGRBA/contractor/relevant implementing actor.
- To assist the SMCG/ contractor/ relevant implementing actor in any clearances/ approvals that may be required to implement the sub-project in terms of completing forms/ applications and defending the sub-project before Government committees.

Baseline Study of Proposed Project Area

- To assemble, evaluate and present baseline data on the relevant environmental characteristics of the sub-project area, including changes anticipated before the commencement of the project. The description of the baseline environmental setting shall be worked out from the secondary data

sources supplemented by the primary data collected as part of the various surveys carried out as part of the EA preparation.

- To describe the physical environment: geology; topography; soils; climate and meteorology; ambient air quality; noise quality; surface and ground-water hydrology; existing sources of air emissions; existing water pollution discharges; and receiving water quality, etc. Description should include both a general overview of overall study area, as well as more detailed information for specific implementation sites.
- To describe the biological environment: flora; fauna; rare or endangered species; sensitive habitats, including reserved forests, wildlife reserves and sanctuaries etc. Description should include both a general overview of overall study area, as well as more detailed information for specific implementation sites.
- To describe the socio-cultural environment: population; land use; planned development activities; community structure; employment; distribution of income, goods and services; recreation; public health; cultural properties; and, common property resources, etc. Description should include both a general overview of overall study area, as well as more detailed information for specific implementation sites.

Public consultation

- To carry out public consultation and participation as an integral part of the EA. Consultation sessions shall be carried out with different stakeholder groups at the local, regional and district levels, so as to incorporate the various environmental concerns and needs of the community and the relevant stakeholders. Specific attention should be paid to Project Affected Persons.
- (PAPs), namely, those whose habitations or livelihoods will be directly impacted by the proposed sub-project.
- To ensure the effectiveness of the consultations and the full participation of all stakeholders in the project, all relevant information shall be shared with the likely PAPs and local NGOs in a timely manner prior to the consultation and in a form and language that are understandable and accessible to the groups being consulted.
- To ensure that consultations with these groups are carried out at least at the following two occasions: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. Such groups should also be consulted throughout project implementation as necessary to address EA-related issues relevant to them, allowing relevant stakeholders the opportunity to share their concerns during both the design and implementation phases of the project.
- To make available both the initial draft EA and the report's conclusions at all relevant public locations accessible to PAPs and relevant stake holders. The EA report shall also be disclosed in website of the SMCG and NMCG.

Impact analysis

- To identify, analyze and evaluate the different kind of impacts, and to distinguish between significant positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts.
- To determine the impacts on sensitive receptors identified during the baseline environmental analysis.
- To determine the impacts on sensitive areas: critical natural habitats (such as conservation areas,

sanctuaries, sacred groves, etc.) and migration routes; “induced development”; historic, cultural and religious buildings and sites; archaeological sites and tourism areas, etc.

Analysis of alternatives

- To describe alternatives that were examined in the course of developing the proposed project and identify other alternatives, which would achieve the same objectives. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures.
- To compare alternatives in terms of potential environmental impacts and suitability under local conditions. A “no project,” or Business as Usual, scenario should also be considered, wherein the environmental impacts of taking no action will be estimated.

Mitigation

- To identify feasible and cost-effective mitigation measures that may reduce potentially significant adverse environmental impacts to acceptable levels, capital and recurrent costs of the measures. These measures should be identified prior to construction of any investments or investments.
- To specify in a table the description of the measure along with who is responsible and when it has to be implemented.
- To include relevant drawings and technical specifications that would be required to implement the mitigation measure effectively during the design phase of any project or sub-project.

Monitoring

- To prepare detailed arrangements in a plan for monitoring implementation of mitigating measures and the impacts of the sub-project during construction and operation.
- To include in the initial plan an estimate of capital and operating costs, and a description of other inputs (such as training and institutional strengthening) needed to carry it out. These estimates should occur during the initial design/planning phase of the sub-project.
- To document in the initial plan what will be monitored, who would do it, who would receive its outputs, how much it would cost, how it would be financed and what other inputs (e.g. training) are necessary.
- To include in the initial plan a list of environmental monitoring parameters, and detailed specifications (methods, schedule, etc.) for performance/compliance monitoring during construction, and operation stage of the sub-project.

Management

- To identify institutional needs to implement the recommendations of the EA. This would include manpower requirements, skill requirements and training, organizational mechanisms and information dissemination requirements.
- To recommend any further studies of environmental issues which should be undertaken during project implementation.

Others

- To document the important contributors to the EA and to record interagency/forum/consultation meetings; including list of both invitees and attendees.

Suggested structure and content of an EIA report

The EIA report should have the following structure and content:

- Executive Summary- project details, policy Guideline, baseline conditions, significant environmental impacts, salient points of the analysis of alternatives, salient mitigation and monitoring measures, and budget.
- Project Description-Concise description of the proposed project and its geographic, ecological, social and temporal context.
- Policy, Legal and Administrative Guideline - Government policies, environmental legislations and regulations currently under force.
- Baseline Data - Assessment of the physical, biological and socioeconomic conditions of the project locations.
- Environmental impacts-Prediction and assessment of the project's likely positive and negative impacts, in quantitative terms to the extent possible. The more significant environmental impacts and those that are considered critical by the public are to be further focused in this chapter.
- Analysis of Alternatives-Comparison of feasible alternatives to the project site/right-of-way, technology, design and operation – including the 'without project' situation – in terms of their potential environmental impacts
- Mitigation and monitoring measures - Enlisting and description of environmental impacts and the remedial measures to be taken. Preferably, this contains a comprehensive table containing a brief description of the impact, the type of remedial measure (prevention or mitigation or enhancement), the description of the measures, phase wherein applicable - pre-construction, construction and operational phases, and implementation responsibility.
- Budgets

Structure and content of an EMP

The EMP report should have the following structure and content:

- Introduction - Objective, scope, proponent's background, brief description of the sub-project and the purpose of the EMP
- Remedial Measures - Description and enlisting of the environmental impacts and remedial measures to be taken. Preferably, this contains a comprehensive table containing a brief description of the impact, the type of remedial measure (prevention or mitigation or enhancement), the description of the measures, phase wherein applicable - pre-construction, construction and operational phases, and implementation responsibility.
- Organizational arrangements for implementation - Institutional Guideline being established to ensure the implementation of the EMP.
- Environmental performance indicators are to be chosen and the basis for their selection. A linkage between these indicators and the important environmental impacts and the associated remedial measures needs also to be established.
- Monitoring mechanisms to be adopted that include reporting progress, frequency of monitoring, enhanced monitoring during specific seasons such as monsoons, etc.
- Mechanisms to ensure an ongoing dialogue with the public during the construction and operational phases.

The budget for the EMP implementation should be included in the overall sub-project. This should cover costs – mitigation, monitoring, training and public / stakeholder consultation and participation - due to be incurred during the construction and operational phases.

Appendix II: Generic Environmental Guidelines / Management Plan for Low impact category Investments

(To be finalized by SMCG with inputs from NMCG as applicable)

Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible Agency for Mitigation	Monitoring Agency
I. Sewerage and Sanitation Investments				
A. Design and Development Phase				
Land Acquisition **	Loss of tree cover	• Undertake afforestation in nearby areas	ULB/ Project Implementing Agency	SMCG/ NMCG
Treated Water Disposal into nearby stream ***	• Pollution of stream water and other water bodies receiving STP discharges due to reduction in efficiency or non-working of STP	• Ensure efficient working condition. – Choice of treatment process, construction technique, equipment and skilled operation and supervision critical to maintain effluent quality compliance. • The treated water quality shall comply with the standards laid down by the state pollution control board for disposal onto the land, water body or for irrigation use.	ULB/ Project Implementing Agency	SMCG/ NMCG
Sludge Disposal***	• Disposal of sludge leading to contamination of land and water.	• Providing adequate and safe sludge disposal facilities	Design Consultant, ULB/ Project Implementing Agency	SMCG/ NMCG
Provision for Accidental leakages/ bursts **	• Flooding of the nearby areas with untreated sewage in event of accidental leakages or bursts	• The Design Consultants should design for bypass arrangements, to discharge untreated sewage.	Design Consultants and EA	SMCG/ ULB
	• Low lying areas in the site, which can get flooded during monsoons	• Provide proper drainage arrangements so that the water does not stagnate on the site	Design Consultants and EA	SMCG/ ULB
*Location of STP**	• Nuisance hazards to neighboring areas.	• Careful planning and design of STP with adequate buffer zones. Future growth of the Surrounding areas shall be considered.	Design Consultants and EA	SMCG/ ULB
*Developing sewage pumping station**	• Noise and odor nuisance to surrounding areas.	• Select appropriate location away from sensitive locations such as schools and hospitals. • Provide sufficient buffer areas • Follow standard codes for selection pumps and other	Design Consultants and EA	SMCG/ ULB

Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible Agency for Mitigation	Monitoring Agency
		apparatus. Use less noise making and easy to operate equipment.		
B. Construction Phase				
*Excavation, cutting and filling operations****	Soil and water contamination by improper disposal of construction and demolition waste.	• Ensure immediate transportation of accumulated waste to an identified site.	Contractor/ Project Implementing Agency	SMCG/ ULBNMCG
	Damage to standing crops due to construction activities.	• Construction activities shall be planned so as not to damage any crops. In case if it is inevitable provide monitory compensation to the owners • Immediately transport accumulated construction waste to a site identified for the purpose.	Contractor / Project Implementing Agency	SMCG/ ULBNMCG
	Temporary flooding due to excavation during monsoons.	• Provide suitable arrangements for drainage control.	Contractor / Project Implementing Agency	SMCG/ /NMCG
	Noise, vibration and dust from construction activities.	• Use of less noise generating equipment for all activities, provision for personal protective equipment, earmuffs, etc. for construction; avoid construction activities during nights; and sprinkle water on site and remove excess matter from the site as soon as possible.	Contractor / Project Implementing Agency	SMCG/ /NMCG
	Safety hazards to labor.	• Provide adequate safety precautions such as helmets, safety shoes, gloves, etc.	Contractor / Project Implementing Agency	SMCG/ / NMCG
Laying of sewer network *	Spillage of fuel and oil	• Store tanks and drums for excess capacity; forbid pouring into soils or drains; enforce adequate equipment maintenance procedures	Contractor / Project Implementing Agency	SMCG/ / NMCG
	Noise and vibration disturbances to residents and businesses	• Establish schedule and other specific restrictions; limit work to daylight hours as possible; use of less noise generating equipment, proper maintenance	Contractor / Project Implementing Agency	SMCG/ / NMCG
Laying of sewer network *	Dust generation	• Water sprinkling, removal of excess materials, cleaning of sites upon completion of activities.	Contractor / Project Implementing Agency	SMCG/ / NMCG
	Reduced pedestrian and vehicle access to	• Establish work sequence and methods to minimize access	Contractor / Project	SMCG/ / NMCG

Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible Agency for Mitigation	Monitoring Agency
	residences and businesses	disruption; provide alternative safe access as possible; temporary bridges and crossings, detours and walkways.	Implementing Agency	
	Temporary water supply interruptions	• Establish coordination procedures for cut-off; minimize time for replacement operations; and appropriate scheduling as necessary.	Contractor/ Project Implementing Agency	SMCG/ /NMCG
	Increased traffic inconvenience (emissions, congestions, longer travel times)	• Use alternate traffic routing; ensure coordination with local authorities; routine control and maintenance of equipment.	Contractor/ Project Implementing Agency	SMCG/ and Traffic Police
Construction Camps*	Health impacts due to absence of housing and sanitation facilities in labour camps.	• Provision of appropriate housing, water supply, and sanitation facilities.	Contractor / Project Implementing Agency	SMCG/ NMCG
	Impacts on surrounding environment due to improper drainage and solid waste management facilities in construction camps.	• Provide proper temporary drainage and solid waste collection and disposal facilities at the construction site.	Contractor / Project Implementing Agency	SMCG/ /NMCG
C. Operation Phase				
Treatment and Disposal ***	Impairment of receiving water quality in surface/sub-surface source due to inadequate /inefficient Treatment. Contamination groundwater supplies due to leaching and impact on soil and agriculture	• Monitor the treated sewage/effluent quality and ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use. • The treated water quality shall comply with the standards laid down by the state pollution control board for disposal onto the land, water body or for irrigation use.	Operator/ EA	SMCG/ /NMCG
Treatment and Disposal ***	Problems arising due to bad odor, insects, polluted air, noise pollution, etc.	• Provide buffer zones in the form of green belt around the STP; to be ensured during the design and development phase itself.	Operator/ EA	SMCG/ /NMCG
	Indiscriminate disposal of sludge leading to contamination of land and soil.	• Prepares a sludge disposal plan and adheres to the same.	Operator/ EA	SMCG/ /NMCG
	Health and safety of workers due to the release of toxic gases	• Ensure safe operation and maintenance practices are followed and plans for	Operator/ EA	SMCG/ /NMCG

Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible Agency for Mitigation	Monitoring Agency
	and hazardous material.	emergencies are in place.		
	Reduced land values in nearby areas and aesthetics affected.	• Adequate buffer zones during development and construction phase should mitigate the affect considerably.	EA	SMCG/ /NMCG

Note: *** denotes – Significant Impact; ** Denotes-Moderate Impacts and *- Minor Impact.

Appendix -IIIA: Sample EMP for the Sewage Treatment Plant

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
Sewerage and Sanitation Investments					
A. Design and Development Phase					
Sewage Treatment plant	Treated water disposal into nearby stream	• Pollution of received water body (river) or land due to inefficient treatment or non- operation of STP	Temporary	• The treated water quality shall comply with the prescribed standards of the bid document and other applicable conditions of consent to establish issued by the state pollution control board. • Selection of best available sewage treatment technology with High BOD removal efficiency. • Ensuring development and compliance to standard operation and maintenance practices. • Provision of effective screening at inlet of STP for removal of grit, fine plastics and other suspended solids • Provision of effective separation and controlled disposal of digested sludge • Provision effective disinfection before discharge of treated water for irrigation or to river	DBO Operator
	STP Breakdown	• Discharge of untreated sewage leading river pollution.	Temporary	• Provision of adequate holding capacity adequate for storage of sewage to prevent flow of untreated sewage to river.	DBO Operator
	Flooding of STP area	• Rain water may flood the STP area in absence of adequate provision of diverting rain water flow towards STP from periphery area.	Temporary	• Suitable drainage provision shall be made to divert the rain water likely to be accumulated from peripheral catchment area of STP, to natural drainage stream or area.	DBO Operator
	Sludge disposal	• Disposal of sludge leading to contamination of land and water.	Permanent	• Efficient Sludge dewatering with minimum land involvement shall be adopted. • Provision shall be made for intermittent	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
				storage of digested sludge at STP site. • Digested Sludge from a waste treatment plant may constitute a hazardous and nonhazardous waste, therefore periodic testing of Sludge to assess the content of hazardous chemical should be identified (as per MOUD manual 2016) before it final disposal at the identified dumping site of MC. Dumping shall be done when the authorized land fill site is not available nearby to project region. • The digested sludge shall be utilized as manure or disposed to suitable site as approved by DBO engineer. If disposal is made for landfill, the site shall be located away from habitation; and water bodies and shall be pre-approved by concerned authorities like Municipal corporation, Pollution Control Board or urban development authority.	
	Provision for safety of workers and safe operation of STPs	• Accidents leading to injury or death of workers (Fall of workers from Height, Fall into deep water tanks, Short Circuiting) • Accidental slip, trip and fall in walk ways or work areas • Fire • Exposure to toxic gas such as chlorine	Permanent	• Ensure adequate provision of Handrails on both sides of walkways close to deeper tanks and STPs need to be ensured; • All electric switches (including unit specific on-off switches installed at respective units) and panels should have adequate protection from rain water to prevent short-circuiting • Proper earthling with installation of earth circuit breakers shall be made • Walkways designs shall be made with proper Slope to avoid accumulation of rain water. Material handling and storage shall be so designed that walk way surface remains free	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
				from wet or oil surface situation to prevent slips, trip fall accidents. • Provision of interlock system to either stop STP or divert untreated effluent to holding tanks in case of short circuiting, or mall functioning of STP • Prepare emergency preparedness plan including identification of assembly area in case of fire	
	Location of STP	• Noise/Odor/fly nuisance hazards to neighboring areas. • Cutting of Trees	Permanent	• Ensure minimum noise generation at pump station in STP; • Minimize Tree cutting if involved. • Tree plantation of at least two rows around the periphery of STP site and landscaping to prevent spread of bad odor with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. • Accumulated sludge and solid waste to be clearedwithin24hoursandsprayingofsuitable herbicides on accumulated sludge/solid waste to reduce odor.	DBO Operator
Sewage Pumping Station	Pumping of sewage to STP	• Noise and odor nuisance hazards to neighboring areas. • Cutting of Trees	Permanent	• Ensure minimum noise generation at pump station in SPS by use of less noise generating equipment meeting prescribed noise standards as applicable and enclosed generators. • Minimize Tree cutting if involved. • Tree plantation of at least two rows around the periphery of SPS site and lands capping to prevent • Accumulated sludge and solid waste to be • Cleared at short intervals and spraying of	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
			suitable herbicides on accumulated sludge/solid waste to reduce odor • Provision for regular maintenance and • switching off equipment when not in use	
B. Construction phase				
Sewage treatment plant and Sewage pumping station Excavation	Loss of topsoil due to excavation activities.	Temporary	• Excavation shall be planned in such a manner that such that no damage occurs to existing structures. • Top soil should be separately stockpiled and utilized for green belt develop mentor landscaping after completion of work	DBO Operator
	Construction waste	Temporary	• All the associated construction waste should be properly managed by storing and disposing off at suitable refusal sites approved by DBO engineer.	DBO Operator
	Nuisance due to domestic solid waste disposal	Temporary	• Provide two bins for recyclable and non-recyclable wastes. • Ensure that recyclable and non-recyclable wastes are collected in segregated manner in theses bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed to designated land fill area of the city. • Provide adequate sanitation facility for workers at construction sites.	DBO Operator
	Dust Generation due to construction activities	Temporary	• Excavated material transported by trucks will be covered and/or wetted to prevent dust nuisance. • Suppressing dust generation by spraying water on stockpiles and unpaved movement areas • Water sprinkling over excavated areas, unpaved movement areas and stockpiles.	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
			• Transportation of loose construction material through covered trucks. • Use dust curtains (poly-sheets/ sheets) around the construction area for containing dust spread. • Construction equipment must comply with pollution norms and carry Pollution under Control certificate.	
	Temporary flooding due to uneven dumping of construction waste	Temporary	• The construction waste material should be stored on the higher areas of the site and or areas where water may accumulate creating flooding like situation	DBO Operator
	Temporary flooding due to uneven dumping of construction waste	Temporary	• The construction waste material should be stored on the higher areas of the site and or areas where water may accumulate creating flooding like situation	DBO Operator
	Spillage of fuel and oil	Temporary	• Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit.	DBO Operator
	Noise and vibration disturbances to residents and businesses	Temporary	• Construction activities to be carried out in daytime with prior intimation to local residents and shopkeepers. • Use of low noise and vibrating equipment (such as enclosed generators with mufflers, instruments with built in vibration dampening and improved exhaust), to meet standards as prescribed by CPCB[17]. • Provision of protective equipment (PPE) like	DBO Operator

[17] http://moef.gov.in/citizen/specinfo/noise.html

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
				earmuffs and plugs for construction workers. • Provision of noise barriers as feasible in inhabited areas, particularly near sensitive zones like hospitals, schools etc. • DG set to be fitted acoustic enclosure.	
General: safety during construction	Safety and Health Hazard	Safety hazards to labours and public	Temporary	• Comply with the Occupational health and Safety act of India • Ensure that the contact details of the police or security company and ambulance services nearby to the site. • Ensure that the handling of equipment and materials is supervised and adequately instructed. • Follow safe practices for working at height or confined area or underground working for safety of workers • Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed Construction works warn the public and traffic flow of the inherent dangers • Provide adequate PPE to workers such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to Workers • Provide handrails on both sides of walkways close to deeper tanks and STPs need to be ensured; • Smaller on and off switches at STP units to be installed with protection from rain water to minimize electrical short circuit; • Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.	DBO Operator
Construction camps (if	Sanitation	Nuisance due to absence of facility of sanitation and solid waste	Temporary	• Labour camp if provided, must have adequate provision of shelter, water supply, sanitation and	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
adopted)		management		solid waste management	
C. Operation phase					
Sewage treatment plant and Sewage pumping station	Treatment and Disposal of Treated Water and Sludge	River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.	Permanent	• Monitor the treated sewage quality and ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use. • Follow standard operating procedures for operation and maintenance. • Undertake periodic audit as per these Procedures. • Comply with all applicable condition of consent to operate • Quarterly monitoring of influent sewage, treated sewage, upstream and downstream point of treated sewage disposal point to river	DBO Operator
		Problems arising due to bad odor, insects, polluted air,	Temporary	• Maintain the green belt as per provision of design to prevent spread of bad odor with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. • Accumulated sludge and solid waste to be Cleared within 24 hours and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odor. • Quarterly monitoring of Ambient Air Quality with respect to PM10, PM2.5, Sox and NOx, CO and Odor at three locations (at STP site, minimum 500 m away from STP site in up-wind and down-wind direction of STP area.	DBO Operator
		Increase in Ambient Noise Level and discomfort to neighboring people	Temporary	• Proper handling and regular maintenance of operating machines including pumps, generators, air diffusers, etc. • Quarterly Monitoring of Ambient Noise level to	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
				check compliance to standards. • Quarterly monitoring of ambient noise levels (day and night) at same locations as of ambient air monitoring	
		Indiscriminate disposal of sludge leading to contamination of land and soil.	Temporary	• Prepares sludge disposal plan as per desire stage provisions and guidelines and adhere to the same. • Ensure proper functioning of STP for digestion of sludge and ensure adequate functioning of dewatering units for efficient functioning of system	DBO Operator
		River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.	Temporary	• Ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use. • Follow standard operating procedures for operation and maintenance. • Undertake periodic audit as per these procedures. • Comply with all applicable condition of consent to operate	DBO Operator
Sewage Pumping Station	Waste Handling	Bad odor, Health hazard and public nuisance	Temporary	• Provision for regular clearance of sludge and solid waste to minimize odor nuisance • Ensure maintenance of Green belt as planned • Periodic disposal of accumulated sludge/solid waste to designated land fill sites of the city.	DBO Operator
General Safety	Workers exposure to hazardous materials/ situations	• Serious/health/ safety hazards	Temporary	• Ensure availability of PPE for maintenance workers. • Follow safety measures and Emergency preparedness plan evolved at design stage	DBO Operator

Appendix -IIIB: Sample EMP for the Sewerage Network

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
Sewerage and Sanitation Investments					
A. Design and Development Phase					
Sewerage Network (Trunk Sewer Line)	Accidental leakages/ bursts	• Due to accidental burst or leakage of sewers, flooding of the nearby areas • Backlogging due to unexpected heavy flowrates	Temporary	• Designing sewers with adequate capacity and flow velocity • Provision for Regular inspection and maintenance of the sewers Preparation of safety and Emergency Preparedness plan	DBO Operator
Sewage Pumping Station	Location of Sewage Pumping Station and Pumping of sewage from District C to STP	• Noise and odor nuisance hazards to neighboring areas. • Cutting of Trees	Permanent	• Ensure minimum noise generation at pump station in SPS by use of less noise generating equipment meeting prescribed noise standards as applicable and enclosed generators. • Minimize Tree cutting if involved. • Tree plantation of at least two rows around the periphery of SPS site and landscaping to prevent spread of bad odor with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. • Accumulated sludge and solid waste to be cleared at short Intervals and spraying of suitable herbicides on accumulated sludge/solid waste to reduce dour.	DBO Operator
				Provision for regular maintenance and switching off equipment when not in use;	

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
B. Construction phase					
Sewerage (laying of sewers) and Sewage Pumping station	Excavation, cutting, back filling, compaction and construction operations	Damage to underground utilities like water, gas line, electricity and telephone conduits, etc. due to construction activities.	Temporary	• Identify existing underground other utility structures, lines through available records and in consultation with concerned authorities and plan construction activities accordingly to minimize damage to such utilities. These underground utilities encountered in excavating trenches carefully shall be supported, maintained and protected from damage or interruption of service until backfills complete and settlement has taken place.	DBO Operator
		Accidents/ damages due to erosion/ sliding of vertical sides of excavated trenches while places the pipes	Temporary	• Maintaining the excavation by Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials • Exposed surface shall be resurfaced and stabilized. Exposed surface will be resurfaced and stabilized by making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest.	DBO Operator
		Generation of substantial debris, top soil and muck during construction	Temporary	• Top soil shall be preserved and maybe used for agricultural purpose or development of city parks. • Soil and debris may be managed for planned land filling and landscaping; • Debris may be suitably stored to filling back the excavated areas after placing the trunk sewer lines.	DBO Operator
		Dust Generation (Air Pollution) due to excavation, cutting, back filling and compaction operations	Temporary	• Water sprinkling over excavated areas, unpaved movement areas and stockpiles. • Transportation of loose construction material through covered trucks.	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
			• Use dust curtains (poly sheets/ sheets) around the construction area for containing dust spread at SPS building construction site. • Construction equipment must comply with pollution norms and carry Pollution Under Control certificate.	
	Noise and vibration disturbances to residents and businesses	Temporary	• Construction activities to be carried out in daytime with prior intimation to local residents and shopkeepers. • Construction work near schools and colleges to be carried out during vacations and work near hospitals to be completed on priority basis (in shorter time period with alternate provision of traffic, accessibility of exit/entry gates etc.). • Use of low noise and vibrating equipment meeting Prescribed noise standards. • Provision of protective equipment (PPE) like earmuffs and plugs for construction workers. • Provision of noise barriers in inhabited areas, particularly near sensitive zones like hospitals, schools etc. • DG set to be fitted acoustic enclosure.	DBO Operator
	Temporary flooding due to excavation during monsoons or blockage of surface drains	Temporary	• Stockpiled areas to be bordered by berms; • Stockpiles to be done in high areas to avoid flow in storm water run-off channels and erosion;	DBO Operator
	Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access)	Temporary	• Alternate traffic routing must be adopted in consultation with concerned traffic police authorities. Proper traffic planning is made for narrow lane areas. • Work should be completed on priority near business and Market place to minimize business loss.	DBO Operator

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
			• Care should be taken to minimize congestion and negative impacts at schools and hospitals. Safe access shall be maintained to these places during construction. • Provide temporary crossing/ bridges as may be required to facilitate normal life and business	
	Settlement of backfilled area after construction	Temporary	• The backfilling material shall be free from petroleum products, slag, cinders, ash or other material. • Backfilling activity shall be completed within five days of laying of sewer. • Proper compaction as per the soil condition and retain the original level of alignment and grade.	DBO Operator
	Spillage of fuel and oil	Temporary	• Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit.	DBO Operator
	Nuisance due to solid waste disposal	Temporary	• Provide two bins for recyclable and non-recyclable wastes. • Ensure that recyclable and non-recyclable wastes are collected in segregated manner in theses bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed for designated land fill area of the city. • Provide adequate sanitation facility for workers at construction sites.	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
• General: safety during construction	Accidents	Safety hazards to labours and public	Temporary	• Comply with the Occupational health and Safety act of India • Ensure that the contact details of the police or security company and ambulance services nearby to the site. • Ensure that the handling of equipment and materials is supervised and adequately instructed. • Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers. • Provide adequate safety precautions such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers • Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.	DBO Operator
C. Operation phase					
Sewer line	Leakage/ overflows	Water pollution and possibility of mixing with water supply line	Temporary	• Regular monitoring of sewer line and manholes for visible leakages/overflows. • Immediate repair shall be carried out to plug the leakages. Restore these were and other utility services if damaged due to leakages.	DBO Operator
Sewage Pumping Station	Waste Handling	Bad odor, Health hazard and public nuisance	Temporary	• Provision for regular clearance of sludge and solid waste to minimize odor nuisance • Ensure maintenance of Green belt as planned Periodic disposal of accumulated sludge/solid waste to disposal site as approved by DBO engineer.	DBO Operator

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
Sewage Cleaning Equipment	Extracted Sewage Sludge handling and cleaning equipment maintenance waste handling	Bad odor, Health hazard and public nuisance and possible land contaminations	Temporary	• Ensure that extracted sewage sludge collected during sewers cleaning are disposed to disposal site as approved by DBO engineer. • Sewage solids shall not be disposed on road sides or non-Designated areas. • Equipment cleaning waste shall be disposed to public sewer or STP inlet for treatment • Waste oil if any generated shall be separately collected. It shall be sold to authorized waste oil recyclers.	DBO Operator
General Safety	Workers exposure to toxic gases in sewers and hazardous materials during sewer maintenance work	• Serious/health/ safety hazards • The toxic gases are likely to contract communicable diseases from exposure to pathogens present in the sewage.	Temporary	• During cleaning/ maintenance operation, the sewer line will be adequately vented to ensure that no toxic or hazardous gases are present in the line. • Ensure availability of PPE for maintenance workers. • Follow safety and Emergency Preparedness plan prepared at design stage Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.	DBO Operator

Appendix IV: State River Conservation Authorities[18]:

Bihar
Name of the Authority:- Bihar State Ganga River Conservation Authority
Headquarter of the Authority :- Patna

COMPOSITION OF THE AUTHORITY

(a) Chief Minister, Bihar	ex-officio Chairperson
(b) Minister, Finance, Government of Bihar	ex officio Member
(c) Minister, Urban Development and Housing, Government of Bihar	ex officio Member
(d) Minister, Water Resources, Government of Bihar	ex officio Member
(e) Minister, Environment and Forests, Government of Bihar	ex officio Member
(f) Minister, Public Health Engineering, Government of Bihar	ex officio Member
(g) Chief Secretary, Government of Bihar	ex-officio Member Secretary

STATE GANGA REJUVENATION, PROTECTION AND MANAGEMENT COMMITTEE, STATE OF BIHAR

(a) Chief Secretary, Government of State of Bihar	ex-officio Chairperson
(b) Principal Secretary, Department of Finance, Government of State of Bihar	ex-officio Member
(c) Principal Secretary, Department of Urban Development and Housing, Government of State of Bihar	ex-officio Member
(d) Principal Secretary, Department of Environment and Forest, Government of State of Bihar	ex-officio Member
(e) Principal Secretary, Department	ex-officio Member
(f) Principal Secretary, Department of Public Health Engineering, Government of State of Bihar	ex-officio Member
(g) Chairman, Bihar State Pollution Control Board, Government of State of Bihar	ex-officio Member
(h) Managing Director, Bihar Urban Infrastructure Development Corporation Ltd.	ex-officio Member
(i) Principal Chief Conservator of Forest, Government of State of Bihar	ex-officio Member
(j) Project Director, State Mission for Clean Ganga, Bihar	ex- officio Member-Convener
Nominated Members:	
(k) Shri Uma Shankar Singh, Retired Engineer-in-Chief, Department of Water Resource, Government of State Bihar, Patna.	Member
(l) Prof. Santosh Kumar Chaudhary, Retired Professor, NIT, Patna	Member
(m) Dr. Sunil Kumar Chaudhary, Head of Botany Post Graduation Department, T.M. University, Bhagalpur, (Dolphin Specialist)	Member

1.http://moef.nic.in/modules/recent-initiatives/NGRBA/ImplementingStructure.html
2.Gazette of India notification no. 1053, April 2017
3.Gazette of India notification no. 1941, July 2017

(n) Dr. Sameer Kumar Sinha, Convener, W.T.I. Regional Head, Bihar and Eastern Uttar Pradesh (River System)	Member
(o) Shri S. N. Jaiswal, Scientist (Solid Waste Management), Bihar State Pollution Control Board.	Member

Jharkhand

Name of the Authority: - Jharkhand State Ganga River Conservation Authority
Headquarter of the Authority: - Ranchi

COMPOSITION OF THE AUTHORITY

(a) Chief Minister,Jharkhand	ex-officio Chairperson
(b) Minister, Environment and Forests, Government of Jharkhand	ex officio Member
(c) Minister, Finance, Government of Jharkhand	ex officio Member
(d) Minister, Urban Development, Government of Jharkhand	ex officio Member
(e) Minister, Water Resources and Irrigation, Government of Jharkhand	ex officio Member
(f) Chief Secretary Government of Jharkhand	ex-officio-Member Secretary

STATE GANGA REJUVENATION, PROTECTION AND MANAGEMENT COMMITTEE, STATE OF JHARKHAND

(a) Chief Secretary, Government of Jharkhand	ex-officio Chairperson
(b) Addl. Chief Secretary/Principal Secretary/Secretary, Department of Finance, Government of State of Jharkhand	ex officio Member
(c) Principal Secretary/Secretary, Urban Development & Housing Department, Government of State of Jharkhand	ex officio Member
(d) Addl. Chief Secretary/Principal Secretary/Secretary, Department of Environment & Forest, Government of State of Jharkhand	ex officio Member
(e) Principal Secretary/Secretary, Water Resource Department, Government of State of Jharkhand	ex officio Member
(f) Principal Secretary/Secretary, Drinking water & sanitation Department, Government of State of Jharkhand	ex officio Member
(g) Chairman, Jharkhand State Pollution Control Board, Government of State of Jharkhand	ex officio Member
(h) Chairman & Managing Director, JUIDCO Ltd	ex officio Member
(i) Principal Chief Conservator of Forest, Government of Jharkhand	ex officio Member
(j) Project Director, State Mission for Clean Ganga, Jharkhand	Member-Convener
Nominated Members:	
(k) Dr. Makarand M. Ghangrekar, Professor, Department of Civil Engineering, Indian Institute of Technology, Kharagpur – 721 302. India	Member
(l) Dr. Chintalacheruvu Madhusudana Rao, Assistant Professor, Department of Civil Engineering, National Institute of Technology Jamshedpur, Jamshedpur-831014, Jharkhand, India	Member
(m) Dr. Alok Sinha, Centre of Mining Environment, Department of Env. Science and Engg., Indian School of Mines, Dhanbad-826004, D-16, Teachers Colony, Indian School of Mines	Member

(n) Dr. Ram Prashad Sharma, Retired Deptt. of Science & Technology, Govt. of Jharkhand, Sector – 4, RH-2, Block-C, Row House, National Game, Housing Complex (NGHC), Hotwar, Ranchi – 835 217	Member

Uttar Pradesh

Name of the Authority: - Uttar Pradesh State Ganga River Conservation Authority

Headquarter of the Authority: - Lucknow

COMPOSITION OF THE AUTHORITY

(a) Chief Minister, Uttar Pradesh	ex-officio Chairperson
(b) Minister, Environment, Government of Uttar Pradesh	ex officio Member
(c) Minister, Forests, Government of Uttar Pradesh	ex officio Member
(d) Minister, Finance, Government of Uttar Pradesh	ex officio Member
(e) Minister, Urban Development, Government of Uttar Pradesh	ex officio Member
(f) Minister, Irrigation Government of Uttar Pradesh	ex officio Member
(g) Minister, public Works Department, Government of Uttar Pradesh	ex officio Member
(h) Minister, Housing, government of Uttar Pradesh	ex officio Member
(i) Mayor, Kanpur	ex officio Member
(j) Mayor, Varanasi	ex officio Member
(k) Mayor, Prayagraj	ex officio Member
(l) Chairman, State Advisory Board, Government of Uttar Pradesh	ex officio Member
(m) Chief Secretary, Government of Uttar Pradesh	ex-officio Member Secretary

State Ganga Rejuvenation, Protection and Management Committee, State of Uttar Pradesh

(a) Chief Secretary, Government of State of Uttar Pradesh	ex-officio Chairperson
(b) Principal Secretary/Secretary, Department of Finance, Government of State of Uttar Pradesh	ex-officio Member
(c) Principal Secretary, Department of Housing and Urban Planning, Government of State of Uttar Pradesh	ex-officio Member
(d Principal Secretary/Secretary, Department of Environment, Government of State of Uttar Pradesh	ex-officio Member
(e) Principal Secretary/Secretary, Department of Forest, Government of State of Uttar Pradesh	ex-officio Member
(f) Principal Secretary, Department of Irrigation and Water Resources, Government of State of Uttar Pradesh	ex-officio Member
(g) Principal Secretary/Secretary, Department of Urban Development, Government of State of Uttar Pradesh	ex-officio Member
(h) Principal Chief Conservator of Forests, Government of State of Uttar Pradesh	ex-officio Member
(i) Chairman, Uttar Pradesh Pollution Control Board	ex-officio Member
(j) Managing Director, Uttar Pradesh Jal Nigam	ex-officio Member
(k) Project Director, State Mission for Clean Ganga, Uttar Pradesh	Member-Convener
Nominated Members:	

(l) Smt. Preeti Chaturvedi, Scientist F & H and Equatic Oxyology Division, I.T.R.C., Lucknow	ex-officio Member
(m) Prof. R.C. Vaishya, Environmental Engineering, MNIT, Prayagraj	ex-officio Member
(n) Shri B.D. Tripathi, Coordinator Centre for Environmental Science & Technology, BHU, Varanasi	ex-officio Member
(o) Dr. Suresh Kumar Rohilla, Saket-12-A, Flat No. 14-A, Vaishali Apartment, New Delhi	ex-officio Member
(p) Shri Neeraj Srivastava, (Ganga Activist) 7/81-Narayan Deep, Annexe, Tilak Nagar, Kanpur	Members

West Bengal

Name of the Authority: - West Bengal State Ganga river Conservation Authority

Headquarter of the Authority: - Kolkata

COMPOSITION OF THE AUTHORITY

(a) Chief Minister,West Bengal	ex-officio Chairperson
(b) Minister, Environment, Government of West Bengal	ex officio Member
(c) Minister, Finance, Government of West Bengal	ex officio Member
(d) Minister, Urban Development, Government of West Bengal	ex officio Member
(e) Minister, Irrigation, Government of West Bengal	ex officio Member
(f) Chief Secretary, Government of West Bengal	ex-officio Member Secretary

STATE EXECUTIVE COMMITTEE

(a) Chief Secretary, Government of West Bengal	ex-officio Chairperson
(b) Secretary, finance, Govt. of West Bengal	ex-officio Member
(c) Secretary, Urban Development, Govt. of West Bengal	ex-officio Member
(d) Secretary, Irrigation, Govt. of West Bengal	ex-officio Member
(e) Chairman, west Bengal Pollution Control Bengal	ex-officio Member
(f) Managing Director, Project Implementing Agency, Govt. of west Bengal	ex-officio Member
(g) Principal Chief Conservator of Forests, Govt. of West Bengal	ex-officio Member
(h) Engineer-in-Chief, Irrigation Department, Govt. of west Bengal	ex-officio Member
(i) Chief Executive Officer, Kolkata Metropolitan Development Authority	ex-officio Member
(j) Chief Engineer, KMDA (dealing with Ganga Action Plan)	ex-officio Member
(k) Chairman, Kolkata Port Trust	ex-officio Member
(l) Municipal Commissioner, Kolkata Municipal Corporation	ex-officio Member

(m) Three experts from relevant fields to be nominated by the Government of west Bengal	Members
(n) Secretary, Department of environment, Govt. of west Bengal	ex-officio Member Secretary

INVESTMENT INITIATIVES IN THE MAIN GANGA BASIN STATES

STATE- BIHAR

NRCP States			
Till 31/03/10 :	GAP-II	NGRBA	TOTAL
Sanctioned Cost:	395.18	25396.28	25791.46
No of Schemes Sanctioned:	18	3	21
No of Schemes Completed:	14	0	14
Funds Released by GOI:	315.13	1537.00	1852.13
Expenditure (including State Govt. Share):	297.54	0.00	297.54 Lakhs

STATE- JHARKHAND

NRCP States				
Till 31/03/10 :	DAP	GAP-II	NRCP	Total
Sanctioned Cost:	41.44	20.67	375.62	437.73Lakhs
No of Schemes Sanctioned:	4	2	9	15
No of Schemes Completed:	4	2	0	6
Funds Released by GOI:	19.81	0	425.60	445.41Lakhs
Expenditure (including State Govt. Share):	36.99	24.57	97.65	159.21Lakhs

STATE- UTTAR PRADESH

NRCP States							
Till 31/03/10 :	YAP	YAP-II	GoAP	GoAP-II	GAP-II	NGRBA	Total
Sanctioned Cost:	28266.50	11507.94	5575.09	26304.22	19811.76	0.00	91465.29 Lakhs
No of Schemes Sanctioned:	146	5	31	30	45	0	257
No of Schemes Completed:	146	2	29	7	32	0	216

Funds Released by GOI:	24001.50 7752.00 4314.72 16743.46 13827.77 1272.00 67911.45Lakhs
Expenditure (including State Govt. Share):	27323.02 7882.84 5287.86 28912.43 16074.92 0.00 85481.07Lakhs

STATE- UTTARAKHAND

Till 31/03/10 :	GAP-II NGRBA TOTAL
Sanctioned Cost:	7062.15 6402.54 13464.69 Lakhs
No of Schemes Sanctioned:	44 10 54
No of Schemes Completed:	32 0 32
Funds Released by GOI:	3138.42 1793.62 4932.04 Lakhs
Expenditure (including State Govt. Share):	5065.57 0.00 5065.57 Lakhs

STATE- WEST BENGAL

NRCP States						
Till 31/03/10 :	DAP	MAP	GAP-II	CETP	NGRBA	Total
Sanctioned Cost:	398.41	5488.23	23560.84	8292.00	10579.97	48319.45Lakhs
No of Schemes Sanctioned:	10	3	202	4	13	232
No of Schemes Completed:	10	1	155	2	0	168
Funds Released by GOI:	10.74	500	19206.63	4224.00	5708.00	29649.37Lakhs
Expenditure (including State Govt. Share):	392.20	1803.36	16250.90	3952.00	0.00	24902.49Lakhs

Appendix V: Comparative Analysis of Right to Fair Compensation and Transparency in LAR&R (RFCTLAR&R) Act 2013 and World Bank Policy 4.12- Involuntary Resettlement.

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
1	Application of LA	Direct economic and social impacts that both result from Bank-assisted investment projects. Applies to all components of the project that result in involuntary resettlement, regardless of the source of financing.	***Section 2*** Applicable to projects where government acquires land for its own use, hold and control, including PSU and for public purpose; for PPP where ownership of land continues to vest with Govt; private companies where 80% of **land owners** [19] have given consent or 70% in case of PPP.	No gap identified.
2	Principle of avoidance	Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project design	Alternatives to be considered as Act in chapter II, point # 4 (d) says "extent of land proposed for acquisition is the absolute bare minimum needed for the project; and (e) says land acquisition at an alternate place has been considered and found not feasible.	No gap identified
3	Linkages with other projects		No such provision	Provision of OP 4.12 will prevail
4	Application of R&R	Same as above	In addition to the above, ***Section 2(3)*** land purchased by private company as prescribed by Govt. or when part acquired by Govt.	No R&R for non-titleholders in national law. Entitlement matrix in RPF has provision of R&R assistance for non-titleholders
5	Affected area	Involuntary take of land resulting in loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood	***Section3(b)***: Area notified for 'acquisition'	Provision of OP 4.12 will be followed in this project.
6	Family	All adversely affected people whether have formal legal rights or do not have formal legal rights on land	***Section 3(m)*** includes person, his and her spouse, minor children, minor brothers and sisters dependent. Widows, divorcees, abandoned women will be considered as separate family.	The entitlement matrix of RPF also considers non -titleholders as affected family

[19] Land Owner – whose land and immovable property acquired and land assigned by state or central govt. under any scheme (Section 3 c (i) and (v))

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
7	Affected family for eligibility		***Section 3 (a)***: whose land and other immovable property acquired. ***(b) &(e)***: Family residing in affected area such as labourers, tenants, dependent on forest and water bodies, etc. whose primary source of livelihood is affected due to acquisition ***(c)*** Scheduled tribes and other forest dwellers whose rights recognized under the Forest Dwellers Act2006 *(not Applicable in this project).* ***(f)*** Family assigned land by state or central government under any schemes ***(g)*** Family residing on any land in urban area that will be acquired or primary source of livelihood affected by acquisition.	This provision leaves scope for interpretation and some of the issues remain unanswered especially in context of urban areas when people use public land for shelter and livelihood and is not acquired but transferred from one agency to another. Will they be recognized as "affected family"? The entitlement matrix of RPF also considers non -titleholders as affected family
8	Cut-Off date	Date established by the borrower and acceptable to the Bank. In practice it is the date of census.	***Section 3 c (ii), (iv) (vi)***: Families residing for preceding 3 years or more prior to "acquisition of land".	For titleholders, provision of RFCTLAR&R Act of 2013 will prevail. For non-titleholders, end date of census survey will be cut off date.
9	Non-application of Chapter II	Stand-alone SIA for all investments	***Section 6(2):*** Irrigation projects where EIA is required under other laws, provisions of SIA not applicable.	No gaps found.
10	Consultation – Phase I during preparation	Consultation a continuous process during planning and implementation	***Section 4(1)*** date issued for *first consultation* with PRIs, Urban local bodies, Municipalities, etc. to carry out SIA. ***Section 5***: Public hearing of SIA in affected area. Provide adequate publicity of date and time.	No gaps found.
11	Time duration to prepare SIA and SIMP	Draft Social Assessment, Resettlement Action Plan and or Social Management Framework prepared before appraisal.	***Section 4 (2)***: ***within six months*** from the date of its commencement.	No gaps found
12	Disclosure – Stage I	To be disclosed before appraisal and 120 days before board date.	***Section 6(1)***: Translated in local language available in PRI institutions and local urban government bodies; district administrative offices and websites of concerned. Government agency.	No gaps found

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
13	Formation of Expert Group to appraise SIA and SIMP	Appraised by Bank staff	***Section 7(1):*** Constitute a multi-disciplinary Expert Group include members of decentralized Govt. Institutes (PRIs, ULBs).	No gaps found.
14	Time stipulated for Group to submit its report	Before the decision meeting for appraisal	***Section 7(4):*** Submit its report ***within two months from the date of its constitution***	No gaps found.
15	Scope of work of the Expert group	Social Assessment, resettlement action Plan reviewed and appraised by Bank staff and approved by Regional safeguard advisor	***Section 7 (4)(a & b)***: assess whether it serves any public purpose or not; if social costs outweigh potential benefits then should be abandoned; ***Section 7 (5) (a & b)***: if serves public purpose, then it has considered minimum land acquisition, and alternate options to minimize displacement; potential benefits outweigh social costs	-
16	Consultation – Phase II during appraisal	In practice consultation workshops are organized in project affected areas at district and state level.	***Section 2 (2):*** Prior consent of 80% and 70% of land owners in PPP and where private company has approached the govt. to acquire balance land has been obtained,	-
17	Disclosure – Stage II	Information dissemination through the planning and implementation	Section 7 (6): recommendations of expert group under 7(4&5)to be made public in local language in district and block administrative office and PRIs	-
18	Minimize impact on multi- cropland	Select feasible design that has minimal adverse impact.	***Section 10:*** In case multi-crop land is to be acquired under exceptional circumstances, the area to be acquired cannot exceed aggregate of land of all projects in district or state. The area to be acquired cannot exceed the total net sown area of the district or state. Wasteland equivalent to twice the area acquired will be developed.	-
19	Information dissemination of preliminary notice	Continuous part of the preparation and participation	***Section 11 (1), (2) & (3)***: Notice published in local language and meetings called of gram sabahs, municipalities to provide full information about the purpose of the project, summary of SIA and particulars of administrator appointed for R&R' summary of R&R scheme	-
20	Updating land records	To be part of RAP	***Section 11 (5)***: Once established that the land is required for public purpose, accordingly notice to be issued ***under section 19 following which land records to be updated within two months***	-

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
21	Census and preparation of R&R schemes	To be part of RAP	***Section 16 (1) (2)***: carry out census of affected people and their assets to be affected, livelihood loss and common property to be affected; R&R scheme including time line for implementation.	-
22	Information dissemination and Public hearing - Stage III	Consultation throughout the process is mandatory	***Section 16(4)&(5)***: mandatory to disseminate information on R&R scheme including resettlement area and organize public hearing on the Draft R&R scheme in each Gram Sabha, Municipality and consultations in Scheduled area as required under PESA.	-
23	Approval of R&R Scheme		***Section 17 & 18***: Draft R&R Scheme to be finalized after addressing objections raised during public hearing and approved.	-
24	Final declaration of R&R Scheme	Approved RAP including budgetary provisions to implement it	***Section 19 (2)***: Only after the requiring body has deposited the money will the govt. issue the notice along with **19(1)**.	-
25	Time period stipulated.	Included in RAP - Time line synchronized with Government's procedures or adopts innovative methods to reduce the time which is based operated on the principles of participation and transparency.	***Section 19 (2):*** the entire process to update land records, disseminate information, preliminary survey, census, hearing of objections, preparation of R&R schemes and approval, deposit of money must ***complete within 12 months*** from the date on which section 11, the preliminary notice issued. ***Section 19 (7)***: If the final declaration not made within 12 months of section 11 (1), the process will lapse, except under special circumstances.	-
26	Preparation of land acquisition plans	Included in RAP.	***Section 20:*** Land marked, measured for preparation of acquisition plans.	-
27	Hearing of claims		***Section 21(1) (2)***: Notices issued indicating Governments intension to take possession of land, and claims on compensation and R&R can be ***made not less than one month and not more than six month*** from the date of issue of section 21(1).	-
28	Time period stipulated for declaring the award		***Section 25:*** It is required to announce the award ***within 12months of issue of Section 19 (final declaration to acquire land, approved R&R scheme)*** after completing land acquisition plans, hearing of objection, settling individual claims for declaration of the award. If award not made within the stipulated time, the entire proceedings will	No gaps found.

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
			lapse.	
29	LA Act 1984 deem to lapse and RFCTLAR&R is applicable		***Section 24***: where award is not declared under section 11, or where made five years ago but land not taken in possession or where award declared but money not deposited in the account of majority of beneficiary.	-
30	Methodology for determining market value for land	Full replacement Cost	***Section 26 and First Schedule:*** Recognizes 3 methods and whichever is higher will be considered which will be multiplied by a factor given in Schedule First; compensation given earlier will not be considered; if rates not available floor price can be set; steps to be taken to update the market value.	-
31	Valuation of structures	Full Replacement cost	***Section 29 (1)*** without deducting the depreciated value.	-
32	Solatium and interest		***Section 30(1)*** 100% of the compensation amount ***Section 30(3)***: 12% per annum on the market rate from the date of notification of SIA to the date of ward or land taken over	-
33	R&R Award	Total cost included in RAP to resettle and rehabilitate the affected persons and assist in their efforts to improve their livelihoods and standards of living or at least to restore	***Section 31, Second Schedule***: A family as a unit will receive R&R grant over and above the compensation and those who are not entitled to compensation. ***Second Schedule:*** Homeless entitled to constructed house, land for land in irrigation projects in lieu of compensation, in case of acquisition for urbanization	-
34		them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher	20% of developed land reserved for owners at a prices equal to compensation' jobs or one-time payment or annuity for 20 years' subsistence grant, transportation, land and house registered on joint name husband and wife, etc.	
35	Transparency		***Section 37(1):*** Information of each individual family including loss, compensation awarded, etc. will be available on the website.	-
36	Possession of land	Taking of land and related assets may take place only after compensation has been paid and, where applicable, resettlement	***Section 38(1)***: Land will be taken over by the government within three months of compensation and 6 months of R&R benefits disbursed; infrastructure facilities at resettlement sites will be completed within18 months	-

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
		sites and moving allowances have been provided to the displaced persons.	from the date of award made under section 30 for compensation; in case of irrigation and hydel projects R&R completed six months prior to submergence.	
37	Multiple displacement		***Section 39:*** Additional compensation equivalent to compensation determined will be paid to displaced	This section does not cover those who may not be physically displaced but lose land over a period of time for multiple projects, expansion works or periodic widening of roads, etc. and may be left with marginal holding or landless.
38	Acquisition for emergency purpose	Not permeable in bank funded projects	***Section 40 (5)***: 75% additional compensation will be paid over and above the compensation amount	-
39	Prior consent before acquisition and alienation	Mandatory to carry out Free, Prior, Informed Consultation with Indigenous people.	***Section 41(3)*** Mandatory to get consent from Gram sabah, Panchayat, Autonomous Councils in Scheduled areas.	-
40	Development plans for SC and ST	Indigenous Peoples' Development plan required along with RAP. Land for land for is an option across all sectors.	***Section 41:*** Separate development plans to be prepared, settle land rights before acquisition; provision of for alternate fuel fodder, non-timber produce on forest land to be developed within 5 years; 1/3rd compensation amount to be paid as first installment and rest at the time of taking possession; ST to be resettled within Scheduled area; land free of cost for community purpose; land alienation will be null and void and ST and SC considered for R&R benefits; fishing rights restored in irrigation and hydel projects; if wish to settle outside the district additional benefits to be provided in monetary terms; all rights enjoyed under other laws will continue. ***Second Schedule***: additional provisions for SC&ST for land for land in irrigation projects, additional sum over and above the subsistence grant,	-
41	Institutional arrangement	Institutional arrangement must be agreed upon and included in RAP, IPDP.	***Section 43-45:*** Appointment of administrator, R&R Commissioner, when more than 100 acres of land is to be acquired, R&R Committee will be formed at project level, social audit to be carried out by Gram Sabha and Municipalities.	-
42	Change of land use		***Section 46(4):*** Land will not be transferred to the requisitioning authority till R&R is not complied with in	-

Serial No.	Topics/Issues/Areas	World Bank OP4.12	RFCTLAR&R	Gaps and Addressal
			full.	
43	Monitoring and Evaluation	Indicators and monitoring system included in RAP and IPDP	***Section 48-50:***Set up National and State level Monitoring Committee to review and monitor progress	-
44	Authority to settle claims		***Section 51-74:*** the Authority will be set up settle any legal disputes that arise from acquisition and R&R, the aggrieved party can move to the high court thereafter.	-
45	Exempt from tax and fee		***Section 96:*** Compensation and agreements will not be liable to tax	-
46	No change in status of land acquired		***Section 99***: Once the land is acquired for a particular purpose, its purpose cannot be changed	-
47	Return of unutilized land		***Section 101:*** If the acquired land remains unutilized for 5 years, then it will be returned to original owner, heir or included in land bank	-
48	Distribution of increased value of land transferred		***Section102***: 40% of appreciated value of acquired land will be distributed to owners provided no development has taken place.	-

Appendix VI: Sample Terms of Reference for Environmental and Social Audit of Namami Gange Program Investments

1. Background:

The National Ganga River Basin Authority with an objective to ensure no entry of polluted water into the River Ganga is supporting number of pollution prevention and river conservation activities in the five basin states of UP, Bihar, Jharkhand, West Bengal and Uttaranchal.

Namami Gange program believes that each of its investments will improve living standards and the environment of the River in and around project locations. Namami Gange program is committed to implementing these activities in an environmentally sound, socially acceptable way. This has reflected its environmental and social commitments through its Environmental and Social Management Framework (ESMF). All investments financed by Namami Gange program should be in consonance with its ESMF.

2. Objectives:

- To audit the conformity of environmental and social categorization of investments approved by the Namami Gange during the Financial Year_, with respect to the categorization prescribed in the ESMF of Namami Gange program
- To audit the compliance of the environmental and social aspects of approved investments, which are under implementation.

3. Outline of the tasks to be carried out: The, following tasks are to be carried out:

(a) To Audit the Environmental and Social Categorization of Approved Investments:

The audit process will check the conformity of environmental and social categorization of investments approved by the Namami Gange with respect to environmental and social categorization in the ESMF of Namami Gange program (i.e.) whether the Environmental and Social categorization specified for the approved investments are in conformity with environmental and social categorization specified in the ESMF.

(b) Auditing the compliance of the Approved Investments:

The audit process will check the compliance of environmental and social aspects during construction, operation and maintenance of investments approved by Namami Gange program, across all categories and different sub-project locations. Adequacy of the ESMP (including RAP, where relevant)

Audit the adequacy of the ESMP (including RAP, where relevant)and recommend practicable measures to include/improve the management measures and the agency responsible for carrying out the measures, wherever found inadequate. The best practices and possible environmental and social enhancement measures with respect to the audited investments will be documented.

(c) Reporting:

To review the status report submitted by the project Management consultant on the implementation of ESMP (including RAP, where relevant) and the process adopted by design consultants in identification and mitigation measures while preparing the DPRs. To report on the adequacy and timely submission of the Quarterly Progress Reports including the process involved in addressing the risk management.

(d) Audit Report

The findings of the review and audit should be summarized in a tabular form and will include compliance, non-compliance, best practices and enhancement measures along with the name of the agency responsible for each of the above. In case of non-compliances, the consultants need to undertake a follow up visit after giving enough time (depending on the type of corrective measures) for the agency responsible to take corrective actions.

4. Final outputs (i.e., Reports, drawings etc.). That will be required of the Consultant;

- EnvironmentalandSocialAuditReportsindicatingconformityofinvestments approved by Namami Gange, relating to the financial year, with ESMF Framework.
- Environmental and Social Audit report indicating the conformity to agreed standards during construction, operation and maintenance of the approved investments.

Appendix VII: Roles and Responsibilities of Social Development Specialists

LEVELS	ROLES and RESPONSIBILITIES
NMCG Social Development Officer	• Finalize ESMF; • Provide policy guidance to the state level counterparts • Ensure dissemination of R&R Policy at national level • Monitoring R&R and Land acquisition activities. Make budgetary provisions for R&R activities • Liaison with state administration for land acquisition and implementation of RAP; • Participate in state level meetings • Finalize TOR of contracting NGO for implementation and external agency for monitoring and evaluation • Prepare training schedule for state and project level social development officials for capacity building to implement the RAP; • Prepare TOR for any studies required and qualitative dimensions to the implementation of RAP; • Facilitate appointment of consultants to carry out the studies and co-ordinate them. • Monitor physical and financial progress on implementation of RAP;
SMCG/ – Social Development Officer	• Co-ordinate with district administration and NGO responsible for implementation of ESMF/RAP; • Translation of R&R policy in local language and ensure dissemination at state; district and community level - prepare pamphlets on policy for information dissemination • Coordinate with the state and district level officials for acquisition of private land and implementation of ESMF/ RAP; Liaison with district administration for dovetailing of government schemes for Income Restoration Schemes • Monitor physical and financial progress of implementation of RAP, • Participate in the project level meetings • Report progress, highlighting social issues not addressed, to provide for mid-course correction, • Coordinate training of project level staff with agencies involved. • Organize by-monthly meetings with NGO to review the progress of R&R and gender actions
Project Level – Executing Agency (EA)	• Disclosure of RAP and entitlements and also ensure that copies are made available to the PAPs; • Oversee land availability and coordinate with local revenue official for land acquisition • Dissemination of Project Information at various stages of project as envisaged in the ESMF/RAP • Ensure community involvement in every stage of the subproject • Documentation and disclosure of consultations • Shall be first level of grievance redress and will guide PAPs further to redress their grievances • Ensure disbarment of compensation and / or entitlements as per schedule • Responsible for addressal of additional unforeseen impacts during construction • Ensuring incorporation of social issues in DPRs • Supervising the ESMF tasks during implementation & its progress • Collect data pertaining to the evaluation and monitoring indicators • Will prepare monthly progress report and quarterly process documentation report

LEVELS	ROLES and RESPONSIBILITIES
Social Specialist of Supervision Consultants	• Ensure social screening of investments; • Implement the agreed social mitigation measures; • Ensure compliance of national and other applicable laws and Acts pertaining to social, • Sensitize and help build capacity of the EA officials towards the implementation of the ESMF provisions. • Assist Environment and Social Development Officer of EA in preparing monthly progress and quarterly process documentation reports
NGO	• Conduct the verification for the affected families and update the census and socio-economic data • Develop rapport with PAFs and between PAFs and EA • Design and carry out information campaign and consultations with the local community during the implementation of the RAP, • Provide information to PAFs and local community and conduct awareness on R&R Policy and distribute the policy to the affected families • Prepare and submit the micro plans for the PAFs • Assist the PAFs in receiving the compensation and rehabilitation assistance • Motivate and guide PAP for productive utilization of the compensation and assistance amount • Assess the level of skills and efficiency in pursuing economic activities, identify needs for training and organize training program • Assist PAFs in approaching the grievance redress mechanism • Assist the PAFs in getting benefits from the appropriate local development schemes • Prepare monthly progress reports and participate in monthly review meetings • Participate in the training program for capacity building • Carry out other responsibilities as required from time to time

Appendix VIII- State-wise Grievance Mechanism

Grievance Redress Mechanism in Uttarakhand

GRIEVANCE REDRESS MECHANISM

As the works of I&D and STP at Muni-ki-Reti, Dhalwala and Lakhargaht at Rishikesh is being started in the Rishikesh town, most of the impacts are construction-related, and therefore it is anticipated that improper or inadequate implementation of ESMP may lead to disturbance and inconvenience to local people. In order to provide a direct channel to the affected persons for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, PIU-Rishikesh has establish a Grievance Redress Mechanism, which has been functioning throughout the construction period. A Complaint receiving system has been be put in place at each site with the help of Community Awareness & Public Participation. A Complaint Register have been made available at the PIU Office, with a display board indicating availability of such facility. This will accept complaints regarding the environment safeguard issues in implementation of the subproject. The grievances received and actions taken shall be included into the environmental monitoring reports submitted to NMCG and the World Bank. The following stages have been followed in grievance redress:

Stage 1: Complaints received (written or oral communication) is being registered in Complaint Register assigning complaint number with date of receipt

I. The PIU Officer will reviews the complaint and direct the Contractor for necessary action; depending on the type/nature of complaint the Contractor will be given reasonable time for corrective action.
II. Contractor must take corrective actions or as directed by PIU.
III. The action taken has been documented in the Complaint Register, and the complaint will be closed if it is satisfactorily addressed, and the complainant will be informed through e-mail/telephonically.

Stage 2: In case of no satisfactory action in Stage-1, the complainant can approach General Manager, Ganga / SPMG for necessary action;

I. General Manager, Ganga / SPMG with the assistance of PIU will initiate the action and take the corrective measures as required.
II. Upon satisfaction of complainant, the case will be closed and marked as resolved

Stage 4: If it is not resolved at GRC, the complainant can approach Court of Law. However, as none of the impacts are complex, long-term or significant, it is unlikely that there have been any unresolved issues after the two stages.

GRC at Rishikesh

12. A Grievance Redress Cell (GRC) has been constituted in the PIU Rishikesh to record and redress public grievances with effect from 10th December 2018 vide office order 4294/Karya-12/47 dated 10.12.0218. The office orders have been appended

A dedicated team under the supervision of the Project Manager has been appointed for recording and forwarding the grievances to the concerned officers. The progress of the grievances so recorded addressed as well as the one pending is being complied on monthly basis and submitted to NMCG.

Concerned PIU has been applied for toll free number for registering grievances.

Grievance Redressal Cell is applicable for addressing the Environmental and Social Safeguards Issues at the ongoing construction sites under world bank funded projects.

कार्यालय महाप्रबन्धक
निर्माण मण्डल (गंगा)
उत्तराखण्ड पेयजल निगम
जगजीतपुर, पोस्ट–कनखल
हरिद्वार–249408

Email:-gmgangahw@gmail.com

Office of General Manager
Construction Circle (Ganga)
Uttarakhand Peyjal Nigam
Jagjeetpur, Post-Kankhal
Haridwar-249408

Letter No. 4294/Karya-12 / 47 date 10-12-2018 Through - Email/Post

Office Order

Establiishment of Grievance Redressal Cell (GRC) in Ganga Unit (Project Implementation Unit) Rishikesh.

The works under Namami Gange program in Rishikesh and Muni Ki Reti town are in execution phase. Public concerns and grievances from the community needs and urgent attention by the Concerned Officer.

The program is attempting to record the public grievances from the community in multiple ways, so that its quick redressal is undertaken in a time bound manner. Keeping the above in mind, the Grievance Redressal System (GRC) is being strengthening in the following way:

1. Project Engineer concern will record the complaints through direct interaction with the public on the sites and submit the grievances to the concerned officer.
2. Contact Nos. of concerned staff of the Unit, Rishikesh will be provided to the general public for early follow up the grievances.

In this regard a Grievance Redressal cell (GRC) is being constituted in the C&M Unit (Ganga), UKPJN, Rishikesh comprising of the following staff/public officer:

1. PM, Rishikesh henceforth will be in charge of the GRC.
2. Concern Project Engineer from Unit, Rishikesh will be assigned duty for compiling of the grievances to put up to the concerned authority.
3. Evnironment Officer and SCD Officer SPMG, Dehradun will oversee the grievances under overall supervison of PM, Rishikesh.

The GRC with immidiate effect on 15.11.2018, will put up the complied progress of all concerns, complaints and grievances recorded, attended, closed along with pending cases on weekly basis to the, GM, Ganga, UKPJN, Haridwar.

(K.K.Rastogi)
General Manager

Endt. No. and date as per above:-

Copy to the following for information and necessary action.

1. PM, C&M Unit (Ganga), Uttarakhand Peyjal Nigam, Rishikesh.
2. All PE's, C&M Unit (Ganga), Uttarakhand Peyjal Nigam, Rishikesh.
3. Environment Officer & SCD Officer, SPMG, Dehradun.
4. M/s R.K.Engineers Sales Ltd., Vibhuti Khand, Gomati Nagar, Lucknow.
5. M/s GDCL-EMIT JV, B-228, Okhla Industrial Area, Phase-I, New Delhi.

General Manager

INTEGRATED GREIVANCE REDRESSAL SYSTEM- UTTAR PRADESH- STATUS OF SMCG UTTAR PRADESH

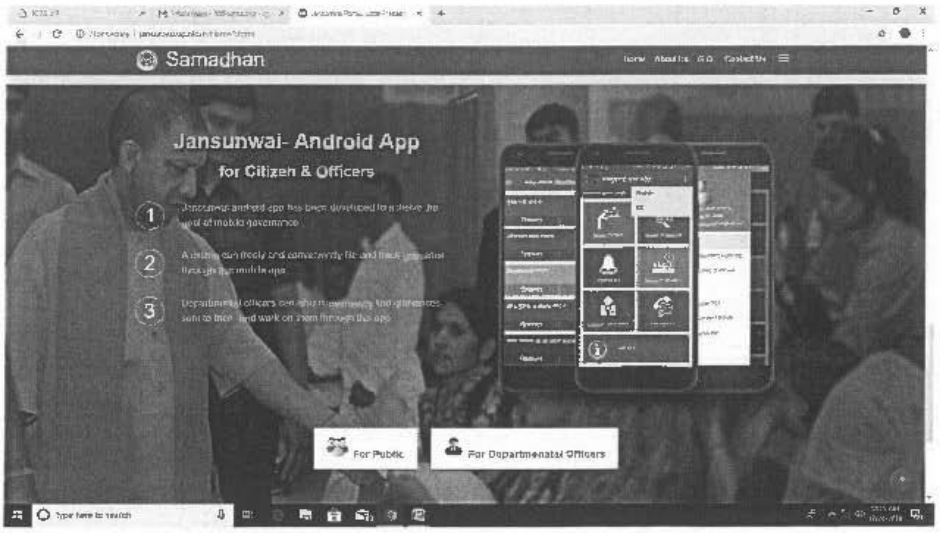
SMCG is working as per provisions specified in the NGRBA framework and Government of Uttar Pradesh guidelines. GOUP has developed comprehensive system of grievance redressal and have ensured all departments to have a dedicated Greivance Redressal Officer. All Head of Offices under GoUP have to register their office at **Samadhan / JanSunvai** portal.

Samadhan / JanSunvai is an integrated system for grievance redressal in Uttar Pradesh to achieve the goal of good governance using technological solution and mechanized processes to avoid human errors integrating all stakeholders. A citizen can freely and conveniently file a grievance, track the grievance lodged on all important platform and receive response to his satisfaction both in terms of quality and time. Along with lodging of complaints, citizen can also interact with Government/Departments/Offices in an easy and transparent manner. Complaints from all sources will be available on a single platform to all departments which will improve access, redressal & monitoring.

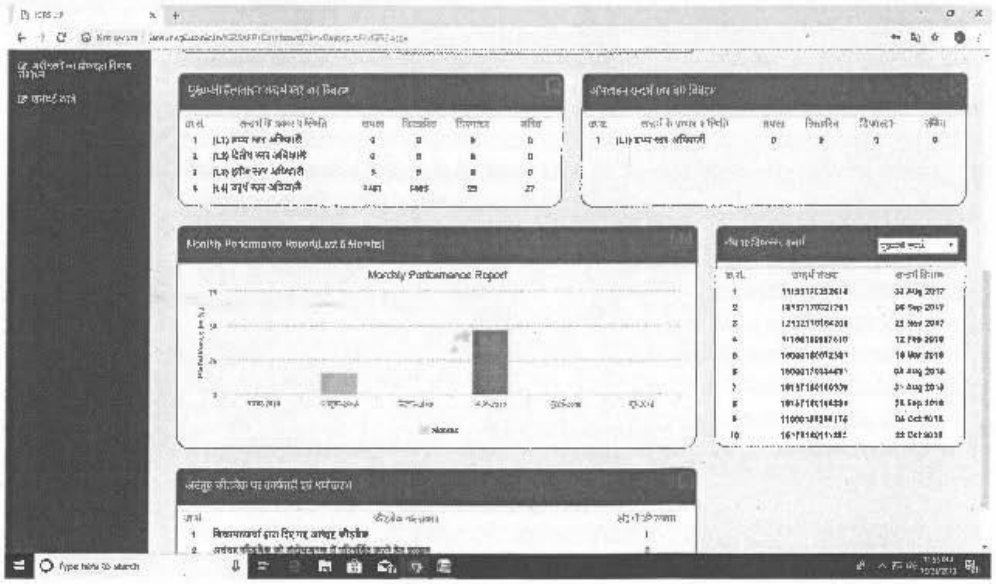
SMCG and all Executing Agency along with their district offices are registered on this platform. Any person, organization can lodge complain, give suggestion to any office, program or project. Once the complaint is registered, it is properly analysed by Greivance Redressal Officer and the appropriate response is prepared for the complaint with the help of concerned officer. If the complaint or advice is related to another department, it is sent or transferred through the Samadhan portal to the concerned officer / department to sort out the problem.

Samadhan / JanSunvai is time bound solution providing portal.

INTEGRATED GREIVANCE REDRESSAL SYSTEM- UTTAR PRADESH-
STATUS OF SMCG UTTAR PRADESH



INTEGRATED GREIVANCE REDRESSAL SYSTEM- UTTAR PRADESH-
STATUS OF SMCG UTTAR PRADESH



Grievance Redress Mechanism for NMCG Projects under implementation in BUIDCo

National Mission for Clean Ganga (NMCG) under the Ministry of Water Resources, River Development & Ganga Rejuvenation has set an objective to ensure effective abatement of pollution and conservation of the river Ganga by adopting a river basin approach for comprehensive planning and management.

Under the flagship Program of Namami Gange, several sewerage projects have taken up along the banks of river Ganga in Bihar. Under these projects, grievance redressal mechanism is proposed to establish. In 14th Implementation Mission meeting at NMCG Office Delhi, a detail discussion was held and a common approach to solve the grievances was finalized which is detailed below:-

1. On receipt of complains and suggestions from different stake holders & citizens, a plan of action is devised accordingly. (SPMG)
2. Time bound reply to the petitioners after doing a root cause analysis (RCA) of the incoming complaint as per rules & regulations of the Government.(SPMG)
3. Co-ordination with Executing Agencies (like BUIDCo, NBCC), SPMG and the Government Department -UD&HD for effective redressal of the complains. (SPMG)
4. Maintenance of records and procedures through proper filing as per rules will be done by the Grievance Redressal Officer of SPMG.(SPMG)
5. BUIDCo has already taken a toll free number which will be activated shortly and the same will be displayed on BUIDCo website and each project site. In BUIDCO GRM will work in three tier(EA)
6. First tier- Control room will collect and segregate the data project wise and forward to concerned Project Director in a week time.(EA)
7. Second tier- At each project site, a Grievance Redressal Committee will work consisting of PD BUIDCo, DPD BUIDCo, Safeguard officer, BUIDCo, Project Manager (contractor),Health & Safety Officer(contractor). Along with toll free number, detail of Grievance Redressal Committee will be displayed on the site This committee will resolve the issues in 15days.If fail to resolve, the issue will be forwarded to BUIDCo level(EA).
8. Third tier- At this stage a committee consisting of MD BUIDCo, SPMG team leader, Chief Engineer BUIDCo, PD HQ and Safeguard Specialist BUIDCo will resolve the issues in a month time as this committee will sit once in a month.(EA)

Grievance Redress Mechanism in Jharkhand

Grievance Redressal Mechanism

SPMG Jharkhand dedicated cell within the UD Department, with the objective of serving as the dedicated institution for effective implementation of the NGRBA program activities at the state level. To Address the grievances NGRBA frame works Governance and Accountability Action Plan (GAAP) an official Notification No 54 dated 07/07/2015 published . A three layer Grievance mechanism is working currently.

A. At SPMG Level

I.	Project Director	Chairman
II.	Project Manager (unit head) SPMG	Member
III.	Communication-cum-Social Development Manager	Member Secretary

B. At Juidco (Executing Agency) Level

I.	Project Director (Technical)	Chairman
II.	General Manager	Member
III.	Assistant Project manager	Member Secretary

C. At ULB Level

I.	Executive officer	Chairman
II.	Assistant Engineer /Junior Engineer	Member
III.	Head Clerk	Member Secretary

Contractor also maintained grievance register at site level .

Any grievance can be submitted at afore said committee. And It will addressed at that level or may be coordination of all. Beside this District administration also receive the grievances which transferred to ULB and then it addressed at appropriate level.

People can also log their grievances at UD&HD Public Grievances Management System Portal through

web interaction https://pgms.dmajharkhand.in/

Toll Free No 1800-120-2929

Landline No 0651-7122727

WhatsAPP :7633928444

Email: info@dmajharkhand.in

Mukhyamantri Jansamvad Kendra is another state government tool to address public grievances
'http://cmjansamvad.jharkhand.gov.in/

Post : JAN SAMVAD KENDRA

SUCHNA BHAWAN
Near Audrey House, Mayers Road
Ranchi, Jharkhand-834008
Web interation http://jansamvad.jharkhand.gov.in

Email: cm-jansamvad@jharkhandmail.gov.in

Facebook cm-jansamvad

Twitter - cm-jansamvad

The departmental and Mukhyamantri Jansamvad grievances also redirected ULB/JUIDCO/SPMG for redressal of grievance .

Grievance Redress Mechanism in West Bengal

Subject: **Regarding "REPORT ON GRIEVANCE REDRESSAL"**
To: director.projects@nmcg.nic.in
Cc: spmg.programdirector@gmail.com,
mahua bhattacharya <mahua.wbspmg@gmail.com>

Date: 12/24/18 04:32 PM
From: APD WBSPMG <apd.wbspmg@gmail.com>

ANNEXURE V : WEST BENGAL

Sir,

The Report on Grievance Redressal mechanism is given below as desired-

Normally a complaint is received at the project site or it is addressed directly to NMCG or WBSPMG through mail. After its receipt the same is forwarded to our Executing Agencies (EAs) like KMDA or KMC for its officers to take appropriate action by required intervention based upon the nature of complaint petition. After taking necessary action on the complaint, The Action taken report (ATR) is forwarded to the complainant with intimation to NMCG as required. This process is usually takes 4 to 7 days.

Regards,
Asst. Project Director, WBSPMG

ANNEXURE VI : NMCG

File No.P-15011/3/2018/SMD/NMCG
Government of India
Ministry of Water Resources
River Development and Ganga Rejuvenation
(National Mission for Clean Ganga)

Dated: 26.12.2018

OFFICE MEMORANDUM

Subject: Small Write-up on Grievances Redressal Mechanism with reference to email dated 24.12.2018 from Director (Projects), NMCG -reg

The under signed is directed to refer to the email dated 26.12.2018 the on the subject cited above from Director (Projects), NMCG regarding the brief description on Grievances Redressal Mechanism under Centralized Public Grievance Redress and Monitoring System (CPGRAM) regulated by the Department of Administrative Reforms and Public Grievances (DARPG) since June 2007.

2. In this context, it is stated that the Public Grievances Redressal is one of the flagship initiatives for the reformation in governance started by Central Government through addressing the grievances of general public. The National Mission for Clean Ganga (NMCG) under Ministry of Water Resources, River Development and Ganga Rejuvenation is one of the parts of this mechanism. One Deputy Secretary has been exclusively nominated as a Nodal Officer to carry out the functions relating to public grievances of NMCG. Around 02 on line grievances and approx 1 to 2 off line grievances by and large relating to projects works undertaken by NMCG and its supporting agencies are received every day which are forwarded both by the Ministry of WR, RD & GR/ PMO/ President Secretariat. On receipt of the same, as a course of action, the Nodal Officer uses to seek reply to the issues raised by the applicants from the concerned officers in NMCG. After receipt of the reply, the same is forwarded to the applicants. If the matter relates to the State Project Management Groups (SPMGs) of Ganga Basin States (Uttar Pradesh, Bihar, Jharkhand, West Bengal and Uttarakhand), the grievances are forwarded to the concerned State with the request to furnish reply direct to the applicants under intimation to NMCG.

This issues with the approval of the Competent Authority.

26/12/2018

(K K Sapra)
Under Secretary (NMCG)

Director(Projects), NMCG

Appendix IX: Minutes of Public Consultation Meetings

1. Public Consultation on Environment and Social Management Framework (NGRBA Program), held at Haridwar, Uttarakhand

Minutes of Meeting

Date: 10th December, 2010. **Time:** 2:30 PM to 5:00 PM

Venue: Nagar Pallika Bhawan, Haridwar, Uttarakhand

Attended by:

- State Nodal agency (Uttarakhand Peyjal Nigam): Mr. Prabhat Raj (Executive Engineer), Mr. S. C Gupta (General Manager), Mr. Y. K Mishra (Project Manager),
- Consultancy team from TERI: Mr. Sakaram Somayaji, Mr. C. G. Hiremath, Ms. C. Sita Lakshmi
- Number of participants: 22 (representatives from NGOs, elected members of Nagar Pallika Haridwar and concerned individuals from Uttarkashi, Gangotri, Dehradun and Haridwar)

The public consultation meeting was flagged-off by Mr. Y. K Mishra who welcomed the participants and briefed them about the agenda of the meeting. Further the meeting was carried forward by Mr. Prabhat Raj, who presented the details about the Environment and Social Management Framework, starting from the current status of river Ganga, future government plans, possible assistance by World Bank, overall significance of ESMF, stake-holder participation during the project, etc. A brief summary of all the important points discussed during the meeting are mentioned in the following points:

- A target-oriented, continuous and regular mechanism to create education and awareness among the people, particularly the younger generation about the importance of keeping river Ganga clean.
- Provide proper sanitation facilities, along with efficient operation and maintenance systems, to the tourists and pilgrims (like the Kaavadis) who visit the state during religious occasions and other festivals.
- Active participation from the NGOs, the local communities and the panchayats needs to be ensured in the process of planning, implementation and monitoring of the project.
- All efforts should be made to safeguard and minimize any possible negative impact on the socio-cultural beliefs and traditions of the local communities regarding river Ganga, while implementing the sub-projects.
- Regular operation and maintenance mechanism for sustainable management of the facilities created during the sub-projects, along with sufficient budgetary provisions.
- In order to ensure proper cleaning of Ganga, all the tributaries in the state also needs to be covered under the project.
- A common concern among the stakeholders was the lack of any solid waste management plan, as of today, in the district. This project should incorporate suitable mechanisms for proper solid waste management in the river basin.
- To avoid time and cost run-over, the time gap between planning and implementation of the project needs to be minimized. This will also prevent the project to suffer due to price-escalations and consequent budget insufficiency.

- All safety and precautionary measures must be taken to avoid any accidents during the construction phase of the projects. Although the notice of the project along with other details and the specific agenda of the meeting was made available on the website of Peyjal Nigam, the ward members of Nagar Pallika, Haridwar suggested that hard copies of these details be provided to them individually, as internet is not easily accessible by everyone, so as to make their participation more effective.
- Ensure proper coordination between different government agencies/ departments with clear allotment of responsibilities and provide sufficient accountability at each level.

The meeting was concluded by Mr. Y. K. Mishra followed by vote of thanks given by Mr. S.C Gupta.

2. Public Consultation Meeting on Environment and Social Management Framework (NGRBA Program) held at Kolkata

Minutes of Meeting

Date: Tuesday, 21 December, 2010 **Time:** 2p.m.

Venue: Unnayan Bhawan, Salt Lake, Kolkata

Attended by:

- Mr. N. Dey, Special Secretary, Urban Development Department, Government of West Bengal, Mr. Chunar Dey, DGO,GAP
- Consultancy team from TERI: Dr. Sujana Dhar, Ms. Avanti Roy Basu
- No. of participants: 43 (including representatives from Barrackpore, Khardah, Panihati, Kamarhati, Gaeshpur, Konnagar, Serampore, Naihati, Halisahar, Mahestala,Behrampore,Jangipur,Nabadwip,Bhatparamunicipalities,Kolkata Metropolitan Development Authority, Howrah Municipal Corporation, Chandannagar Municipal Corporation, West Bengal Pollution Control Board, Jadavpur University, ME Directorate and KMW&SA).

The public consultation meeting was initiated by Mr. N. Dey who welcomed the participants and briefed them about the agenda of the meeting. The details of the Environment and Social Management Framework (ESMF), including the future activities planned by the government, possible assistance by World Bank, overall significance of the ESMF, stakeholder participation during the project, etc. were discussed.

A brief summary of the important points discussed during the meeting are mentioned below.

- The various river pollution mitigation projects to be implemented under NGRBP, namely sewerage and sanitation schemes, sewage treatment plants (new/ up gradation), solid waste management, industrial pollution control initiatives and river front development schemes were highlighted. He stressed on the importance of the treated sewage water to only flow into the river.
- Mr. Dey presented the genesis of the NGRBP/Namami Gange and informed the participants that the mission is to clean River Ganga by 2020 and to bring the water quality to acceptable limits, which primarily flows through 5 states, namely, Uttar Pradesh, Uttarakhand, Bihar, Jharkhand and West Bengal.
- He described the structure of the NGRBA/Namami Gange, chaired by the Hon'ble Prime Minister

of India. The organizational structure of the NGRBP/Namami Gange is as follows: At the national level, NGRBA /Namami Gange was chaired by the Hon'ble Prime Minister of India, and the Empowering Steering Committee (ESC) has been formed. At the state level, SGRBA (State Ganga River Basin Authority) /SMCG is chaired by the Hon'ble Chief Minister of the respective states. Also, State Project Planning and Monitoring Unit/ SMCG will be the state nodal agency and will be formed in West Bengal shortly. The SMCG will be a registered body and will be headed by the Principal Secretary of the State Urban Development Department. The State Executing Agency (SEA) will be formed at the state level. For execution of the project, EA (Executing Agency) – NGO or any state agency. City level monitoring agencies at the district level will also be formed.

- He discussed in length about the purpose of the ESMF (Environment and Social Management Framework) including matters related to land acquisition, entitlement issues, resettlement and rehabilitation of the Project Affected Persons (PAPs).
- The laws and regulations as well as World Bank Safeguard policies applicable to the project were discussed.
- The environmental categorization of the various sub-projects envisaged under the NGRBP was discussed.
- He mentioned that based on proper guidelines, Feasibility Reports (FR) will be prepared, and after obtaining necessary approvals from the state government and GoI, the DPR will be documented. The modifications will be made at the FR stage, and not at the DPR stage.
- Many activities related to RFD have already been implemented in many parts of the state. He stressed on the need of ladies' changing room (as part of the RFD sub-project) and the need of low-income scheme (as part of the sewerage and sanitation subproject).
- The O&M cost for the first five years will be included within the project cost and will follow the 70:30 pattern (70% by GoI and 30% by state government). The funds will flow from GoI to SMCG to EA.
- The representatives of Panihati, Mahestala, Bhatpara, Gayeshpur and Chandan Nagar municipalities raised their queries, which were successfully handled by Mr. Chunar Dey (GAP), Prof. A Majumdar (Jadavpur University) and Dr. T K Gupta (WBPCB).
- Observations that the different agencies mostly failed to operate and maintain properly the sewage treatment plants e.g. Activated Sludge Process, Trickling Filters etc. constructed under GAP-Phase I and Phase- II were heard. The STPs like Waste Stabilization Ponds (WSP), however installed under GAP Phase I and Phase II operated and maintained satisfactorily. So, efforts must be exerted for installation of WSP for treatment of city sewage. Accordingly, land selection (in rural areas) and acquisition should receive priority for interest of the work.
- Prof. Mazumder stated that the current phase of GAP envisages installation of sewerage system in the town. The storm water during rain will flow along surfacedrainsleadingtoGanga.Thushouseconnectionsintheseweragesystem need guarantee from the municipal authorities. If house connections are not done then sullage will continue to get discharged in the river. Thus house connection is a challenge for the future action plan.

- He also mentioned that recycling and reuse of treated wastewater must receive serious attention in the projects. This will ensure use of treated wastewater in agriculture, pisciculture, ground water recharging etc. One must conceive ecologically balanced wastewater treatment system for

abatement of river pollution

- One of the objectives of GAP must be the positive impact on public health, Non- point pollution needs also to be addressed, and more thrust is needed to ensure peoples' participation in the programme.

Representatives of certain municipalities expressed their opinions and suggestions during the participatory discussion, and a few experts present in the meeting presented their views accordingly. A brief summary of the interactive session is given below:

- Panihati Municipality – Under the Ganga Action Plan, 13 towns were covered in the 1st phase within KMA including Panihati. However, the representative of Panihati Municipality complained that the sewage treatment plant (STP) constructed under GAP I is currently non-functional.
- Mahestala Municipality – There are several small-scale industrial units in Mahestala, which discharge untreated/partially treated wastewater directly into the river and pollute it. The representative of Maheshtala Municipality opined that due to financial reasons, it is not possible for these small units to set up wastewater treatment facilities at an individual level. Also, there is no sewerage network in Maheshtala. As a response to this, Dr. T K Gupta, Chief Engineer, West Bengal Pollution Control Board (WBPCB) suggested that Common Effluent Treatment Plant (CETP) will be constructed for which land has to be identified. The formalities of land possession (for the CETP) may be discussed in the Committee meeting at a later stage during the project. The smaller industries need to be shifted to the common location so that their wastewater is managed in an efficient manner (through the CETP).
- Bhatpara Municipality – There are 18-19 large-scale industries in Bhatpara. The sewerage system in Bhatpara is decades old, with problems like sewerage congestion due to weak O&M practices. Even after making repeated requests to the WBPCB, no actions were taken from their end. Therefore, the problems related to management of industrial wastewater as well as sewage do exist in a big way. Dr.T.K. Gupta assured that he will take necessary actions to address their grievances.
- Gayeshpur Municipality – The problems discussed by the representative of Gayeshpur municipality are similar to that of Bhatpara. He added that there is land available in Gayeshpur for any construction that might be required.
- Chandan Nagar Municipality–Untreated sewage from various point and non- point sources fall into the river. The representative from Chandan Nagar Municipality was of the opinion that municipal engineers should be involved in the decision-making process.

The meeting ended with the vote of thanks given by Mr. Dey. He was grateful for the overwhelming response of the participants for the meeting and requested their whole- hearted participation throughout the project.

3. Public Consultation on Environment and social management Framework (NGRBA Program), held at Sahibganj, Jharkhand

Minutes of Meeting

Date:23rd December, 2010 **Time:** 11:00 am to 2:00 pm

Venue: Vikash Bhawan, D.C. Office, Sahibganj, Jharkhand

Attended by:

- State nodal agency:
  - Mr. K. Ravi Kumar (District Commissioner, Sahibganj)
  - Mr. Sangram Besra (Deputy Secretary, Urban Development Department)
  - Mr. Gajanand Ram (Associate town planner, Urban Development Department, Jharkhand)
  - Mr. Sisir Kumar Soren (Executive officer, Sahibganj)
  - Mr. Suresh Kumar (Executive officer, panchyat, Rajmahal)
- Consultancy team from TERI: Mr. Sunil Kumar, Ms.G.Mini
- Number of Participants: 75 Representatives from NGOs, elected members of Nagar palika Sahibganj and concerned individuals from Sahibganj and Rajmahal.

The public consultation meeting was flagged-off by Mr. K. Ravi Kumar (District Commissioner, Sahibganj) and Mr. Gajan and Ram (Associate town planner, Urban Development Department, Jharkhand) who welcomed the participants and briefed them about the agenda of the meeting.

Further the meeting was carried forward by Mr. Gajanand Ram, who presented the details about the Environment and Social Management Framework (ESMF), starting from the current status of river Ganga, future government plans, possible assistance by World Bank, stakeholder participation during the project and the overall significance of ESMF. Various agencies involved in implementing the current programme were also explained in detail to the gathering. The guidelines were translated to vernacular and made available to public and also all the documents related to NGRBA program has been uploaded in the MoEF&CC/NMCG website.

Mr. K Ravi Kumar and Mr. Gajanand Ram also briefed the gathering about the earlier efforts (GAPIandGAPII)tocleanGanga.Themainreasonsfortheprogrammetobe not so successful were cited as lack of proper operation and maintenance of assets created and comprehensive planning.
The Projects Planned under NGRBA program in Sahibganj and Rajmahal are:

- Sewage treatment system
- Solid waste management
- Improved crematorium
- River front beautification

A no. of sub-Projects would be considered under the above-mentioned categories. Another important component considered under NGRBA program would be to create public awareness to check activities, which contribute to pollution in the river.

A brief summary of all the important points discussed during the meeting are mentioned

below:

- It was informed that in Rajmahal & Sahibganj majority of the population lived in slum areas and they also need to be considered and sensitized while planning any projects/schemes. At the moment the fringe population are availing all the infrastructural benefits without being accountable to any kind of maintenance. Earlier there were only 18 wards in 2001 census and currently there are around 28wards.
- It was emphasized that the projects have to be location specific and the paying capacity of the community has to be considered while planning the projects.

- Small industrialists were conspicuous by their absence in public consultation meeting, hence it was opined that they should also be included in any further meetings especially the brick manufacturing industries which are normally situated at the bank of the rivers.
- The public wanted to know whether the levy of public contribution/tax for operation and management of the existing projects and upcoming projects under the scheme would be same for the local public and the industrialist. It was clarified that reference of taxation system would be asper State Govt. decision.
- It was expressed that in the upcoming sewerage project there should not be any mixing of drinking water pipelines with sewerage pipelines. Also solid waste should not be diverted towards sewer drainage. In response to the questions raised, the DC clarified the technical details of the drainage system and assured that mixing of drainage and drinking water cannot happen.
- A common concern among stakeholders was the indifference towards the rules and regulations when it comes to usage and maintenance of the infrastructure facilities provided. For instance, in spite of some existing drainage network people still continue to dispose their waste into the river, open defecation is common, littering of riverbanks is widespread. So how will the agency ensure discipline when the new projects come up? In response to the questions and concerns raised the D.C. conveyed that part of the problem is due to lack of manpower in Urban Local Bodies. New recruitments will take place and effective measures will be put in place to abide by the rules and regulations.
- It was suggested that projects should not be like as how case it should be fruitful to the entire beneficiary.
- It was suggested that anti erosion projects/ works, which is currently under CWC, should be included in the Ganga main stem project.
- Since Sahibganj is an underdeveloped district levy of tax should be lesser as compared to other major towns and cities. Another justification given for less levy of tax is that Sahibganj being a non-industrial area/zone becomes the least polluter of the river. Hence, “polluter pays “concept has to be considered and higher taxes have to be levied from high polluting towns and cities.
- Currently dead animals are disposed in river Ganga as there are no burial places for animals. Nagar Palika also does not have any disposal place for dead animals.
- Another suggestion was to ensure proper coordination between different government agencies/ departments especially the Drinking Water and Sanitation Department and the urban body while implementing the project.
- The community was keen to know both tangible and in tangible benefits of the project, which was explained to them in detail by the District collector and the Associate town planner.
- People did not voice any concern regarding R&R issue. They mentioned that they are largely satisfied by the existing compensation scheme.
- A common concern voiced by the stakeholders was regarding the difficulty of land acquisition in khas mahal state of government. Nearly 1000 acres of land in Sahibganj comes under khas mahal state. There is a high possibility that certain portion of the khas mahal land would come under project (mainly for – laying pipelines, sewerage junctions, pump house, sewage treatment plant etc.) and giving compensation for such land will create problems as these lands are claimed both by the government and the community.
- Peoples were also largely concerned about the decreased river flow of Ganga and expressed their

doubts about the existence of the river in another 10 to 12 years. Most of the queries related to planning and implementation of the project raised were satisfactorily answered by the D.C. and Associate Town planner.

The meeting was concluded by Mr. Gajan and Ram followed by vote of thanks, especially to Mr. K.Ravi Kumar (District commissioner) for their presence and valuable suggestions.

4. Public Consultation on Environment and Social Management Framework (NGRBA Program), held at Kanpur, Uttar Pradesh

Minutes of Meeting

Date: 28th December, 2010. **Time:** 3:00 PM to 5:30 PM

Venue: Nagar Nigam, Guest House, Kanpur, Uttar Pradesh

Attended by:

- State Nodal agency (Ganga Pollution Control Unit, U.P Jal Nigam): Mr. C M. Chaudhary (General Manager), Mr. Mukesh Kumar (Project Manager)
- Consultancy team from TERI: Ms. Sonia Grover, Ms. Swati Dabral, Mr. C. G Hiremath
- Number of participants: 38 (Mayor, Commissioner, Additional Municipal Commissioner, elected members of Kanpur Municipal Corporation, representatives from NGOs and Schools, concerned government officials).

The public consultation meeting was initiated by Mr. C M. Chaudhary who welcomed the participants and briefed them about the agenda of the meeting. Further Mr. Mukesh Kumar presented the scope and objectives of the Environment and Social Management Framework (ESMF). Details about the ongoing and proposed projects under NGRBA program for Kanpur city was also presented during the meeting. A summary of the important points discussed during the meeting are mentioned below:

- Disposal of unburnt or half burnt dead bodies into the river Ganga should be prohibited and promotion of social institutions to perform last religious rites of unidentified and unclaimed dead bodies.
- More crematoriums should be built, and existing ones should be renovated to cater to the need of growing population.
- Stakeholders' involvement at both project planning and implementation phase of the projects.
- Provision of proper sanitation facilities during religious occasions and other festivals.
- Inclusion of social development projects in the projects portfolio proposed by NGRBA program.
- Promotion of awareness generation at community and school levels especially in the fields of better solid waste disposal (idols, calendar, flowers, polythene), promote usage of crematoriums, etc.
- Involvement of local communities (Pandits) for maintaining the river ghats to curbs pollution. Initiative to start same rituals with the bodies specified for burning in electric crematorium as is done with normal bodies to enhance acceptance of e-crematoria.

- Administrative and financial support for regular operation and maintenance of the projects.
- Establishment of institutional facilities for monitoring and maintaining the minimum flow (at least 50% of the volume generated) in the river, which is currently being interrupted by infrastructural activities (dams, barrages, diversions) on the upstream side of river Ganga.
- Facilitate reuse of treated wastewater for agricultural practices, parks, firefighting, etc.
- Provision of segregated wastewater treatment from industry and domestic sectors.
- Provision of buffer zones (no-man zone)/integrated river front development for protection of river ghat against pollution (solid and liquid waste disposal, infrastructural development). Facilitate usage of this buffer zone for afforestation or flower plantation)
- Creation of Ganga Heritage Zone to focus development and protection against pollution.
- Adopt bio-remediation techniques for treating wastewater until the new STPs become functional.
- Facilitate proper solid waste management along with the provision of utilization of compost in agricultural/gardening activities.
- Prohibition of reverse boring of wastewater by the industries which are likely to pollute groundwater.
- Proper coordination between different government agencies during appraisal of the proposals and environmental impact assessment of the projects which may cause time delay for execution.

The meeting was concluded followed by vote of thanks given by Mr. C M. Chaudhary.

5. Public Consultation on Environment and Social Management Framework (NGRBA Program), held at Prayagraj, Uttar Pradesh

Minutes of Meeting

Date: 29th December, 2010. **Time:** 3:00 PM to 5:00 PM

Venue: Sadan Hall, Nagar Nigam, Prayagraj, Uttar Pradesh

Attended by:

- State Nodal agency (Ganga Pollution Control Unit, U.P Jal Nigam): Mr. A K Mittal (General Manager)
- Consultancy team from TERI: Ms. Sonia Grover, Ms. Swati Dabral, Mr. C. G Hiremath
- Number of participants: 22 (Mayor, elected members of Nagar Palika Prayagraj, representatives from press and concerned government officials).

The public consultation meeting was flagged-off by Mr. A K Mittal who welcomed the participants and briefed them about the agenda of the meeting along with details of upcoming and proposed projects under NGRBA program. Further the meeting was carried forward by TERI's representatives, who presented the scope and objectives of the Environment and Social Management Framework and requested participants to share their concerns/suggestions with respect to the framework. A brief summary of the important points discussed during the meeting are mentioned below:

- A continuous and regular mechanism of creating awareness among community and school children's through street plays, public and religious gatherings (Mela), displaying banners, etc.
- Provision of proper sanitation facilities along with efficient operation and maintenance systems

during religious occasions and other festivals.

- Community involvement needs to be ensured during the project initiation and implementation stage of the project.
- The implementation activities of the projects must be completed in time to avoid the problems of traffic diversions, public congestions, and commercial displacement especially during Maha Kumbh Mela.
- Promote reuse of treated wastewater for irrigation and gardening purposes.
- Mechanism for proper solid waste management along the banks of both river Ganga and Yamuna.
- ProvisionofwastewatertreatmentfacilityatDhobiGhatforcausticsodabased effluents.
- Imposing strict regulation on upcoming new colonies to establish their own STPs.
- Ensure proper site selection for pumping stations along with efficient operation and maintenance of pumping stations in order to avoid back flow or clogging of sewers.
- Request to start sewer and drainage projects simultaneously and completed in time to avoid mixing of wastewater with drainage water.
- Ensure technically feasible solutions while designing the alignment of sewer lines and dimensions of the sewer to cater the needs of growing population.
- Request to maintain minimum size of the sewer more than 150 mm. to avoid clogging of sewers.
- Ensure sufficient distance/depth while aligning the sewer lines adjacent to the water supply lines to avoid contamination of drinking water.

The meeting was concluded followed by vote of thanks by Mr. A K Mittal

6. Public Consultation on the Environmental and Social Management Framework (ESMF) for the National Ganga River Basin Authority (NGRBA Program) held at Patna, Bihar

Minutes of Meeting
Date: 04/01/2011 **Time:** 03:00 pm to 5:00 pm
Venue: Conference hall, urban development office, Vikas Bhawan, Patna, Bihar.

Attended by:

- State nodal agency:
  - Dr. D.K. Shukla (Special Secretary, Urban Development and Housing Department, Government of Bihar)
  - Mr. A.K. Sharma (CGM, Bihar Urban Infrastructure Development Corporation Ltd. Bihar)
  - Mr. P.U. Asnani (Team leader, UTAST-SPUR, Bihar)
  - Mr. Satish Chand Agrawal (Senior Environment and Public Health Engineer, SPUR-UTAST, Bihar)
  - Mr. Sanjay Shakya (Infrastructure and Procurement specialist, SPUR- UTAST, Bihar)

- Mr. Chand Rehmani (BUDA, Urban Development and Housing Deptt.)

- Consultancy team from TERI: Mr. Sunil Kumar, Mr. Avneesh Nayal

- Number of Participants: 26 Representatives from NGOs, elected members of Nagar Palika and concerned individuals from Patna and other districts of Bihar.

The public consultation meeting was flagged-off by Mr. Satish Chand Agrawal (Senior Environment and public health engineer, SPUR-UTAST, Bihar), and Mr. P.U. Asnani (Team leader, UTAST-SPUR, Bihar) who welcomed the participants and briefed them about the agenda of the meeting.

Further, the meeting was carried forward by Mr. P.U. Asnani, who presented the details about the Environmental and Social Management Framework (ESMF), starting from the current status of river Ganga, future government plans, possible assistance by the World Bank, stakeholder participation during the project and the overall significance of the ESMF. Various agencies involved in implementing the current programme were also explained in detail to the gathering.

The guidelines were translated to vernacular and made available to public and also all the documents related to NGRBA program have been uploaded onto the MoEF&CC/NMCG, department website.

Mr. P.U. Asnani and Mr. Satish Chand Agrawal also briefed the gathering about the upcoming projects and list of towns selected under the NGRBA program. Total 21 towns have been selected from 9 districts of the Bihar state.

The upcoming Projects Planned under NGRBA program in Bihar are:

- Sewage treatment plants including Dhobi Ghat and Community toilet
- Integrated Solid waste management
- Improvement of crematorium
- River front development

A number of sub-projects would be considered under the above-mentioned categories. Another important component considered under NGRBA program would be to create public awareness to check river-polluting activities

A brief summary of all the important points discussed during the meeting are mentioned below:

Social and organizational concerns/suggestions:

- Awareness about the program projects and sub-projects must be generated to a large extent in order to ensure implementation and effectiveness.
- For all projects, elected representatives of the state must lead the way and communicate efficiently with the public.
- Documents and messages delivered to the public must be made in simple language and easily comprehendible. This will ensure that they are made aware, will respond positively to their duties and will contribute to the implementation of projects.
- It is essential for good communication and transparency between the elected representatives (ward councilors, mayor) and government officials to ensure efficient execution of the projects.

- A higher level of cooperation and contribution from the State Pollution Control Board will be required.
- 'Livelihood links' that exist with the Ganga River and the related projects should be highlighted. For this, a task force or Ganga Panchayat should be constituted. These task force units would partake in Capacity Building of locals and training of Urban Local Bodies.
- Before implementation of projects, the location of projects must be consulted with the local people of the project-affected area.
- Local institutional support could be taken for project planning and development.
- Encroachment of lands and construction of residential complex should not take place in the River Catchment areas.

Environmental and Technical concerns/suggestions:

- Solid Waste Management related projects must implement a door–to–door collection system in order to reduce the number of waste collection points. All efforts to be made to make the town a bin free city.
- Effluent discharge limits for slaughterhouses along the riverbanks should also be established. In addition, these slaughterhouses must be made modern and more environment-friendly. The State Pollution Control Board should strictly implement the Environment Protection Act particularly for slaughter houses discharging their waste in to river Ganga without treatment.
- Various check dams could be built on the tributaries of the river Ganga in order to achieve better flood and disaster management. In this way, formation of islands in the course of Ganga can also be stopped. In addition, small hydropower plants could also be setup.
- There are various 'Arsenic-zones' adjacent to the riverbanks that must be addressed.
- A master plan is to be developed for the entire Ganga River Basin using Remote Sensing and GIS under the NGRBA program.
- Integrated River Basin projects should also be developed under NGRBA program.
- The demarcation of 'Heritage Zones' must be done about 1-2km adjacent to the river bank area. These zones will be protected and could serve as recreational and scenic areas.
- Technical trainings should be provided to concerned officials and elected members for better implementation of the projects.

The SPUR-UTAST on behalf of Urban Development Department has submitted comments on ESMF (copy attached). Finally, the meeting was concluded by Mr. P.U. Asnani followed by vote of thanks.

7. Consultation with the SMCGs and EAs on the revised ESMF for Namami Gange Programme held at New Delhi on 04.08.2017.

Minutes of Meeting

Date: 04/08/2017 **Time:** 10:30 am to 1:30pm

Venue: Conference Room, National Mission for Clean Ganga, New Delhi

Attended by:

- Dr. Nikhil Ranjan, Monitoring and Evaluation Officer, SMCG, Bihar
- Shri R.B.Singh, Senior Procurement Specialist, SMCG,UP
- Shri Biplab Debnath, EE/KMDA, Govt. of West Bengal
- Shri Kinkar Sarkar, EE/KMDA, Govt. of West Bengal
- Shri Faizuallah Khan, Enforcement Coordinator, NMCG
- Shri K.K. Sapra, Under Secretary, NMCG, MoWR, RD&GR
- Shri Vijay Yadav, Asst. Civil Engineer, NMCG
- Dr. Pravin Mutiyar, Director (T-III),NMCG
- Shri Mohd. Najeeb Ahsan, Sr. Social Management Specialist, NMCG
- Shri Saumyasib Mukhopadhyay, Sr. Environmental Specialist, NMCG

A brief presentation of the revision of ESMF was given by the NMCG's Environmental and Social Experts. The provisions of revised land acquisition and R&R acts were discussed in length and new entitlement matrix was also explained. Further the provisions made in the revised ESMF for implementation of (i) Retro-financing of projects and (ii) Hybrid Annuity based PPP projects were discussed in length.

- For the Hybrid Annuity Based projects, it was agreed that at the DPR stage only Environment and Social Due Diligence Report (ESDDR) along with Environment and Social Management Action Plan (ESMAP) will be prepared.
- The ESDDR will cover the basis nature of the projects, a very brief description of the environment and present status along with screening checklist and an analysis of environmental and social issues associated with the project.
- The ESDDR to describe the future action plan to be taken during the detailed design stage by the Concessionaire like:
  - Various regulatory clearances (e.g. environmental clearance, forest clearance, NOC etc. as applicable)
  - Preparation of Environmental and Social Assessment (ESA)/EIA
  - Resettlement Action Plan (RAP), as applicable
  - other actions, and management measures to be implemented by the SPV
  - / PPP Concessionaire / operator

125 (A) the public consultation and disclosure process will continue during project implementation. The draft EIA/EMP/RAP etc. for the specific sub-projects will be discussed with the affected communities and the final documents will be placed on the websites of the NMCG and the SMCGs. The copies of the EMP and RAP will also be placed at the offices of the executing agencies, district magistrate and contractor's office. The executive summary of the EIA and RAP will also be translated into local language and placed in the office of the Gram Panchayat of the affected villages.

ADDENDUM-I

Addendum to Environmental and Social Management Framework of Namami Gange Programme (April 2017)

Environmental and Social Safeguards Management in PPP Projects

This addendum document shall be read in conjunction with Environmental and Social

Management Framework (ESMF) for Namami Gange Program 2011(revised in December 2016)

A. Financing Projects under PPP Model:

1. Under the NGRBA framework, National Mission for Clean Ganga (NMCG)shall financeonlycommerciallyviableprojectsunderPPPmodel.Viableprojectsmay also include those projects that will become viable after receiving viability gap funding under a government scheme.

2. In order to be eligible for funding through NGRBA framework under Namami Gange program, in PPP mode:

   a) The project will be developed (i.e. designed, financed, built and operated for a specific term) by a private sector entity selected under a Private-Public Partnership (PPP) concept through annuity or Hybrid annuity or any contractual arrangement between a public entity and a private company whereby risks from design, construction, and/or operations, and/or financing are fully or partially transferred to the private company.

   b) A Special Purpose Vehicle (SPV) will be formed and will assign overriding priority to PPP projects that are implemented by private sector entities, selected through a competitive bidding process.

3. This addendum outlines the framework and procedures to be followed for managing environmental and social safeguard issues in PPP projects that may be implemented through NGRBA framework under Namami Gange Program.

B. Environmental and Social Safeguards Management for PPP Projects under

4. All sub-projects and activities to be developed and operated under PPP mode following NGRBA Framework shall carry out an Environmental and Social Due-Diligence (ESDD) of the respective sub-project. The ESDDR shall be prepared by the Executing Agency (EA) as part of the feasibility / Detailed Project Report (DPR) and shall be based on (i) field investigations of all the proposed sub-project facilities and (ii) formal consultations with the stake holders.

5. The ESDDR shall comprise of (i) a description of the sub-project and its components (ii) an environmental and social profile of the sub-project areas and the proposed project facilities (iii) an Environmental and Social Screening and categorization of the sub-project as outlined in Section 4.3 of Environmental and Social Management Framework of NGRBA / Namami Gange Program (iv) an analysis of environmental and social issues associated with the project and (v) Environmental and Social Management Action Plan (ESMAP) out lining various regulatory clearances, preparation of Environmental and Social Assessment (ESA) Resettlement Action Plan(RAP), other actions, and management measures to be implemented by the SPV / PPP Concessionaire / operator and various other participating agencies in line with the requirements of ESMF for a particular safeguard category

of subproject.

6. The State Mission for Clean Ganga (SMCG) will primarily be responsible for the preparation of ESDDR and ESMAP and overall management of their implementation.

7. The ESDDR along with ESMAP shall be submitted to NMCG along with the DPR for appraisal. Upon receipt of the ESDDR, NMCG will review the project categorization as per the ESMF, applicable regulatory clearance requirements and the ESMAP. Their view will follow the process outlined in the Section 4 of the ESMF, including the approval of The World Bank.

8. The ESDDR and ESMAP upon approval and prior to the initiation of the PPP bid process, shall be disclosed locally in the website of EA, SPMCG, NMCG and in the info-shop of the World Bank.

9. The ESMAP shall be included in the PPP bid document, clearly outlining the responsibility for various safeguard management actions including the preparation of ESA RAP for the sub-project in line with its safeguard requirements outlined in section 4 of the ESMF.

10. During the implementation, the selected SPV / PPP concessionaire / operator/ prepare a design specific detailed ESMP/EIA/SIA/RAP report (as applicable) as per the ESMF and obtain approval of NMCG and The World Bank before the technical closure of the subproject and starting the construction work. All necessary environmental clearance[20], regulatory clearances and land clearances shall be obtained as per the applicable regulations of Government of India and the State Government before the commencement of construction works.

11. The ESMP/EIA/SIA/RAP reports shall be prepared by the SPV in line with the guidelines provided in the ESMF and shall be disclosed locally in the websites of EA, SMCG, NMCG and also in the info shop of The World Bank.
12. The SPV / PPP concessionaire / operator shall be responsible for the implementation of final ESMP/EIA/SIA/RAP and their recommendations. The EA for the sub-project will supervise the implementation and NMCG with the help of SMCG will monitor the all the safeguard actions. This responsibility allocation and institutional arrangements for the sub-project shall be clearly spelled out in the bid document.

C. Safeguard Compliance Monitoring and Reporting for PPP Projects

13. Projects financed by NMCG on PPP mode will be periodically monitored by the Lender's Independent Engineer (LIE) or similar technical agency and the quarterly reports (including the compliance to ESMAP) shall be shared with the SMCG and NMCG. The following procedures related to safeguards compliance monitoring & reporting will apply.

    i) The PPP Partner/SPV will submit monthly Environmental and Social Compliance Monitoring Report (ESCMR) to LIE. EA and SMCG for various project activities/actions agreed as per the ESMAP/ESMP/EIA/SIA/RAP reports. A sample format for the compliance monitoring for a sewerage project is given in **Enclosure 1**.

[20] For the present portfolio of projects under NGRBA programme, currently only Regional Solid Waste Management projects may attract Environmental Clearance. However, time to time the clearance requirement may also be applicable to other projects as well as per the amendments of EIA notifications.

ii) The LIE will review the ESCMR, conduct field inspections and submit the report to SMCG along with recommended follow up actions.

iii) Environment and Social Safeguard Specialists of SMCG/EA will also conduct quarterly / monthly compliance monitoring of the projects through site visits based on ESCMR and LIE's recommendations. In absence of necessary specialists, such safeguard monitoring is to be done by the concerned safeguard specialists of PMC appointed by SMCG.

iv) Safeguard specialists of NMCG will also make quarterly visits to projects site to ensure compliance to the agreed ESMAP and other safeguard documents as prepared by SPV along with LIE report. Indicative checklists of the documents that are required to be checked during the site visits of SMCG/EA/NMCG are given in **Enclosure 2.**

v) An annual audit of all PPP projects will be conducted by the NMCG along with other sub-projects in line with the provisions of the ESMF.

Enclosure 1: Sample Format for Periodic Environmental Monitoring Report

1. EMP for XXXX Sub-Project

1.1. Introduction –XXX Town

The components taken up for XXX are detailed in the following Table.

Package	Sub Project	Physical Completion (%)	Date of Award	Date of Completion
HRR-1	Providing Under Ground Drainage system to XXX City Municipal Council			
	UGD Network (Total –.)			
	Manhole (Total - Nos.)			
	House Service Connections (Total – Nos.)			
	Wet well (No,)			
	Sewage Treatment Plant -			

The status of Environmental Management Plan (EMP) for the month of March, 2015 are presented in the following sections

1.2. Permissions/Consents/Clearances/Approvals:

Particulars	Sub Project	SPCB	Railways	PWD	Utility shifting	Forest	Minor Irrigation	Irrigation*
Consent/Clearances/ Permissions/Approval Status (Date of Clearance and completion status)	UGD & STP	CFE obtained On xxxx	Cleared on)	Cleared on	Cleared	NA	NA	NA

Note: For details refer Monthly Progress Report March, 2015.; NA-Not Applicable;

1.3. Field Visits &Training Conducted

Field Visit	Date	Sites Visited	Persons Met	Remarks

1.4. Compliance to EMP

Particulars	Sub Project	Complied	Compliance to EMP
Pre-Construction Phase	Sewerage System & STP	√	Details on EMP are made part of Contractor Agreement Page No. xx (Contract Agreement dated xxx)
Construction Phase	Sewerage & STP	√	Details on EMP are made part of Contractor Agreement Page No.xxxx1. Contractor complying with EMP are monitored by the Site Engineer and xxxx on daily basis (Provided in Annexure 1)
Monitoring Requirements & Specifications	Sewerage System & STP	√	Details on EMP is made part of Contractor Agreement Page No. xxxx Informed the Contractor to comply the same

Insert Construction Stage EMP (in Annexure) table here and provide compliance status, and Recommendations for each EMP measures

1.5. Redress of Grievances

Sub Project	Registers Maintained	No. of Grievances received in the month	Action Taken
Sewerage System & STP	√	Xx	

1.6. Labour Registration

The contractor has submitted the renewed labour license with a validity period of one year from xxxxx (Annexure x of EMP Report).

1.7. Summary and Conclusions

EMP monitoring being done daily (see Annexure1) on the critical issues and following improvements / positive developments are observed. Various issues are detailed out in Annexure 8).

S.no.	Details	Compliance Status
1	Labour License	Complied – Renewed upto xxx
2	Project Information Board	Complied at STP
3	Grievance Register	Complied
4	Identification of dumping land for surplus earth	Complied
5	In order to avoid drain blockages, removing of left out excavated material to be cleared on urgent basis	Complied,

However, the following issues need to be addressed.

Sl	Issues/Deviations	Compliance status last visit	Corrective Actions	Compliance status during this month
1	Safety measures, Helmets, Gum boots, First Aid Kits, barricading etc. needs to be provided at all locations			
2	Name of contact person with phone number to be included in project information board.			
3	Labours staying in the STP Camp Site. Presently there is no toilet and no bathing facility			
4.	Accessibility for Public			
5	Maintaining safe slope at work site and avoid collapsing of soil/ avoid accidents			
6.	Drain Cleaning			
7	Soil Sinking stretches/Soil collapse			
8	Pipeline trenches and Manhole construction pit kept open since 10 to 15 days in xxx place			
9	Precautions for Opening Manhole			

Attachment 1: Photographs

Enclosure 2: Checklist of Documents to be checked during the site inspection

1. Environmental Impact Assessment(EIA) and Environmental Management Plan (EMP) reports/ ESIA Study/ Initial Environmental Examination Study Report
2. Copy of various clearances like (Environmental Clearance, forest clearance and NOC)from various authorities like MoEF&CC, SPCB, other state level regulatory authorities etc. and , RAP and SMP as applicable and grievance register.
3. HSE Manual/Plan prepared for the project, if any
4. Detailed Project Report(DPR)
5. Proposed Institutional arrangement (Project Site Organogram) in place for implementation and monitoring of EMP;
6. Annual EMP Budget and its expenditure status
7. Disaster Management Plan (DMP),as applicable
8. Onsite and offsite Emergency Preparedness Plan, as applicable
9. Any other Miscellaneous study done for project regarding Environmental safeguards Aspects

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH
NEW DELHI
.....

ORIGINAL APPLICATION NO. 200 OF 2014

(C.WRIT PETITION No. 3727/1985)

(M.A. No. 594/2017 & 598/2017)

IN THE MATTER OF:

M.C. Mehta
.....Applicant

Versus

Union of India
.....Respondents

AND

ORIGINAL APPLICATION NO. 501 OF 2014
(M.A. No. 404 of 2015)

Anil Kumar Singhal
.....Applicant

Versus

Union of India & Ors.
.....Respondents

AND

ORIGINAL APPLICATION NO. 146 OF 2015

Society for Protection of Environment &
Biodiversity & Anr. .....Applicant

Versus

Union of India & Ors. .....Respondents

AND

APPEAL NO. 63 OF 2015

Confederation of Delhi Industries & CEPT Societies
(An Organisation of CETP Societies) .....Applicant

Versus

D.P.C.C. & Ors. .....Respondents

AND

ORIGINAL APPLICATION NO. 127 OF 2017

J.K. Srivastava .....Applicant

Versus

Central Pollution Control Board & Ors. .....Respondents

AND

ORIGINAL APPLICATION NO. 133/2017

(WRIT PETITION (C) No. 200/2013)

Swami Gyan Swarop Sanand .....Applicant

Versus

Ministry of Home Affairs & Ors. .....Respondents

COUNSEL FOR APPLICANT:
Mr. M.C. Mehta, Advocate in person
Ms. Katyani and Ms. Mehak Rastogi, Advocates
Mr. Gaurav K. Bansal, Advocate
Mr. Ritwick Dutta & Mr. Rahul Chaudhary, Advocates
Mr. S.K. Bhattacharya and Mr. N.B. Paonam, Advocates

COUNSEL FOR RESPONDENTS:

Ms. P.B. Singh, Advocate
Mr. Rahul Verma, AAG with Dr. Bharti Reddy
Mr. Raj Kumar, Advocate
Mr. Abhishek Attrey, Advocate
Mr. Abhishek Yadav, Advocate
Mr. Pradeep Mishra, Advocate
Mr. Raj Panjwani, Senior Advocate
Mr. Mukesh Verma, Advocate
Mr. Kabir S. Bose, Advocate
Mr. Vijay Bahadur Singh, Senior Advocate along with Mr. Ranjit Rao, AAG for State of U.P
Ms. Antima Bazaz, Advocate for AIDA UPSMA
Mr. Sanjeev Ralli, Advocate for GNCTD/DPCC
Mr. A.R. Takkar, Advocate
Mr. Parag Tripathi, Senior Advocate

Mr. Sanjay Upadhyay, Advocate
Mr. B. V. Niren, Advocate for CGWA
Mr. I. K. Kapila, Advocate
Mr. Devashish Bharuka, Advocate
Ms. Yogmaya Agnihotri, Advocate for CECB
Mr. Raman Yadav, Advocate for UP Jal Nigam
Mr. Jayesh Gaurav, Advocate for JSPCB
Mr. Anil Grover, AAG with Mr. Rahul Khurana, Advocate for State of Haryana
Mr. A. K. Prasad, Advocate
Mr. Rajul Shrivastav, Advocate for MPPCB
Mr. Rajiv Nanda, Advocate
Mr. Vibhav Misra, Advocate
Ms. Shagun, Advocate for WBPCB
Ms. Priyanka Sinha Advocate for Jharkhand
Mr. Rudreshwar Singh, Advocate for BSPCB
Ms. Alpana Poddar, Advocate for CPCB
Mr. U. K. Uniyal, AG for Uttarakhand
Mr. Asheesh Jain, Mr. Ritwick Dutta & Mr. Rahul Chaudhary, Advocates
Mr. Suraj Prakash Singh, Advocate for UPSMA
Mr. Atul Batra, Advocate
Ms. Neelam Rathore, Advocate
Mr. Ajay Kumar Mishra, Senior Advocate with Mr. Kumar Anurag Singh, Advocates
Mr. Motish K. Singh, Advocate
Mr. M. Z. Choudhary, Advocate
Ms. Asha Nayyar Basu, Advocate
Mr. S. Wasim A. Qadri, Advocate
Mr.Amit Anand Tiwari, Advocate for State of UK
Mr. Rashid Saeed, Advocate for CETP
Ms. Diya Kapoor, Advocate
Anunaya Mehta, Advocate
Mr. S.A. Zaidi, Advocate
Mrs. Rachna Gupta, Advocate
Mr. Abhishek Paruthi, Advocate
Mr. Narender Pal Singh, Advocate
Mr. D. Rajeshwar Rao, Advocate for R-4
Mr. Krishna Kumar Singh, Advocate for MoEF
Mr. Moni Cinmoy, Advocate for DSIIDC

JUDGEMENT

PRESENT:
HON'BLE MR. JUSTICE SWATANTER KUMAR (CHAIRPERSON)
HON'BLE DR. JUSTICE JAWAD RAHIM (JUDICIAL MEMBER)
HON'BLE MR. JUSTICE R. S. RATHORE (JUDICIAL MEMBER)
HON'BLE MR. BIKRAM SINGH SAJWAN (EXPERT MEMBER)
HON'BLE DR. AJAY A DESHPANDE (EXPERT MEMBER)
HON'BLE DR. NAGIN NANDA (EXPERT MEMBER)

Reserved on: 31st May, 2017
Pronounced on: 13th July, 2017

1. Whether the judgement is allowed to be published on the net?
2. Whether the judgement is allowed to be published in the NGT Reporter?

JUSTICE SWATANTER KUMAR (CHAIRPERSON)

तवजलममलंयेननिपीतंपरमपदंखलुतेनगृहीतम्।
मातर्गङ्गेत्वयियोभक्तः कलतंद्रष्टुंनयमःशक्तः

Ganga is Holy, thus, as stated above, "he who has drunk your pure water, indeed he will obtain the highest abode". This depicts the extent to which millions of Indians and people from abroad have put their faith in Ganga. It is pristine, it is perennial and probably one of the most celebrated river of all times. Ganga is considered sacred by people for providing life-giving and life-sustaining succour for the environment and ecology. Ganga is not an ordinary river. It is a life-line, a symbol of purity and of virtue, for countless people of India. Millions of Ganga devotees and lovers still throng the river just to have a holy dip, Aachman (Mouthful with holy water), and absolve themselves of their sins. We Indians are raised to consider Ganga as a goddess, as sacred. We tell our children and

grandchildren the stories of how she came down to Earth through a lock of Shiva's hair. The Ganga temples, countless rituals associated with Ganga and our belief that Ganga is a cleanser par excellence prove that Ganga has a status of a deity. Hundreds of verses have been used to extol her glory and greatness.

Swami Vivekananda expressing himself on the phenomenal resource and the contribution of river Ganga said "Fool indeed is he, who, living on the banks of the Ganga, digs a little well for water. Fool indeed is the man who, coming to a mine of diamonds, begins to search for glass beads".

The ice-cave of Gaumukh at the snout of the Gangotri glacier, 4100 meters above sea level, is recognized as the traditional source of river Ganga. The river cuts its meandering path through the Himalayas and flows for a distance of about 205 kilometers from Gaumukh and traverses through two districts of State of Uttarakhand, i.e., Uttarkashi and Tehri to reach Devprayg where another head stream of Ganga, the Alaknanda, joins it to form the Holy Ganga. The river Alaknanda is a major tributary of the river Ganga in Uttarakhand that begins at the confluence of the Satopanth and Bhagirath Kharak glaciers in Uttarakhand and it travels approximately 190 kilometers. before meeting Bhagirathi.

After flowing through the northern most part of Uttarakhand, the river flows through Uttar Pradesh, Bihar,

Jharkhand and West Bengal, and finally drains into the Bay of Bengal. The river traverses a length of 1450 kilometres in Uttarakhand and Uttar Pradesh while touching of Uttar Pradesh and Bihar for a stretch of 110 kilometres. It then flows through Bihar, more or less covering a distance of 445 kilometres. The length of the river measured along the Bhagirathi and Hugli rivers during its course in West Bengal is about 520 kilometres. The river Ganga has a large number of tributaries, namely, Kali, Ramganga, Yamuna, Gomti, Ghaghara, Gandak, and Kosi. The river Yamuna, although a tributary of Ganga, is a river basin in itself. Its major tributaries are Chambal, Sind, Betwa, and Ken. The main plateau tributaries of the river Ganga are Tons, Son, Damodar, and Kangsabati-Haldi.

Charakasamhita, the ancient medical treatise, characterizes Ganga's water as pure and sacred. It is a major source of drinking water, as no germ, bacteria or fungi can thrive in it. This is now a scientifically proven fact. With some concerns, we must notice here, various studies carried out have demonstrated that Ganga is able to reduce its biochemical oxygen demand level much faster than other rivers (Refer: *D.S. Bhargava, Purification Power of the Ganges unmatched. L.S.T. Bull.* 34, pp. 52, 1982). Organic materials usually exhaust a river's available oxygen and start decomposing. But in the Ganges, it is

interesting to know how an unknown substance acts on organic materials and bacteria and kills them. Ganga's self-purifying quality leads to oxygen levels 25 times higher than in any other river in the world. In the study conducted by the Malaria Research Centre in New Delhi, it was observed that the water from upper ambits of Ganga did not host mosquito breeding, and also prevented mosquito breeding in any water it was added to. The self-purifying capacity of the Ganga is derived from its unusually high ability to retain dissolved oxygen (DO) inherited from this environment. Hence, Ganga water is revered as holy. The properties of the river regime primarily depend on the geology, wind, sun rays, climate and rainfall, trees and vegetation in the drainage basin.

The Ganga basin is one of the most populous regions on Earth, home to 450 million people at an average density of over 550 individuals per square kilometre. In the delta zone this rises to over 900 per square kilometre. As a result, there is heavy demand and competition for natural resources, especially water for domestic use and irrigation and most of the basin tributaries are regulated by barrages. Fisheries along the river are of considerable economic value and their output makes a major contribution to regional nutritional and economic needs.

Ganga is the largest and the most important river of India. The 2525 kilometre long river carries off the drainage of

large number of sub-basins bounded by the snow peaks of the Himalayas on the North, and the peninsular uplands and the Vindhya range on the South. The Ganga basin accounts for a little more than one-fourth (26.3%) of the country's total geographical area and is the biggest river basin in India, covering the States of Uttarakhand, Uttar Pradesh (UP), Bihar, Delhi, and parts of Punjab, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, and West Bengal. The Ganga basin encompasses an area of 1,060,000 (one million sixty thousand) square kilometres spread over four countries: India, Nepal, Bangladesh and China. The catchment area of river Ganga in India is 861,404 square kilometres covering 26.3% area of India's total geographical area.

Out of India's total renewable water availability of 1,869 Km^3/yr, the national river Ganga Basin's share is 525 Km^3/yr. It is the largest river water basin that supports 43% of India's population.

Ganga supports a rich fauna and flora, including the endangered Ganga river dolphin (*Platanista gangetica)* and at least nine other species of aquatic mammals. Reptiles include three species of crocodiles, along with one species of monitor lizard and eleven different freshwater turtles. The Ganga also has the richest freshwater fish fauna anywhere in India.

The above narration demonstrates that river Ganga is the

epitome of religious belief and a revered natural resource. It is said to be the cradle of Indian civilization and has been given the status of "first living entity of India" by the Uttarakhand High Court in the case of *Lalit Miglani v/s State Of Uttarakhand And Others* (Writ Petition (PIL) No. 140 of 2015). Operation of the judgement has been stayed by the Hon'ble Supreme Court of India. The judgement of the High Court provided new dimensions to the expression legal person acceptable as an entity in law. Amongst others, the fundamental reason for such legal status was to protect the river from continuous abuse.

POLLUTION LOAD OF RIVER GANGA

2. We have already noticed that river Ganga flows for a distance of 2525 km through five different States of the country. The two main sources of pollution of this river are industrial pollution and sewage (domestic) discharge. On the one hand, it receives high pollutants from the above mentioned two sources, while on the other, diversion of water and extraction of groundwater is so heavy that it considerably reduces the flow of the river. For instance, in Haridwar, Uttarakhand the natural flow of river Ganga is 31,000 cusecs, after which gets is reduced to 4000 cusecs when it reaches Kanpur. As of present river Ganga is one of the most polluted rivers of the country. It receives very heavy quantity of pollutants through industrial as well as

sewage discharge into the river, directly or indirectly. Diverse pollutants enter into river Ganga and its tributaries not only through the natural drains but even from the drains coming from the Sewage Treatment Plant (for short, 'STPs')/Common Effluent Treatment Plant (for short, 'CETPs'). From certain STPs/CETPs, even the effluents directly enter river Ganga and its tributaries either because of overflow or the bypass created by such plants due to of low capacity of the plant.

During the course of hearing, we had directed all the stakeholders to provide to the Tribunal the extent of pollution load on river Ganga, presently as well as in the past. The purpose was to bring on record a comparative data to show rapid increase in pollution of river Ganga. The data furnished jointly by the stakeholders demonstrate that with the passage of time, the pollution of river Ganga has increased manifolds both in regard to quantity and quantum for the entire stretch of river Ganga. The same reads as under:

A. Total Pollution Load disposed/being disposed into river Ganga

2008-09		2011-12/13		2016-17	
Industrial Effluent General (MLD)	Domestic Sewage Disposed (MLD)	Industrial Effluent General (MLD)	Domestic Sewage Disposed (MLD)	Industrial Effluent General (MLD)	Domestic Sewage Disposed (MLD)
285.9	2683.6	501 (764 Grossly Polluting Industries)	6966.3	669 (1035 Grossly Polluting Industries)	10705.28

Since in the present case, we are concerned with Segment-B of Phase-I of river Ganga, i.e., the stretch from Haridwar

to Unnao, Kanpur, it will be useful to refer also to the pollution load on river Ganga and its tributaries in that stretch.

A. Total Pollution Load disposed/being disposed in Segment-B, Phase-I

2011-12/13		2016-17	
Industrial Effluent General (MLD)	Domestic Sewage Disposed (MLD)	Industrial Effluent General (MLD)	Domestic Sewage Disposed (MLD)
366.5 (692 GPI)	1958.19	319 (789 GPI)	2456.19

The BOD load on river Ganga, Ramganga and Kali-East is stated to be 318.22 TPD in 2011-2012. There were 43 drains in 2011-2012 while in 2016-2017 there are 86 drains in Segment-B. The flow has increased from 2324.7 MLD to 2775.19 MLD. However, the BOD load became 229.42 TPD in 2016-2017.

The above data was acceptable to all the stakeholders. However, on behalf of the MoWR [National Mission for Clean Ganga (for short, 'NMCG')] it was pointed out that from Gangotri to Ganga Sagar, the discharge flow was 3520 MLD and from Haridwar to Unnao was 549 MLD. It was stated that this data is based only with reference to 106 towns located on the bank of river Ganga for entire stretch and 12 towns falling in Segment-B. This does not take into account all the cities and towns falling in the catchment area of the river Ganga and its tributaries either for entire stretch or for Segment-B of Phase-1. Furthermore, the discharge from the drains had not been

taken into consideration. While providing this clarification, Mr. Sundeep, Director (T-II) of NMCG pointed out that if all relevant points of discharge from cities and drains are taken into consideration, the entire discharge flow of river Ganga would be much in excess of 11374.28 MLD (industrial 669 MLD plus sewage 10705.28 MLD), as provided by all other stakeholders. The data provided has been signed by all the stakeholders. This would show that the pollution load of river Ganga has increased nearly four times from the year 2008-2009. These are the dimensions of the problem of pollution of river Ganga that we are expected to find a solution in the present case.

The quality of the effluents that join the river Ganga or its tributaries directly violate the prescribed parameters to a large extent. Particularly, Faecal Coliform, which is one of the main pollutants, carries at times the value in crores as against the prescribed value of 230 MPN/100ml. The effluents also contain high BOD, COD, TSS and even heavy metals like iron, copper, manganese, zinc, etc.

Most of the STPs that have been installed are not at the 'end of the pipe' where the drain on which it is located joins the river, but inside the cities within municipal limits. Most of these are non-performing or are incapable of handling the load and contents of the effluents. Majority of the STPs installed are incapable of treating Faecal Coliform as this parameter was not considered relevant in the past

when these STPs were planned and/or constructed. These high pollutants coupled with indiscriminate dumping of waste and misuse of floodplains has resulted in causing serious pollution of river Ganga in this Segment. Seriously/grossly polluting industries like sugar, distilleries, textile, paper, electroplating, slaughterhouses, and more importantly leather tanning industries are major sources of pollution. Majority of the industries are non-compliant to the prescribed norms and conditions of consent granted by the State Pollution Control Boards (for short, 'SPCB'). Even the industries, which have installed anti-pollution devices, like Effluent Treatment Plant (for short, "ETP"), river Osmosis (for short, "ROs") and Multiple Effect Evaporator (for short, "MEE") do not operate regularly, to reduce their expenditure and to maximize their profits. The cumulative effect of the above narrated facts and data is that river Ganga in its entire stretch is polluted but it is most polluted in Segment-B of Phase-I, the stretch that we are presently dealing with in this judgement.

BACKGROUND AND SCOPE OF THE CASE

3. The pollution of river Ganga is not a recent phenomenon. It had been a matter of serious concern for different stakeholders including the Government, Local authorities and the public at large. Public awareness about pollution of river Ganga is demonstrated from the fact that as far

back as on 11th September, 1994 the media had started publishing articles with regard to heavy pollution of river Ganga by different industries near Haridwar and other places. The environmentalist Mr. M.C. Mehta had filed a petition in the year 1985 titled *M.C. Mehta vs. Union of India & Ors,* Writ Petition No. 3727 of 1985. By this petition, the petitioner brought into sharp focus the problems arising from the unabated pollution of the holiest river in the subcontinent. This Writ Petition was primarily directed against four industries which were located in Rishikesh, Haridwar and Dehradun, praying that the private respondent industries should be restrained from letting out their untreated/partially treated effluents from entering the water bodies. It was prayed that they should be directed to fix necessary equipments to contain and arrest the pollution and/or they be directed to be shifted. The relief was primarily directed towards prevention of pollution of river Ganga. It was prayed that the municipal sewage should be treated before it enters river Ganga. The other reliefs generic in nature in relation to pollution of river Ganga and requiring the official respondents to take preventive measures were also made. The Supreme Court *vide* its order dated 9th September, 1985 in the case of *'M.C. Mehta vs. Union of India & Ors." 1986 4 SCC 463* had issued notice to all the industries and even ordered them to stop discharging effluents without treating them in

accordance with the standards prescribed by the Central Pollution Control Board (for short, "CPCB"). The scope of this petition appears to have been extended while the matter was pending before the Supreme Court, which did not confine itself to four or five industries, which had been impleaded as party respondents to this petition. The Supreme Court also dealt with the matter of tanneries located in the Kanpur area and even directed closure of nearly 29 tanneries while issuing various directions for prevention and control of pollution of river Ganga from the tannery cluster located therein. In this judgement, Supreme Court applied the Principle of Strict Liability and noticed that the tanneries cannot be allowed to continue their industrial activity unless they take steps to establish primary treatment plant. The financial capacity of the tanneries should be considered as irrelevant while requiring them to establish primary treatment plant. The Supreme Court also noticed that this public nuisance or other wrongful act affecting or likely to affect public is being committed and the statutory authorities which are charged with the duties to prevent the same are not taking adequate steps to rectify the wrongful acts. Noticing the significance of the problem, the Supreme Court also observed that the pollution of river Ganga is affecting life, health and ecology of the Gangetic plain. The Government as well as the Parliament both have taken a number of

steps to control the water pollution but nothing substantial till date has been achieved. Although, closure of tanneries may bring unemployment and loss of revenue but life, health and ecology have greater importance. We may usefully reproduce relevant part of the order besides above observation:

> "Moreover, the tanneries involved in these cases are not taken by surprise. For several years they are being asked to take necessary steps to prevent the flow of untreated wastewater from their factories into the River. Some of them have already complied with the demand. It should be remembered that the effluent discharged from a tannery is ten times noxious when compared with the domestic sewage water which flows into the River from any urban area on its banks. We feel that the tanneries at Jajmau, Kanpur cannot be allowed to continue to carry on the industrial activity unless they take steps to establish primary treatment plants. In cases of this nature this court may issue appropriate directions if it finds that the public nuisance or other wrongful act affecting or likely to affect the public is being committed and the statutory authorities who are charged with the duty to prevent it are not taking adequate steps to rectify the grievance. For every breach of a right there should be a remedy. It is unfortunate that a number of tanneries at Jajmau even though they are aware of these proceedings have not cared even to enter appearance in this Court to express their willingness to take appropriate steps to establish the pre-treatment plants. So far as they are concerned an order directing them to stop working their tanneries should be passed. We accordingly direct M/s. Delight Tannery (respondent 14), M/s Hindustan Tannery (respondent 15), M/s Primer Allarmin Tannery

(respondent 33), M/s Mahaboob Tannery (respondent 37), M/s Popular Tannery (respondent 38), M/s Standard Tannery (respondent 39), M/s Vikash Tannery (respondent 40), M/s New Golden Tannery (respondent 41), M/s D.D. Tannery (respondent 42), m/S Himalaya Tannery (respondent 44), M/s Commercial Industry (respondent 45), M/s Madina Tannery (respondent 46), M/s Kanpur Tannery (respondent 48), M/s New Jab Tannery (respondent 49), M/s Famous Tannery (respondent 50), M/s Glaxy Tannery (respondent 53), M/s Bengal Tannery (respondent 56), M/s Chhangal Tannery (respondent 59), M/s Nadari Tannery (respondent 63), M/s Jajmau Tanners (respondent 65), M/s International Tanning Industry (respondent 66), M/s Poorwanchal Tanning Industry (respondent 70), M/s Navratan Tanning (respondent 71), M/s Haroou Tannery (respondent 73), M/s Himalayan Tanners (respondent 76), M/s R.A. Traders (respondent 79), M/s Alam Tannery (respondent 83), M/s G.T. Tannery (respondent 84), M/s Awadh Tannery (respondent 86) to stop the running of their tanneries and also not to let out trade effluents from their tanneries either directly or indirectly into the River Ganga without subjecting the trade effluents to a pre-treatment process by setting up primary treatment plants as approved by the State Board (respondent 8) with effect from October 1, 1987.

15. M/s Indian Tanning Industry (respondent 30), the U.P. Tannery (respondent 19), M/s Zaz Tannery (respondent 28), M/s Super Tannery India Ltd. (respondent 21), M/s Shewan Tannery (respondent 20), M/s Pioneer Tannery (respondent 23) and M/s M.K.J. Corporation (respondent 89) who have already put up the primary treatment plants may continue to carry on production in their factories subject to the condition that they should continue to keep the primary treatment plants established by them in sound working order.

> 16. Shri S.K. Dholakia, learned counsel for the other tanneries who are members of the Hindustan Chambers of Commerce and the other tanneries who have entered appearance through Shri Mukul Mudgal submits that they will establish primary treatment plants within six months and he further submits that in the event of their not completing the construction of the primary treatment plants as approved by the State Board (respondent 8) and bringing them into operation within the period of six months the said tanneries will stop carrying on their business. We record the statement made by the learned counsel and grant them time till March 31, 1988 to set up the primary treatment plants. If any of these tanneries does not set up a primary treatment plant within March 31, 1988 it is directed to stop its business with effect from April 1, 1988."

4. *Vide* its order dated 12th January, 1988, in *M.C Mehta v. Union of India and Ors., (1988 1 SCC 471)* the Supreme Court reiterated the earlier directions and recorded its dissatisfaction in relation to the steps that were being taken for controlling the pollution of river Ganga. It stated that the sewage system had to be improved and the steps in that direction were being taken at a snail's pace. *Vide* its order dated 4th August, 1992, the three States, i.e., State of Uttar Pradesh, Bihar and West Bengal, were directed to identify industries discharging effluents into river Ganga and submit a report before the Supreme Court. As the progress was not evident, the Supreme Court again *vide* its order dated 17th September, 1993 directed the Central Government to file an affidavit to show the

details of work done under the river Ganga project. An affidavit was filed on behalf of the Government wherein it was stated that there were as many as 68 grossly polluting industrial units in the State of Uttar Pradesh, Bihar and West Bengal. These grossly polluting industries were classified under three different heads (i) those directly discharging more than 1 million litre per day effluents into river Ganga (ii) those having toxic substance in their effluents (iii) those having BOD concentration of more than 100 mg/L. The non-compliance of the directions, slow progress of the project for cleaning of river Ganga and non-cooperative attitude adopted by the industries compelled the Supreme Court to pass an order in relation to the tannery complex in Jajmau. This order primarily related to non-installation and non-performance of ETPs by these tanneries to the specific condition of primary treatment plant.

5. In the year 1994–1996, the Supreme Court passed various orders relating to sewage, interception and diversion of sewage in relation to States of UP, Bihar and West Bengal. Total schemes were stated to be 123. The schemes were being executed in State of UP by the UP Jal Nigam (for short, 'UPJN'). Even the Director of Ganga Project appeared in the Court on 19th January, 1995 and fairly admitted that there were variations in the affidavit filed on behalf of the Directorate and the National Environmental

Engineering Research Institute (for short, "NEERI"). Various financial aspects were also deliberated upon before the Supreme Court with regard to the projects. It was again emphasised in these orders that the work under either of the projects including Ganga Action Plan Phase-I & II was not progressing effectively. The Court further observed that the only way to save Ganga from pollution is to entrust the responsibility solely to the National River Conservation Directorate. Municipal Committees/Corporations and State Governments can be asked to contribute their share of costs to the Directorate and form an appropriate committee.

6. During the course of hearing of the Writ Petition No. 3727 of 1985, the Supreme Court viewed the pollution of river Ganga in its entirety and did not centralise itself to a particular entity, State or segment. In the very opening paragraph of the order dated 19th December, 1996 (1997 2 SCC 411), the Supreme Court noticed that the petition in public interest under Article 32 of the Constitution of India was initially directed against the tanneries located in the city of Kanpur and its order dated 22nd September, 1987, issued directions in relation to the same cluster of tanneries but while monitoring the said directions, the scope of the petition was enlarged and the industries located in various cities on the bank of river Ganga were called upon to stop discharging untreated effluents into

river Ganga. Under this order, the Supreme Court expressed its concern with regard to the tanneries located at Tangra, Tiljola, Topsia and Pagla Danga, the four adjoining areas in the eastern fringe of the city of Calcutta. Noticing that although land had been acquired for the tanneries complex, the industries had been causing pollution. Keeping in view the fact that it was not possible to install a CETP at the existing location in Calcutta, the Court decided to relocate the tanneries. The Supreme Court while issuing wide ranging directions in relation to various facets of relocation, prohibited these industries from functioning which were not inclined to shift. Some of the directions can usefully be reproduced hereunder:

1. "The Calcutta tanneries operating in Tangra, Tiljola, Topsia and Pagla Danga areas in the eastern fringe city of the Calcutta (about 550 in number) shall relocate themselves from their present location and shift to the new leather complex set up by the West Bengal Government. The tanneries which decline to relocate shall not be permitted to function at the present sites.
2. The Calcutta tanneries shall deposit 25% of the price of the land before February 28, 1997 with the concerned authority. The subsequent instalments shall be paid in accordance with the terms of the allotment letters issued by the State Government.
3. All the Calcutta tanneries who deposit the 25% of the land-price shall be permitted to function at the present sites provided they keep on depositing the subsequent instalments in accordance with the terms of the allotment letter.

4. The State Government shall render all assistance to the tanneries in the process of relocation. The construction of the tannery buildings, issuance of any licenses/permission etc. shall be expedited and granted on priority basis.
5. The tanneries which are not closed on April 15, 1997 must relocate and shift to the new leather complex on or before September 30, 1997.
6. The amount of compensation shall be deposited with the Collector/District Magistrate of the area concerned. In the event of non-deposit the Collector/District Magistrate shall recover the amount from the polluter-tanneries, if necessary, as arrears of land revenue. A tannery may have set up the necessary pollution control device at present, but it shall be liable to pay for the past pollution generated by the said tannery which has resulted in the environment degradation and suffering to the residents of the area.
7. We impose pollution fine of Rs. 10,000/- each on all the tanneries in the four areas of Tangra, Tiljola, Topsia and Pagla Danga. The fine shall be paid before February 28, 1997 in the office of the Collector/District Magistrate concerned.
8. The compensation amount recovered from the polluting tanneries and the amount of fine recovered from the tanneries shall be deposited, under a separate head called "Environment Protection Fund" and shall be utilised for restoring the damaged environment and ecology. The pollution fine is also liable to be recovered as arrears of land revenue. The tanneries which failed to deposit the amount of Rs. 10,000/- by March 15, 1997 shall be closed forthwith and shall also be liable under the Contempt of Courts Act."

7. Various orders have been passed by the Supreme Court in

relation to implementation of its directions for protecting river Ganga. *Vide* its order dated 4th January, 1999, the Ministry of Environment Forest and Climate Change (for short, "MoEF&CC") was required to submit a detailed report in terms of the order dated 29th October, 1996. The CPCB was also directed to inspect the industries. A committee headed by Dr. G.D. Aggarwal was constituted and MoEF&CC was required to place its report before the Supreme Court. In the order dated 31st August, 1999, the Supreme Court noticed that the pollution of river Ganga and the action plan for rectifying the same has engaged the attention of this Court for more than a decade and several orders have been passed by this Court calling upon several authorities to act in accordance with the directions issued in the matter of construction of STP and the discharge from several cities located on the banks of river Ganga. The Court directed that the status report should be placed on record and directed the three States to constitute cells to prepare the status report. The CPCB was also directed to give its response in the matter. The affidavits filed by the State Governments were found to be deficient as recorded in the order dated 26th October, 1999. The non-compliance of the directions resulted in the Supreme Court issuing the notice of contempt to the Chief Secretary of the State of Bihar as well as Secretary of the Irrigation Department of State of Bihar *vide* order dated 14th December, 1999. In

the order dated 28th March, 2001, the Supreme Court observed that though the concerned State Governments and the concerned municipalities have taken some action but it cannot be disputed that they are not taking up the project in the right earnest. The matter was being approached in a cavalier attitude even though all the municipalities through which the Ganga flows, have filed their affidavits indicating what action they have taken. CPCB was, therefore, directed to examine the same in relation to different States and municipalities, co-jointly with the respective SPCBs.

7. The proceedings before the Supreme Court on the one hand demonstrated lack of proper execution and willingness to execute the projects and on the other hand, it was improper financial management that compelled the Hon'ble Supreme Court of India to pass an order of stay in relation to spending of money on Ganga Action Plan. An application had been moved for vacation of such order of stay. However, the Supreme Court *vide* its order dated 7th September, 2001 declined to vacate the stay and passed specific directions which reads as follows:

> "**SLP (C) 16935/1998**
>
> We are not inclined to interfere with the order of stay that has been passed by this Court. However, we further direct that the Jal Nigam will not carry out any of its plans in respect of Ganga Action Plan, without leave of this Court. Liberty to file additional documents."

8. Further, directions were passed requiring participating States to place on record the amount received from the Central Government and the expenditure incurred by the State Governments in relation to the Ganga Action Plan.

The Hon'ble Supreme Court of India, specifically noted that the project was approved by the Technical Committee and permitted carrying on of work at Varanasi in relation to GAP-II.

9. The Supreme Court while expressing its displeasure to the manner in which the Ganga Action Plan project had proceeded, made serious observations while referring to the report of the CAG of India in its order dated 10th October, 2006. The said order reads as under:

> "This matter relates to the implementation of Ganga Action Plan, the object whereof was to improve the water quality of River Ganga. The States concerned are Uttar Pradesh, Bihar and West Bengal. Noting the statement of Mr. Vijay Panjwani, learned counsel, that he had no instructions in this matter on behalf of the Ministry of Environment and Forests, on 31st March, 2006, an order was made directing the parties to file within four weeks affidavits placing on record up-do-date position but no affidavit has been filed. Mr. Panjwani states that he had orally informed the Ministry that it is not possible for him to represent it in view of conflict of interest with the stand of the Central Pollution Control Board, as contained in I.A. No. 106. Despite that, again, there is no representation on behalf of the said Ministry, Mr. Vijay Panjwani, learned counsel, states that despite his informing the Ministry, again yesterday evening, he was sent docket to appear

for the Ministry of Environment and Forests without any instructions in the matter. It is difficult to comprehend the approach of the Ministry. We also fail to understand the reason for non-filing of the affidavit placing on record the status position. The order on 31st March, 2006, was passed, inter alia, considering the observations made in the Report of the Comptroller and Auditor General of India for Ganga Action Plan for the year ending March, 2000. The Report is required to be submitted to the President of India in terms of Article 151 of the Constitution of India for being laid before each House of the Parliament. The Comptroller and Auditor General has reported in the highlights that the Ministry has discontinued the water quality monitoring, a key component for technical assessment of the success of the plan since September, 1999, reportedly due to funds constraints. It further states that collateral findings reveal further deterioration of water quality in all its parameters. This finding becomes important in view of the object, above-noted, for setting up of the Ganga Action Plan. It also notes that the Ministry did not take action on the recommendation of the Expert Committee for control of bacterial load. Regarding the industrial pollution, the Comptroller and Auditor General reports that only forty five per cent of the grossly polluting industrial units have installed Effluent Treatment Plant. Over eighteen per cent of those plants did not function properly and did not meet the technical standards. Those units discharged industrial effluent of 2667.16 MLD into the Rivers. It also notes that N.R.C.D. has no mechanism to see that the installed plants functioned satisfactorily.

Further, State of West Bengal was yet to submit a satisfactory detailed project report and obtain the Ministry's sanction for setting up a Common Treatment Plant of effluents of relocated tanneries in Calcutta, which this Court

has ordered in April, 1995.

Regarding the financial aspects, it is noted that the States reported expenditure of Rs. 587.63 crores out of Government funds of Rs. 655.23 crores released to the implementing agencies. Audit test check in the States found many instances of financial mismanagement, such as funds diversion to unauthorized activities (Rs. 36.07 crores), incorrect reporting (Rs. 6.75 crore), and parking of funds by B.R.J.P. in its own personal account (Rs. 1.17 crores) and unutilised funds with the implementing agencies (Rs. 72.62 crores), etc.

The Comptroller and Auditor General further notes that both at the Central and State levels, monitoring of the plan was inadequate. This becomes important in view of the various bodies that have been set up for policy implementation and monitoring of the Ganga Action Plan which have been out-lined in the summary note given by Mr. Krishan Mahajan, learned amicus curiae. At the Central level, there is Central Ganga Authority known as 'National River Conservation Authority' headed by the Prime Minister to lay down the policy and to approve the programme, and review the progress of implementation and give necessary directions to the Steering Committee. Then, there is Steering Committee headed by the Secretary, Ministry of Environment and Forests. There is Ganga Project Directorate, now known as N.R.C.D. The Planning Commission releases the funds for the implementation of the Ganga Action Plan with the approval and concurrence of the Planning Commission and Union Finance Ministry. Then, there is Monitoring Committee, the Chairman whereof is a Member of the Planning Commission. The Monitoring Committee is to receive reports from the Project Director, N.R.C.D. (who is also the Secretary of the Steering Committee). The Committee is required to meet once in every quarter for the

purpose of assessing shortfalls and gaps in the implementations aspects and advise the Steering Committee.

In view of the total non-representation on behalf of the Ministry of Environment and Forests, we are at a loss to know as to what effective steps were taken after the report of the Comptroller and Auditor General since status report in terms of the order of this Court dated 31st March, 2006, has not been filed despite lapse of nearly seven months. In the plan where hundreds and crores of rupees have been spent with a view to improve the water quality, the result is, going by the report of the Comptroller and Auditor General, that water quality has instead deteriorated and pollution level increased instead of it being controlled.

Under the aforesaid circumstances, we direct the Secretary, Ministry of Environment and Forests, to file on affidavit the status report as on 31st October, 2006, taking into account all relevant factors, including what we have noted above. The affidavit shall be filed by 15th November, 2006. If necessary, the Secretary, Ministry of Environment and Forests, can discuss the matter with the learned amicus curiae. The Ministry shall also ensure that a Law Officer represents it on the next date of hearing and has proper instructions on all factual aspects of the matter.

The notices shall also be sent to the Chief Secretaries of the aforesaid three States concerned, besides Jharkhand and Uttaranchal, in view of the reorganisation of the State of Bihar and Uttar Pradesh. The State Governments shall also file status reports as on 31st October, 2006, in the form of affidavits to be filed by 15th November, 2006. Copies of the affidavits shall be exchanged between the Ministry of Environment and Forests, State Governments, learned amicus curiae, the petitioner and the learned counsel for the Central Pollution Control Board.

List the matter in the end of November,

2006."

Again in its order dated 20th February, 2007, the Supreme Court noticed that the plan had not progressed well. Reference was again made to the various deficiencies pointed out by the CAG of India.

In the order dated 5th December, 2007, the Supreme Court noticed that the scheme for cleaning river Ganga had started in the year 1985 and the Government had allocated ₹ 949 crores for Ganga Action Plan-I and ₹ 451 crores was released by the Government to the States of UP, Bihar and West Bengal. Ganga Action Plan-II was allocated ₹ 279 crores that has been released to the States of UP, Bihar, Uttarakhand, Jharkhand and West Bengal, but the results had been far from satisfactory. The Court then asked the CPCB, Union of India and Amicus Curiae to suggest steps that are required to be taken for effective implementation and progress.

10. Finally, the Hon'ble Supreme Court *vide* its order dated 29th October, 2014 while making reference to some of the orders that we have referred to above, expressed anguish towards the non-performance on the part of the stakeholders, particularly the States. The Supreme Court noticed that the concerned Ministry did not take action on the recommendations of the Expert Committee for control of bacterial load. In relation to industrial pollution, it was pointed out in the report that only 45% of the grossly

polluting industrial units had ETPs and 18% of these did not function properly or meet the technical standards. Such units discharge industrial effluent to the extent of 2667.16 MLD into the river Ganga.

11. Seventeen different categories of industrial units were described as highly polluting industries and were duly stated in the affidavit filed on behalf of the CPCB. The industries were directed to submit an action plan by 30th April, 2014 and all anti-pollution measures were required to be taken by 31st March, 2015 in terms of the directions passed by the CPCB. The Supreme Court while observing that in the past 30 years no fruitful results had been achieved despite Court's efforts, directed that issues relating to enforcement of provisions of the statues concerning environment and its preservation arising out of discharge of industrial effluents into river Ganga to be transferred to the National Green Tribunal and passed a detailed order. The relevant part thereof reads as follows:

> "We regret to say that the intervention and sustained efforts made by us over the past 30 years notwithstanding no fruitful result has been achieved so far except the shutting down of some of the polluting units. This is largely because while orders have been passed by us their implementation remains in the hands of statutory authorities including the CPCB and the State PCBs which have done practically nothing to effectuate those orders or to take independent steps that would prevent pollution in the River. A total lack of monitoring by the statutory bodies has also contributed to the current state of

affairs. The report of the Comptroller and Auditor General to the effect is a clear indictment of the statutory authorities and those at the helm of their affairs.

There is no gainsaying that River Ganga has for the people of this country great significance not only in the spiritual or mythological sense but also in material terms for it sustains millions who are settled on its bank or eke out their living by tilling lands that are fertilized by its water. Despite the experience of the past we have not lost hope, for the Central Government appears to be resolute in its efforts to ensure that the Mission of cleaning the holy River is carried forward and accomplished. How far will the Government's renewed zeal make any difference on the ground is for anyone to guess. What is, however, clear is that if the mission has to succeed, all those concerned will have to rededicate themselves to the accomplishment of the cause that will not only cleanse the holy River but comfort millions of souls that are distressed by the fetid in what is believed to be so holy and pure that a dip in its water cleanses all sins. Statutory Authorities that are charged with the duty to prevent pollution need to monitor and take action where they find any breach of the law. Failure of the authority to do so may also have to be noted for such action as may be required under law. This may call for a closer monitoring of the performance of all concerned. Time constrains unfortunately do not allow us to do that on a continuing basis no matter we have over the past thirty years devoted enough time and energy in that direction. We are comforted by the thought that the National Green Tribunal has been established under the National Green Tribunal Act, 2010. The Tribunal, it is evident from the provisions of the Act, has the power to take stock of the situation and pass necessary orders on the subject. It has the legislative mandate to undertake

> effective and speedy adjudication and disposal of issues touching preservation of environment by prevention of pollution. It is in the above backdrop that we consider it more appropriate to refer the issue relating to enforcement of the provisions of the statutes touching environment and its preservation arising out of discharge of industrial effluents into River Ganga to the National Green Tribunal. We are confident that the Tribunal which has several experts as its members and the advantage of assistance from agencies from outside will spare no efforts to effectively address all the questions arising out of industrial effluents being discharged into the River. This will include discharge not only from the grossly polluting industries referred to in the earlier part of this order but also discharge from"highly polluting units" also. As regards the remainder of the matter concerning discharge of domestic sewage and other sources of pollution we will for the present retain the same with us.
>
> We accordingly request the Tribunal to look into all relevant aspects and to pass appropriate directions against all those found to be violating the law. We will highly appreciate if the Tribunal submits an interim report to us every six months only to give us an idea as to the progress made and the difficulties, if any, besetting the exercise to enable us to remove such of the difficulties as can be removed within judicially manageable dimensions. The Registry shall forward a copy of the order to the National Green Tribunal along with a copy of the writ petition and the affidavits filed in reply from time to time".

As is evident from the above order, it is only the matters/cases in relation to industrial pollution of river Ganga alone that had been transferred to this Tribunal.

The matters in relation to pollution of river Ganga by sewage continued to be dealt with by the Supreme Court itself. An Affidavit dated 22nd September, 2014 had been filed before the Supreme Court giving details of 70 projects spread over 5 Ganga Basin States and it was pointed out that the Government has also referred the matter to a consortium of IIT's to formulate a basic management plan for cleaning the river and for its rejuvenation. Notification dated 18.12.2012 was issued with regard to Ecologically Sensitive Zone areas stretching from Gaumukh to Uttarkashi. The Supreme Court observed that formulation of an appropriate plan for management of such an ecologically sensitive area zone ought to be a high priority matter for the concerned Governments. The matter in relation to Municipal and domestic wastes also came to be transferred to this Tribunal *vide* order of the Supreme Court dated 24th January, 2017 that reads as follows:-

> "Learned counsel for the rival parties are agreed that the issue relating to River development and Ganga rejuvenation including municipal waste, domestic waste as also industrial waste is being heard on day to day basis by the National Green Tribunal (for short "the NGT") and as such the proceedings in these matters be transferred to the NGT for a joint consideration.
> In view of the above, the proceedings in the instant writ petitions are directed to be transferred and be placed before the NGT along with Original Application No.200 of 2014 pending before it. It will be open to the NGT to take into consideration the allied matters connected with cleaning of River Ganga

> that it may encounter during the course of hearing.
> Disposed of in the above terms.
> Needless to mention that the instant order is being passed in the same terms as the earlier order passed by this Court on 29th October, 2014.
> Consequent upon the disposal of the writ petitions, pending applications filed in these matters are also disposed of."

12. Resultantly, the entire Writ Petition (C) No. 3727 of 1985 along with the applications stood transferred to this Tribunal. The Supreme Court while passing this order also relied upon order dated 29th October, 2014 that we have already reproduced above. Thus, the entire matter in relation to Industrial waste, Municipal Solid Wastes, Sewage and Domestic wastes, polluting the river Ganga in its entirety became the subject matter subjudice before the Tribunal. It is necessary to notice here that in the case of *Paryavaran Suraksha Samiti and Another v. Union of India and Others*, Writ Petition(C) No. 375 of 2012, the petitioners before the Supreme Court had prayed that all State Governments should ensure that no industry which requires 'Consent to Operate' from the concerned Pollution Control Board, is permitted to function, unless it has an effluent treatment plant, which is capable of meeting the prescribed norms for removing the pollutants from the effluent before it is discharged into the river. The Supreme Court *vide* its order dated 22nd February, 2017 directed certain actions to be taken by the respective

Boards. It observed that mere directions are inconsequential unless a rigid implementation mechanism is laid down. It required the industry to set up primary effluent treatment plants as well as setting up of functional Common Effluent Treatment Plant within the time limits provided in that order. The complaint about non-implementation of the directions could be made to any of the concerned Benches of the National Green Tribunal having jurisdiction over the unit and the Tribunal was required to deal with the complaints in accordance with law expeditiously. In the year 1994, the Supreme Court had taken *suo moto* notice of the news items published in Hindustan Times, '*And Quiet Flows the Maily Yamuna*' which was registered as Writ Petition (C) No. 725 of 1994 along with many other Writ Petition, wherein the Government of Delhi, Union of India and National Ganga River Basin Authority all were respondents including another Writ Petition titled *M.C. Mehta Vs. Union of India* Writ Petition (C) No. 4677 of 1985.

13. In Writ Petition (C) No. 725 of 1994, the Supreme Court observed that it was not appropriate to have two parallel jurisdictions to deal with the same controversy and therefore, decided to transfer the Writ Petition relating to Yamuna also to this Tribunal *vide* order dated 24.04.2017. Along with Writ Petition (C) No. 725 of 1994, all other Writ Petitions and the Contempt Petition no. (C) No. 64/2013

in Writ Petition (C) No. 914/1996 and Interlocutory Application Nos. 20 and 21 in Writ Petition (C) No. 4677/1985 were also transferred to the Tribunal. The order dated 24th April, 2017 reads as follows:-

> "An Affidavit dated 9.3.2017 has been filed in this Court for and on behalf of Delhi Jal Board, in furtherance of the motion Bench order dated 20.2.2017. Having heard learned counsel for the rival parties and having perused various orders passed by this Court from time to time, we are of the view, that it is not appropriate to have two parallel jurisdictions to deal with the same controversy. We are satisfied, that the National Green Tribunal is examining the issue in hand effectively, and is passing appropriate orders from time to time. In the instant view of the matter, we consider it just and appropriate to transfer these proceedings and the writ petition to the National Green Tribunal.
> Ordered accordingly.
> We are also satisfied, that liberty should be granted to the National Green Tribunal to pass appropriate orders, requiring the amicus curiae in this case, namely, Mr. Ranjit Kumar, learned senior counsel, to move an appropriate interlocutory application before this Court, in case there is any constitutional or other legal hurdle, which is beyond the adjudicatory capacity of the National Green Tribunal, but needs to be redressed.
> In case the amicus curiae Mr. Ranjit Kumar files any such application before this Court, it shall be processed by the Registry of this Court, and shall be placed before this Court for consideration, without any delay.
> The writ petition is disposed of in the above terms".

As a result of passing of the above order, the matters in

relation to control of pollution and rejuvenation of river Ganga and river Yamuna pending before the Supreme Court stood transferred to the Tribunal. River Yamuna is the biggest tributary of river Ganga which meets river Ganga at Allahabad (Sangam). All the tributaries of river Ganga are consequently subject matter of adjudication before the Tribunal as a result of the above orders. Also there are certain matters pending before the National Green Tribunal itself in relation to Ganga and some of its tributaries which we shall shortly discuss. It is important to note here that the matter in relation to cleaning and rejuvenating of river Yamuna was also pending before this Tribunal in the case of *Manoj Misra v. Union of India* (O.A no. 06 of 2012).

14. This matter finally stood concluded by a detailed judgement of the Tribunal dated 13th January, 2015. In fact, before the Supreme Court transferred the Writ Petition (C) No. 725 of 1994 and other matters related thereto, the National Green Tribunal had already pronounced this judgement. The Judgement not only decided the legal issue but even provided a complete project titled as *'Maily Se Nirmal Yamuna'* Revitalization Plan, 2017. The Judgement provided for all the aspects comprehensively in regard to all the facets, that are, technical, execution of the requisite work of STP, laying down of pipelines, treatment capacity of the STP's,

discharge of treated water and the financial contribution to be made by different stakeholders. In fact, this was divided into two facets, Phase I related to Najafgarh drain and Delhi Gate drain which cause 64% of the total pollution load of river Yamuna in the stretch of 27 kilometres of the NCT Delhi. Phase II related to two other drains resulting in 36 % of the pollution load.

We also record with some satisfaction here that the work of Phase I has already been awarded to various concerns and they have started their ground work and it is likely to be completed by 2019. Thus, matters in relation to pollution of river Yamuna in NCT Delhi were taken care of by the judgement of the Tribunal. The remnant parts of it flowing through other States remains which now would be dealt by the Tribunal in furtherance to the judgement of the Supreme Court.

THE CASES RELATING TO POLLUTION OF RIVER GANGA BEFORE NGT

15. The Applicant Mr. Krishan Kant Singh filed the first case being Original Application no. 299 of 2013 before the Tribunal in relation to the industries which were causing pollution in river Ganga by discharging their trade effluents into the drains which ultimately join river Ganga. In this case, National Ganga River Basin Authority, the concerned states and the polluting industries, which included a Sugar Mill, Gopalji Milk Food Pvt. Ltd., were

impleaded as Respondents. It was stated in the application that the industries were seriously polluting industries and were discharging their trade effluents even by bypassing the Phuldera Drain and Sambhaoli Drain. The Applicant had got the effluent of the drain analyzed and it was found that the values were much beyond the prescribed limits. The Total Suspended Solids were 1448 milligram/L as against the prescribed value of 100 and 150 milligram/L. The Biochemical Oxygen Demand was found to be 2209 milligram/L as against the value of 100 milligram/L for dairy and 30 milligram/L for sugar and distillery units, Oil and Grease was 262 milligram/L against the value of 10 milligram/L. Not only was a Committee constituted by the Tribunal in this case to inspect the premises of the industries and analyse the effluent but even the learned Expert Members of the Tribunal visited the industries and they found that the industry particularly, the Sambhaoli sugar and distillery mill had deficiencies with regard to anti-pollution devices and were causing pollution by violating the prescribed parameters. They were also operating without consent of the SPCB. For these reasons, the Tribunal *vide* its Judgement dated 16th October, 2014 finally disposed of this matter by imposing environmental compensation of ₹ 5 crores upon the industry as well as issued directions for ensuring that there was proper prevention and control of

pollution from the activity that the industry was carrying on. During the course of hearing in the Original Application No. 299/2013, on 22nd April 2014, the Tribunal directed the Uttar Pradesh Pollution Control Board, (for short, 'UPPCB') to serve notices to all the industries whose names had been pointed out by the CPCB in their Report dated 7th February, 2014. All these industries were discharging their untreated/partially treated effluents into river Ganga or its tributaries. When the matter came up on 6th May, 2014, it came to light that the UPPCB had issued notices to nearly 956 industries which are polluting industries and were discharging their effluents into river Ganga and its tributaries and out of them the most polluting industries were Chemical, Distillery, Dyeing, Fertilizer, Pesticide, Pulp, Paper and Tannery units. The Officers of UPPCB and CPCB were required to examine cases of all these 956 identified industrial units which had not installed anti-pollution devices and those which had installed such devices but the devices have not been functioning properly and their parameters were in violation of the prescribed limits. The issuance of the notices, submission of Report by the constituted teams and the responses filed by the industry came to be dealt with separately by the Tribunal and it was registered as Original Application No. 196/2014 and 200 of 2014 (*M.C. Mehta V.s Union of India in C.W.P 3727/1985*

transferred by Hon'ble Supreme Court of India). [The M.C. Mehta case was transferred to the Tribunal has as already been noticed on 29th October, 2014 and all these matters then came to be dealt with together and common orders were passed in these cases.] Original Application No. 196/2014 was *Krishan Kant Singh v. National Ganga River Basin Authority & Ors.* while Original Application No. 200/2014 was *M.C. Mehta v. Union of India*.

16. On 29th October, 2014, the National Green Tribunal (NGT) directed the CPCB to place on its website the criteria for terming the industries as Seriously Polluting Industries (SPI), Grossly Polluting Industries (GPI) and industries not seriously polluting and categorise them into Red, Orange and Green. Both the above cases were taken up together on 13th October, 2014 and on that day the Tribunal directed that the Special Committee constituted by the Tribunal and the State Boards of the concerned States shall take immediate steps to ensure that no industry which has not obtained or is operating without consent of the State Board and is polluting directly or indirectly river Ganga or its tributary should be permitted to operate by this very order invoking 'Stakeholder Consultative Process in Adjudication', the Tribunal directed a Chamber meeting to be held on 11th November, 2014 of the Secretary (MoEF&CC), Secretary (Ministry of Water Resources, River Development & Ganga Rejuvenation) and Chief Secretaries

of all the above States for working out a comprehensive action Plan to clean river Ganga in terms of the orders of the Hon'ble Supreme Court of India. In the order dated 17th November, 2014, the Tribunal referred to the various orders of the Hon'ble Supreme Court of India as well as the fact that river Ganga is mainly polluted by two sources, one is industrial waste effluent and the other is domestic waste and sewage. Having heard all the stakeholders and in view of the Chamber meeting dated 11th November, 2014, the Tribunal constituted 3 different Committees, that is, the Principal Committee consisting of senior most officer from the respective Ministries and the State Governments including Financial Advisor of the Ministry, Implementation Committee consisting of the Chief Secretary of concerned States and the Principal Secretaries of Department of Environment and the Boards and, lastly, the State Level Committee consisting of the Officers/Secretaries of the concerned Departments, Member Secretary of the concerned State Boards, representatives and Scientists including eminent Professors from reputed educational institutions in the field of environmental engineering and representative from NEERI were part of this Committee. The Committee was required to examine the scope of Zero Liquid Discharge (ZLD) units and online monitoring system installations. The Committees were required to deal with all aspects of

installation of ETPs, drainage systems, finances and execution of the work. On 12th December, 2014, another Chamber meeting was held and views of all the concerned stakeholders were taken into consideration. In the meeting, very senior officers from both the Ministries, that is, MoEF&CC and Ministry of Water Resources, River Development & Ganga Rejuvenation, Chief Secretary of the States, environmentalists and Expert Members were present. Even the CGWA was impleaded as a party and the various issues in relation to preservation and control of pollution in river Ganga were considered.

The UPPCB had given details of the industries which were operating without any effluent treatment plant. Show cause notices were issued to 134 industries and out of which 19 only had applied for obtaining the consent of the Board. 109 industries out of 134 were ordered to be closed down under the orders of the Board. It was pointed out that nearly 400 tannery industries in Kanpur are located on the banks of river Ganga and are one of the biggest sources of pollution. One of the major issues raised was that the CETP which has been constructed in Jajmau was practically non functional and could not deal with the pollutants that are generated by the tannery sector. In this order, the Tribunal made it clear that the tannery industry would be liable to contribute for establishment of the CETP and its maintenance based on the 'Polluter Pays

Principle'. In the order dated 4th February, 2015, it was noticed that the attitude of the State of Uttar Pradesh was non-cooperative. In various other orders, it has been noticed that the officers of the Pollution Control Board and the UPJN or Nagar Nigam were not discharging their functions satisfactorily. The data produced before the Tribunal was not accurate and it had in built deficiencies. In this order, directions had also been passed for the State of Uttarakhand, which were required to be complied with, particularly, in relation to pollution of river Ganga in Haridwar, Roorkee and Kashipur etc. The Report in relation to existing STPs was also asked for as well as the referred CETPs operating in that area. *Vide* this very order, a Special Technical Expert Committee was constituted comprising of Scientist from MoEF&CC, Scientist from CPCB, UPJN, Commissioner of Corporation, Secretary Environment of State of UP and Senior Chief Engineer of UP. They were directed to inspect the CETP at Jajmau, Kanpur and submit a Report to the Tribunal upon Joint Inspection.

17. During the hearing on 13th April, 2015, the UPJN informed the Tribunal that it was not possible to discharge pollution free effluent into river Ganga. It remains undisputed that from the concerned CETP at Jajmau, 60 % of the effluent is being discharged directly into river Ganga without any treatment. In fact, the said CETP was found deficient in

terms of capacity as well as quality of effluent discharged after treatment. Some of the industries could be ordered to be shutdown forthwith but on a suggestion made and in economic interest, it was considered appropriate to provide certain time limits to the industry to install anti-pollution devices.

18. The Advocate General appearing for the State of Uttar Pradesh on 26th May, 2015 touched upon the issues that were discussed in the Chamber Meeting on 1st May, 2015 and stated that a holistic approach is required to be taken in relation to the entire industrial activity in question. The concerned regulatory bodies were required to exercise more control and persuade the industries to install anti-pollution devices. Directions were also issued for conducting a Joint Inspection of the polluting industries. The Tribunal, from time to time, took up the cases of the industries which were seriously polluting industries and passed appropriate directions. However, compliance of these directions remains a matter of concern. Some of the industries were even required to be closed down but it was found in some of the cases that even such directions were not complied with in its true letter and spirit.

19. When the matter came up for hearing on 12th October, 2015, it was noticed that the Counsel and officers appearing for different stakeholders were not able to provide complete answers to the issues raised by the

Tribunal. The direction was issued to the State of Uttarakhand to organise an appropriate meeting of the senior officers and submit a complete plan in relation to completion of Segment-A of Phase-I (Gaumukh to Haridwar) of cleaning of river Ganga. In the order of the 2nd November, 2015, a Joint Inspection Team was constituted comprising of the nominees of the Principal Committee, Member Secretary of the Pollution Control Board, Member Secretary of UPPCB and the Professors of IIT, Delhi, Kanpur and Roorkee. The CETPs in the industrial cluster were required to be inspected and it was also to be examined whether the tanneries and other industries were discharging their effluent into the conveyor drain and the possibility of the CETP being ZLD based. The samples were to be collected at the point where the tributaries were joining river Ganga and the drains were joining the tributaries.

20. Importantly, in the order of 2nd November, 2015, the Tribunal reserved its judgement in Original Application No. 196 of 2014 and the connected matters thereto. It also directed a Chamber meeting to be held on 6th November, 2015. The purpose obviously was to get the final input from the members of the Principal Committee and other Committees appointed by the Tribunal under its various orders.

21. On 4th November 2015, the Tribunal passed an order

asking if any particular study had been carried out to understand the deficiencies in Ganga Action Plan I (GAP I) and Ganga Action Plan II (GAP II). The purpose of passing of this order was to bring to surface, the drawbacks in the execution of the two plans so that in the orders passed by the Tribunal such deficiencies or drawbacks could be avoided. It may also be noticed that in the chamber meeting held on 6th November, 2015 where all senior officers were present including executing agencies, it was undisputed that GAP I and II could not bring the desired results and the pollution of river Ganga had not been reduced or controlled. On the contrary, with the passage of time, due to setting up of more industries and unplanned developments in the cities and towns on the bank of river Ganga and its tributaries has resulted in increase in pollution in river Ganga.

> "During the course of the hearing various question have arisen with regard to implementation of Ganga Action Plan– I and Ganga Action Plan–II. It is necessary for the Tribunal to know that whether the Ministries have conducted any studies on the deficiencies with which they suffered. This would be absolutely necessary to know while passing its final judgement in relation to Phase – I of Ganga Project, in terms of the orders passed by the Hon'ble Supreme Court of India. If there are any documents which are not in the public domain liberty is granted to the Ministry to file them in a sealed cover and deliver the same to the Deputy Registrar (Judicial) of the Tribunal."

Despite the above order, none of the parties filed any specific response. However, the report of the Consortium of 7 IITs had been placed on record which provided some insight into the reasons for failure of Ganga Action Plan-1 and 2, respectively.

22. *Vide* order dated 5th November, 2015, the judgement in the case of *Indian Council for Enviro-legal Action vs. National Ganga River Basin Authority* & Ors. and *M.C. Mehta vs. Union of India & Ors.* was reserved. The judgement in Original Application No. 340 of 2014 and the connected matters was pronounced by the Bench of the Tribunal on 10th December, 2015. By this judgement, 130 applications were disposed of which were filed by various industries in response to the notices issued by the UPPCB in terms of the earlier orders of the Tribunal. The UPPCB had issued notice to 956 polluting industries, out of which, 269 were stated to be seriously polluting industries and 687 were the industries pointed out by the CPCB making a total of 956 industries. Under this judgement, the industries were classified under different heads. 93 industries were operating with the consent of the Board and in consonance with the prescribed procedure and parameters. These industries were permitted to operate. There were nearly 65 industries which were non-compliant and have been shown at serial number 66 to 99 except at serial number 83 to 84 which were permitted to carry on their operations

but were directed to be subjected to a joint inspection by a team consisting of CPCB and UPPCB to ensure that they operate strictly in accordance with the prescribed norms. The industries which were lying closed under the orders of the Board, were ordered to remain closed as they did not comply with the law by obtaining consent of the Board and were not discharging their trade effluents within the prescribed norms and their ETPs were either not installed or were found to be non-functional. The Tribunal observed that the right to carry on business was subject to the reasonable restriction imposed by law i.e. the Water Act, the Air Act and the Environment Protection Act, 1986. These industries were not permitted to commence their operations. Lastly, specific directions in relation to a group of industries were issued in the order which need not be reproduced here. One fact which we have to notice here is that the CETP installed at Jajmau was receiving effluents in excess of its capacity. Large quantity of sewage and effluents were being directly diverted to conveyer belt leading to river Ganga and the remaining part was being processed through CETP. The CETP did not have any adequate technology or Chromium Recovery Plant to recover chromium in the effluent and the parameters were found to be much in excess to prescribed standards. Thus, a direction was issued in O.A. No. 428 of 2014 that management of CETP should ensure proper operations and

management of the plant, in any case, till disposal of *M.C. Mehta Vs. Union of India* case. An environmental compensation of ₹ 1 Lakh was imposed upon the CETP which was to be paid to the UPPCB.

23. The cases of *Indian Council for Enviro-legal Action vs. National Ganga River Basin Authority* & Ors." and *M.C. Mehta vs. Union of India & Ors.* were disposed of by an exhaustive judgement passed by the Tribunal dated 10th December, 2015. Based upon the lengthy arguments addressed, spread over a number of hearings, the view of the Principal Committee and other Committees and also that of the Expert Members including Professors from IITs, it was considered most appropriate that the Tribunal should deal with the river Ganga by dividing it into different segments. This was also recorded in different orders, some of which we have already referred. In paragraph 58 of the said judgement, the Tribunal held as follows:

> "58. After serious deliberations, keeping in view the extent of pollution, particularly, industrial pollution of River Ganga and the length of the River (2525 km) it was considered absolutely essential to divide the project of cleaning of River Ganga into different segments. One factor, which was commonly admitted and was quite evident from the records before Tribunal is that discharge into River Ganga is not exclusive in its nature and content. In some places the discharge is from sewage and at other places discharge is from industrial clusters but mostly the discharge consists both

> of sewage and industrial effluent together. In light of this, it was unanimously resolved that the River Ganga should be divided into different segments for its restoration and thus, the Tribunal directed as under:
>
> Ganga Phase-I-Segment-A: Gomukh to Haridwar
> Ganga Phase-I-Segment-B: Haridwar to Kanpur
> Ganga Phase-II : Kanpur Border to Uttar Pradesh Border
> Ganga Phase-III: Uttar Pradesh Border to till Jharkhand Border
> Ganga Phase-IV: Jharkhand Border to Bay of Bengal (West Bengal)
>
> The solutions for prevention and control of pollution as well as restoration of River Ganga to its pristine form quality have to be multi-fold i.e. have treatment of sewage as well as industrial effluent. If only one was concentrated, the pollution shall still persist and cost of the project would be very high if at all places different STPs and/or CETPs are required to be installed and made operative. We have discussed other economic factors in this judgement separately."

24. Another important feature that was noticed in this judgement was that even in Segment A of Phase-I, there was dumping of municipal solid waste and other wastes into river Ganga. Upon adding the above deficiencies, sewage and industrial effluents were the common sources of pollution in this segment and therefore, it was necessary to provide multi-faceted solutions to prevent and control the pollution of river Ganga. Besides this, there were CETP and STPs operating at Haridwar and Jagjeetpur. It was noticed that till the river reaches Haridwar, the presence of Faecal/Total Coliform was much in excess and its value

were found to be 4000 to 1,60,000 MPN/100 ml. The other parameters like BOD, COD, TSS were not a matter of issue. The technology of Root Zone treatment or the Reed Bed technology was not found suitable for the hilly areas but could be tried in the foothills.

It was also noticed that even where the sewage was being treated through the STPs, the STPs did not have mechanism for treating coliform and the industrial effluent was being directly discharged into the river, either untreated or partially treated. The scheme of Uttarakhand authorities, which established STPs in every city or town falling under Segment-A of Phase-I even after laying down the sewer pipeline, is not only impractical but also un-economical and would cause more damage to the eco-sensitive area of the State. Large scale digging, blasting for the purpose of laying down pipelines would expose the entire ecology to disaster, making it prone to landslides. Thus, disturbing not only the environment but also the day-to-day living of the people in the State as well. The State of Uttarakhand and its various organizations were not even able to confirm as to how many drains already exist and how many of them have already been intercepted and how many directly join river Ganga. Thus, it was considered appropriate to provide collective septic tanks or bio-digesters with a proper system for extraction of the sewage and taking it to the STPs located in the cities and

towns on the foothills.

25. The State of Uttarakhand enacted the Uttarakhand Flood Plain Zoning Act, 2012 to provide for zoning of the floodplains of the river in the State. Under Section 25, any person who prevents the Flood Plain Zoning Authority in discharging its functions or any act imposed on such authority under this Act, would be deemed to have committed an offence under Section 86 of Indian Penal Code, 1860. Despite lapse of three years, no action had been taken in furtherance to the said Act. The Central and the State Governments were fully cautious of the eco-sensitive area. The Tribunal noticed that the Ganga Action Plan did not succeed primarily because of non implementation of the decisions and the directions issued by the authorities and courts. Lack of accountability, responsibility and vacuum in implementation and execution were the paramount causes for non-achievement of the goal of cleaning river Ganga or any part thereof. The Applicant had raised a specific contention that the various projects taken up, whether at the State or at the National level, have proved to be ineffective. Huge sum of money have been spent on cleaning of Ganga but no part of Ganga has got rid of either sewage, industrial effluents or dumping of other wastes. It was noticed that the authorities have chosen not to raise any contentions with respect to the specific data or material. Mr. Bhajan Singh,

MD of Peyjal Nigam has informed that there are 143 drains/Nallahs in the entire Segment – A of Phase–1 falling into all three rivers, i.e., Bhagirathi, Alaknanda and Ganga. Out of them, 8 are the drains/Nallahs, which are carrying natural water and are absolutely non-polluting. 48 drains out of them have already been trapped and were being treated at different STPs. However, these STPs were stated to be incapable of maintaining the current standards for treated sewage discharge, and in any case could not treat Faecal Coliform bacteria. It was stated that there are 77 drains which were to be trapped and the sewage thereof is to be treated. The total sewage generated was measured at 149.31 MLD, out of which nearly 77.5 MLD was being treated partially as indicated. Besides the existing STPs, there are two STPs at Jagjeetpur, Haridwar, third one is at Sarai, Haridwar, one at Rishikesh, one STP at Swarg Ashram, one STP at Uttarkashi and one STP at Srinagar. But all these STPs were suffering from deficiencies afore-indicated. Physical inspections of the cities like Uttarkashi, Rishikesh, Haridwar, etc. were conducted and detailed data thereof was placed before the Tribunal. The hotels, ashrams and guest houses were a serious source of pollution as most of them were indiscriminately putting their entire waste into the river Ganga, directly or through the sewage pipelines which itself was not treating the entire sewage satisfactorily. The

Tribunal considered, with the help of the Expert Committees, all the aspects of the pollution of river Ganga and addressed the possible solutions. The status of the existing STPs, CETPs, drains and dumping of waste and other contributory factors of pollution were considered along with various reports that were filed on record and the Tribunal issued the following detailed directions with regard to execution of various works that should be performed without any delay, to check, control and prevent the pollution and ensure that Segment-A of Phase-I of river Ganga is entirely pollution free. It provides a time bound programme in relation to compliance of the directions. The directions are contained in paragraph 98 of the judgement which reads as under:

> "I. The directions in this Judgement would strictly relate to all contributories to pollution of River Ganga in Segment 'A' of Phase I, i.e., Gaumukh to Border of District Haridwar downstream in the State of Uttarakhand.
>
> II. DIRECTIONS IN REGARD TO COLLECTION AND DISPOSAL OF SEWAGE:
>
> A. The Executing Committee as stated **in para 95** shall be directly and personally responsible for execution of works specifically stated and compliance of the directions enunciated in this judgement.
>
> B. No work in relation to sewer line network shall be carried out by the State of Uttarakhand and/or any public authority/ body except at Gangori where the sewer line network has been completed and at Gopeshwar where 96% work has already been completed and both are to be connected to the STP. If

any work of this nature is to be carried on by the State of Uttarakhand or any of its Instrumentalities or Public Authorities or Bodies, it shall submit the proposal to the Principal Committee. The comments of the Principal Committee would be placed before the Tribunal for final orders. We also direct that no fresh works will be undertaken by the State or Public Authorities without approval of the Tribunal in relation to collection, treatment and disposal of the sewage except the works specifically provided in this judgement.

C. Every effort would be made to provide a common Bio-Digester for hamlets.

D. Establishment of 40 MLD Sewage Treatment Plant at Jagjeetpur, Haridwar shall be completed within 6 months from today.

E. All the concerned public authorities and the district administration would be responsible for proper operation and maintenance of this new Plant as well as both the existing STPs having a capacity of 45 MLD (18+27). The new STP being constructed now shall ensure that they are capable of treating Faecal Coliform Bacteria.

F. All the established and to be established STPs, shall ensure that the treated sewage released from these STPs is adhering to the prescribed parameters, i.e., BOD and TSS amongst others, should be below 10 mg per litre which is the current standard declared by the CPCB.

G. The Tribunal is not passing any direction in relation to 9 Hydro-projects which are operational and 11 which are stated to be under construction, as we are informed that the matter is pending before the Hon'ble Supreme Court. However, we would specify here that all hydro-projects which are in

operation or under construction would be directed to provide their own STP's and make them operational within 3 months from the date of pronouncement of this judgement, upon which, the Joint Inspection Team shall inspect such STPs, analyse their discharge and if found to be beyond the prescribed parameters, the UKPCB shall take punitive action against the head of the department of such projects and persons responsible for operation and maintenance of such plants. This would be in addition to the action that the Tribunal may direct for violation of its directions. Even this direction is subject to the orders that may be passed by the Hon'ble Supreme Court of India in the matter relating to Hydro projects. The Project Proponents would not be entitled to claim any advantage of this order.

H. No drain carrying sewage in any of the cities/towns forming part of Segment A of Phase-I would be permitted to join River Ganga or its tributaries. All the drains shall be tapped and the sewage from these drains would be brought to the common bio-digesters/STPs as the case may be. We prohibit discharge of any sewage or any untreated effluent through drains or otherwise into the River Ganga or its tributaries in the entire Segment-A of Phase-I.

I. Wherever there is a town which is closer to the industrial clusters, it will be ensured that the treated sewage water from the town is recycled for industrial purposes or other permissible purposes. However on other places it should be used for agriculture and horticulture purposes and other permissible purposes. Every effort should be made not to discharge more than 25 per cent of the total release from all the STPs into River Ganga.

J. Proper management scheme or protocol shall be prepared and notified by the State and all its agencies to ensure that the sewerage or sewage effluent collected in common septic tanks or bio-digesters, is emptied regularly and taken to the STP for appropriate treatment and its consequential release. The manure collected in the bio-digester shall be distributed free of cost to the farmers around the area and for this purpose the State administration shall ensure effective participation of the respective gram panchyats.

K. There shall be a team constituted of senior officers from Uttarakhand Pey Jal Nigam, UKPCB and representatives of the Government from Department of Urban Development. They shall submit quarterly reports to the Tribunal in regard to operation and management of the STPs and bio-digesters and in regard to the implementation of the action plan.

L. Every officer and head of the department of the public authority or body responsible for maintaining and operating the STPs/Bio digesters would be personally responsible for default, if the released sewage/effluent is found to be excessive to the prescribed parameters.

M. The Executing Committee appointed under this judgement shall be responsible for completion of up gradation of the six existing STPs and would ensure that the projects are completed and operationalised within the time noticed in the Judgement. Further, this Committee would be responsible for construction and establishment of another 15 STPs and 24 Bio-digesters of requisite capacity at the locations and within the time specified in **para 86** of the judgement. This Committee shall

work under the supervision and control of the Principal Committee. The total project is valued at Rs. 502 crores, funds for which would be provided through the Principal Committee in the proportion so determined. The State of Uttarakhand, its instrumentalities, public bodies, Uttarakhand Pey Jal Nigam, Uttarakhand Jal Sansthan and all other local bodies shall fully co-operate and extend full support to the Executing Committee to ensure that the works are executed expeditiously and within the time specified. The complete Action Plan along with the copies of the DPRs already submitted to NMGC/Ministry of Water Resources would be present before the principal committee and then for approval before the NMGC for sanction of fund within 1 month from today.

N. The Executing Committee with the help of the Uttarakhand Pey Jal Nigam, Uttarakhand Jal Sansthan and all other public authorities would submit a comprehensive report in relation to up-gradation of technology or otherwise of the existing 7 STPs which are not performing to the prescribed standards. It will be ensured that the technology of filtration and ozonisation is used to ensure that Faecal Coliform Bacteria does not enter into water bodies in excess of the prescribed parameters. The project so submitted shall be dealt with by the Principal Committee with utmost expeditiousness and shall be executed through the proper agencies.

DIRECTIONS IN RELATION TO INDUSTRIES

A. All the Seriously Polluting Industries which are operating without consent of the UKPCB and/or who have failed to comply with the directions issued by the UKPCB shall be closed down

forthwith.

B. There are 4 seriously polluting industries located at Sitarganj which are persistent defaulters as stated **in para 89 of** this judgement. We direct that such industries shall be closed forthwith. After remedial and rectification steps are taken by these industries and they install anti-pollution devices, they would be at liberty to approach UKPCB for grant of 'consent to operate'. If they approach UKPCB for obtaining 'consent to operate', such applications would be decided by the Board expeditiously. The consent granted would become operative subject to the orders of the Tribunal.

C. The State Government and District Administration shall ensure that all the Seriously Polluting Industries in relation to which UKPCB has already passed orders of closure shall also be closed forthwith.

D. In the event, any of the industries are found to be defaulting, their premises shall be sealed and electricity and water connection shall be disconnected forthwith.

E. The industries which are in the process of complying with the directions issued by UKPCB and/or are installing anti-pollution devices like ETPs or other mechanism to ensure that the trade effluent discharged by them on land, drains, water bodies or any other places is strictly complying with the prescribed parameters, would not be closed and would be permitted to do the needful at the earliest and in any case within three months.

F. Some of the Grossly Polluting Industries (15 in number) have applied for obtaining 'consent to operate' from UKPCB. The applications which are pending with UKPCB shall be disposed of in accordance with law not later than six weeks from passing of this

judgement. Names of these industries have been given **in para 89 of** this judgement.

F.1. The Grossly Polluting Industries (10 in number) which have not obtained/or applied for obtaining the consent of the UKPCB shall be ordered to be closed forthwith. They would also be permitted to carryout remedial measures and install anti pollution devices, whereupon they could apply to UKPCB for obtaining 'consent to operate'. If upon Joint Inspection, consent is granted, the industry would be permitted to operate subject to orders of the Tribunal (**recorded in para 89**).

G. The Industries which are operating without consent of UKPCB and are not seriously or grossly polluting as stated in the Judgement would be at liberty to apply for obtaining 'consent to operate' from UKPCB. If such applications are filed within one month from today, then UKPCB will deal with such applications with utmost expeditiousness. However, none of these industries would carry out their operations without specific orders of the Tribunal.

H. All industries located anywhere in any part of Segment-A of Part-I would obtain consent of the Board irrespective of nature of their business and quantity and quality of discharge of their trade effluent.

I. In the case of grossly and seriously polluting industries, UKPCB shall grant consent only after the industries have been subjected to a joint inspection by the Joint Inspection Team consisting of representatives of CPCB, UKPCB, Directorate of Industries, State of Uttarakhand and nominated a lecturer from IIT Roorkee.

J. The four industries to whom 'consent to operate' has been declined by UKPCB as stated at serial no. 1 to 4 under **para 89 of** this judgement shall be closed

forthwith and would not be permitted to operate till further orders of the Tribunal. These industries shall be inspected and report should be submitted to the Tribunal by UKPCB on the aspect that they are actually lying closed. They would be at liberty to take remedial measures and approach UKPCB for obtaining 'consent to operate' afresh.

K. The 10 industries whose names have been given **in para 89 of** the judgement and which have not even applied for obtaining 'consent to operate' from UKPCB shall be liable to be shutdown forthwith.

L. The Joint Inspection Team shall collect effluent samples and analyse them and recommend grant of consent, only if their parameters are found to be within the prescribed limit. They would be permitted to operate subject to the orders of the Tribunal. All industries which are not seriously polluting but are operating without the consent of UKPCB or have violated the conditions imposed by UKPCB in the order granting them 'consent to operate' shall be served with a Notice/Show Cause Notice requiring them to comply with the requirements of environmental protection and obtain the consent of UKPCB. If such industries become compliant and non-polluting, they would be permitted to operate. In the event they fail to comply with the same within 2 months of the issuance of the Show Cause Notice, which should be issued within 15 days from the date of passing of this judgement, such industries would also be liable to be closed and UKPCB would take appropriate action in accordance with law against such units.

M. The two existing CETPs, one at Sitarganj and other at SIDCUL, Haridwar are a matter of serious concern. While the first is not

operational, the second does not discharge effluents as per prescribed norms. The CETP at SIDCUL, Haridwar was directed to become zero liquid discharge unit which it has failed despite directions.

Thus, we direct that the Uttarakhand Industrial Development Corporation should ensure that the CETP at Sitarganj is serviced and made operational within one month from today. It should be ensured that the effluent that it discharges meets the current prescribed standards. The said Corporation can do the work itself or operate it through some agency but it shall be the exclusive responsibility of the Corporation to ensure proper operationalisation and management of the CETP. The CETP at SIDCUL, Haridwar should become a zero liquid discharge unit. As this process is likely to take some time, we direct the government and operating agencies to ensure that the effluent discharge from this CETP is definitely of tertiary levels and should be recycled for the benefit of the industries which are discharging their trade effluent to this very CETP.

We further direct that in the event the CETP is unable to attain zero liquid discharge, the authorities and the Society shall install an independent ETP of 4 MLD at SIDCUL, Haridwar to ensure that no pollutants enter River Ganga from that CETP.

N. The Joint Inspection Team shall also conduct a survey and submit a report to the Tribunal stating whether the established CETPs are capable of treating the effluent discharged in terms of quantum and quality from the respective industrial cluster to which they are catering.

O. The State Government and all

concerned authorities and public bodies would ensure that the industries located under any industrial cluster, particularly at SIDCUL and Sitarganj, should be connected to the CETP through the existing common conveyor belt. If any industry does not comply with this direction, the UKPCB and the concerned maintaining/operating authority should serve notice of show cause upon that industry as to why it should not be directed to be closed in case of the default, where-after, it shall pass appropriate order which shall be submitted before the Tribunal and the same would be subject to the orders of the Tribunal.

O. (1). The Supervisory Committee, therefore, should submit a report within one month from the date of pronouncement of this judgement to the Principal Committee in regard to basic need and possibility of operationalisation of this CETP. It must be ensured that industrial untreated effluents from the SIDCUL, Pant Nagar does not enter River Ganga or its Tributaries at all.

O. (2). The 19 Seriously Polluting Industries (SPIs) and 4 Grossly Polluting Industries (GPIs) industries whose application for obtaining consent of UKPCB have been rejected and they are still operating, as stated **in para 89** of the judgement are directed to be closed forthwith. Upon taking remedial measures and installing anti-pollution devices, they would be entitled to apply for obtaining consent of UKPCB afresh. However, they would be permitted to operate only after orders of the Tribunal.

P. The effluents discharged from the CETP are presently stored in the lagoon from where it is being discharged into River Sukhi. Steps will be taken by the agency operating CETP as well as all concerned authorities to channelize

effluents into lagoon through the reverse osmosis system and recycle the same so that least effluent is discharged into River Sukhi. The Executing Committee shall examine whether it is possible to utilize In-Situ Bioremediation for treatment of sewage technology in place of installing STP/Bio-digesters. This technology is stated to be economically more viable and practically efficient for smaller plants. They would make their recommendations to the Principal Committee within the time directed.

Q. BHEL is hereby directed to install its own STP of 11 MLD capacity by January 2016 as it is stated to be under finalisation. The STP so installed, should preferably achieve zero liquid discharge. The treated sewage water should be used and recycled for agriculture, horticulture or its own industrial purpose. If it discharges any treated sewage water, it should be strictly of the current prescribed values, i.e., 10 mg per litre BOD and 10 mg per litre TSS and should be capable of fully treating Coliform, Faecal or otherwise, as per prescribed norms.

R. As noticed in the Judgement, there are 226 kinds of industries (total being more than 4000) which are operating without the consent of UKPCB. They claim to have exemption granted to them by the Industries Department of the State. The Department of Industries has no jurisdiction to exempt the industries from operation of the Water Act and Air Act. (refer *Gurdev Singh v. Punjab Pollution Control Board, Punjab Pollution Control Board Zonal Office, Sohan Singh and The Punjab State Electricity Board* 2013 ALL (I) NGT REPORTER (2) (DELHI) 1)

All these industries except the ones which have a dry process and which do not discharge any trade effluent either directly or indirectly

into River, water bodies or drains would be required to move an application, complete in all respects, to take consent of UKPCB within one month from the date of pronouncement of this Judgement. Such application, if filed would be dealt with by the Board and consent granted or refused to the units within 3 months thereafter. The units which are refused consent shall be closed and would not be permitted to carry on their industrial operations.

Keeping in view that there is a likelihood of substantial increase in the work load of UKPCB, we would require the State Government to consider providing more posts in the hierarchy of UKPCB to ensure proper implementation of the Environmental Laws, particularly the Acts specified in Schedule 1 of the NGT Act.

III. <u>DIRECTIONS IN RELATION TO HOTELS/ DHARAMSHALAS / ASHRAMS</u>

A. All the Hotels which have failed to establish their own STPs, and have failed to obtain the consent of UKPCB despite persuasion and public notice dated 15th September 2015 and are releasing their domestic waste and sewage into River Ganga or its tributaries and/or the drains whether or not leading to the STPs in Rishikesh or Haridwar, shall be directed to be shut down forthwith.

B. The hotels which have applied for obtaining the consent of UKPCB in response to the above mentioned public notice shall be granted and/or refused consent within 1 month from the date of pronouncement of this Judgement without default.

C. Similarly, ashrams and Dhramshalas which are discharging their sewage or domestic effluent directly into the River Ganga or its tributaries, whether or not they

have their STP, would be directed to stop such discharge within 1 month from the date of issuance of the notice in this regard. Drains which directly bring sewage to the STP already established or to be established as afore-directed shall be connected to the common conveyor belt.

D. The ashrams/dharamshalas which do not have their own STP would be required to establish such STP within 3 months from the date of pronouncement of this Judgement. They will not, in any event, be permitted to release their discharged sewage or domestic waste into River Ganga directly. They must discharge such effluent into drains alone that bring such effluent to the STP.

E. If any hotel, dharamshala or ashram violates these directions it shall be liable to pay environmental compensation for causing pollution of River Ganga at the rate of Rs. 5000 per day. The Joint Inspection Team referred above shall conduct inspection of the hotel, ashram and dharamshala and if any of them is found to be violating these directions and/or whose STPs/ETPs are either not functioning effectively or not releasing effluent within the prescribed limits then the inspection team shall submit the report to the Tribunal quarterly.

IV. <u>DIRECTIONS IN RELATION TO MUNICIPAL SOLID WASTE</u>

A. There shall be complete prohibition on use of plastic, i.e., plastic carry bags/plastic plates, glasses, spoons, packages and allied items in all the cities/towns falling on the River Ganga and/or its tributaries in Segment 'A' of Phase-1. Under no circumstances, plastic carry bags of any thickness whatsoever would be permitted. The procurement, storing and sale of such plastic bags, plates, glasses, spoons, etc.

are hereby prohibited.

B. These restrictions would become operative w.e.f. 1st February, 2016. We further make it clear that the State of Uttarakhand in co-ordination with Ministry of Textile and other agencies would provide bio-degradable materials including jute bags, paper glasses, tumbler and such other items, use of which would be permitted from the specified date in the entire Segment 'A' of Phase-1.

   We direct the Ministry of Textile within 15 days from today to provide the complete alternative or possible alternatives to the State of Uttarakhand in this regard.

C. All the directions contained in relation to MSW in our order dated 2nd July, 2015 in Original Application No. 10 of 2015 shall remain in force. The said order which we have reproduced **in para 49 of the Judgement** shall be read as an integral part of this judgement.

D. The MSW dumping site at Chandi ghat which is located on the flood plain shall not be used any longer for dumping MSW. We hereby prohibit the State Government and all the Local Authorities at Haridwar from dumping any waste henceforth at the Chandi ghat site.

   We direct the State Government to develop and construct MSW dumping site at Sarai Village, Haridwar in terms of the stand taken by the State before the Tribunal in the case of *Gram Sarai Samiti v. MoEF&CC & Ors.*, Appeal no. 106 of 2015. From the records submitted before us in that case, it is clear that the Environmental Clearance for the site has already been granted. Once this site is ready, the entire MSW deposit at Chandi ghat site shall be segregated, removed and deposited at the new site. Transportation and segregation of the MSW at this site

shall be strictly in accordance with the conditions of the Environmental Clearance and the Municipal Solid Wastes (Handling & Management) Rules, 2000. The authorities concerned shall formulate a scheme and methodology for door to door collection from the bins in the respective colonies, segregation at the collection point, its transportation in covered vehicles and its disposal at the site and the Plant in accordance with the MSW Rules.

E. We hereby direct the Supervisory Committee constituted under this judgement to submit a report to the Tribunal for construction of MSW dumping sites and plants which would ensure that the generated waste from the entire State can be effectively collected and disposed of in accordance with MSW Rules. The report should be submitted within one month from today. Preferably the scheme should be District based and with the adequate mechanism for transportation of MSW.

F. There shall be prohibition on throwing of any municipal waste, construction and demolition and other wastes into River Ganga and its tributaries and even on banks thereof. Any person/body, if found violating this condition, shall be liable to pay environmental compensation at the rate of Rs. 5000 per event. The authorities concerned shall bring it to the notice of all concerned, widely publicise the same and place sign boards at the relevant sites.

G. We further direct the State Government, and its instrumentalities and all public authorities to ensure that public facilities like toilets are provided on the appropriate places in colonies abutting River Ganga all along Segment-A of Phase-I. The toilets should be connected and linked to

bio-digesters or STPs constructed for that purpose alone. The State Government, public authorities, Nigam and Municipalities shall prepare an action plan in relation to providing bio-toilets in such number which is commensurate to the floating population coming to Haridwar and different parts of Uttarakhand as pilgrims or in the festive season. The bio-toilets so provided will be cleaned and the sewerage so collected shall be transported to the STPs establish for this purpose alone for treatment and removal of coliform as per prescribed standards.

H. During the interregnum, the local authorities shall ensure proper system in place for cleaning of these toilets and bringing the sewage and other waste from these toilets to the existing STPs for treatment. This direction is necessitated to ensure that there is no human defecation on the flood plain or areas nearby.

I. Uttarkashi is also to have its own site for STP. However all these steps are long term measures. For the present, the authorities should identify atleast temporary dumping sites in all the districts and major towns forming part of the Segment-A where the MSW should be dumped after segregation. The State Government, all public authorities, Nigams and Municipalities, etc. would ensure that even such temporary sites should not be within 500 meters distance from the end of the flood plain of the River Ganga or its Tributaries. The plastic or such other waste which can be used as a fuel should be sent to the proper plants.

V. <u>DIRECTIONS IN RELATION TO FLOOD PLAINS</u>

A. The State of Uttarakhand shall prepare and submit to the MoEF&CC, Tourism-cum-Plain

map, Flood Plain map and zoning of flood plain shall be in accordance with the Notification dated 18th December, 2012 issued by the Ministry and the Act of 2012 afore-referred positively within 3 months from the date of pronouncement of this judgement. Upon submission, MoEF&CC shall approve such plans with amendments or otherwise within 1 month thereafter and then it shall be notified and brought in the public domain.

B. Keeping in view the Notification of the MoEF&CC, intent of the Act of 2012, orders passed by the Tribunal in other matters, High Courts and the Hon'ble Supreme Court in various cases, we would order and direct that as an interim measure at least 100m from middle of the River would be treated and dealt with as 'Eco sensitive and prohibited zone'. No activity whether permanent or temporary in nature will be permitted to be carried on in this zone including camping. The only exception would be the points for picking up and dropping the guests who are doing rafting in River Ganga.

The area beyond 100 meters and less than 300 meters would be treated as regulatory zone in the hilly terrain, for which the State will comply with the above directions.

The area upto 200 meters shall be the prohibited area in the plain terrain and more than 200 meters and less than 500 meters would be treated as regulatory zone.

Area/River bank/flood plain 2 kilometres. upstream to Rishikesh and till Border of the State of Uttarakhand towards Uttar Pradesh in River Gangaes would be treated as plain terrain while upstream the above hilly terrain.

The State Government while complying with its obligations under the Act of 2012 and this judgement in this regard would

keep in mind 1 in 25 years flood to be the criteria for declaring flood plain and the regulated activities which would be permitted in that area. This is the guiding factor which has complete scientific and documented studies to impose such limitations.

C. Strict supervision in that regard shall be enforced by the State agencies responsible for that purpose, primarily by the Secretary of Irrigation Department, State of Uttarakhand and the Chief Conservator of Forests, Uttarakhand. The policy so framed, with the restrictions as contemplated in the Notification of the MoEF&CC and the Act of 2012 formulated by Government of Uttarakhand shall be placed before the Tribunal after expiry of the above stated period.

D. Any activity or construction in the regulated area afore-referred where the gradient is beyond 35^0 should be further checked and preferably no activity should be permitted, to prevent ecological damage and land sliding in that area. All precautionary steps should be taken in that behalf.

E. In this prohibited area, no public authority or State department, including the panchayat would grant permission for any activity whatsoever, including eco-tourism except to the extent of points for pick up and dropping for River rafting.

VI. <u>DIRECTIONS IN RELATION TO MINING ON THE RIVER BED</u>.

A. The Riverbed mining shall be carried on in a highly regulated manner and under strict supervision of the authorities concerned.

B. No mechanised Riverbed mining would be permitted. No JCBs would be permitted to operate in the Riverbed.

C. No suction of the minerals from the

River and the Riverbed would be permitted by the mechanical process like suction pumps etc.

D. The regulated mining would include the seasons during which such mining is permitted and which shall be strictly adhered to.

VII. <u>DIRECTIONS IN RELATION TO BIO MEDICAL WASTE</u>

A. In absolute terms there should be no throwing of any medical, bio medical or any other waste, into the River, on the River banks and anywhere in the areas forming part of Segment-A of Phase-I. If any present hospital is found throwing such waste anywhere on land, water bodies or other places, UKPCB and the Municipal Authorities would re-cover Rs. 20,000 per violation from that person, Hospital or authorities on account of Environmental Compensation in terms of Section 15 of the NGT Act and on the basis of Polluter Pays Principle. These amounts would be deposited with the State Government and should be utilised for the project under this judgement.

B. The two entrepreneurs specified **in para 93** of this judgement which are dealing with collection, treatment and disposal of bio medical and hazardous medical waste will obtain Environmental Clearance within 3 months from the date of pronouncement of this judgement. Such application should be filed within 2 weeks from today and dealt with by the concerned authorities expeditiously. We direct the State Government to construct and establish by itself through annuity/PP mode or any other method that is suitable in the opinion of the Central Government at least two more bio-medical waste and hazardous waste plants of such capacity that would meet the requirement of 708 hospitals in the

State of Uttarakhand. These plants would be established at safe sites and away from beyond 1000 meters from the River/flood plain of the River Ganga. These plants would be established and made operative in accordance with law.

C. All the 708 Hospitals would be served with a notice by UKPCB and the department of health of the State requiring them to ensure proper collection, segregation and disposal of such waste in accordance with the Bio Medical Waste (Management and Handling) Rules, 1998. In the event the hospitals fail to comply with the directions so issued by the authorities, UKPCB should take action against such hospitals in accordance with law.

IX. GENERAL DIRECTIONS

A. For completion of the project and compliance of these directions, the State Government, its instrumentalities, public authorities and bodies would be entitled to invoke the Principal of 'Polluter Pays' and require the industries, hotels and Dharamshalas and even households to pay environmental compensation, and/or sewage charges in all events the State and its instrumentalities would ensure efficient, and effective operation, maintenance and management of the various STPs/CETPs, and Bio-digesters, etc.

B. The Environmental Compensation payable under these directions would be directly proportionate to the discharge of the effluent from such premises. This should primarily be imposed upon industries, hotels, ashrams and dharamshalas, for instance, hotel having 10 rooms should be directed to pay a particular amount, while a hotel of 50 rooms or above should be directed to pay much higher amount on this account. We leave,

fixation of this amount, in discretion of the State Government.

C. We also direct that the State of Uttarakhand and its various departments and public authorities to divert the balance funds provided for that purpose towards this project. Rs. 258 crores was provided out of which Rs. 78 crore has been spent thus, a balance of Rs. 180 crores is left. These funds would be utilised for carrying out the directions under this judgement. For the balance requisite amount, State Government will approach the NMCG and the Ministry of Water Resources to provide the funds from the already earmarked budget for cleaning of River Ganga.

D. If the Government proposes imposition of such environmental compensation or environmental cess then that cess shall be used only for implementation of the projects covered under this judgement till completion. Thereafter, the State could use these amounts as it considers appropriate.

E. In regard to granting sanction and release of funds for establishment of the 40 MLD plant at Jagjeetpur, Haridwar the NMCG shall release the same expeditiously and in any case not later than 1 month from today. The project, as noticed above, has already been approved. Plant should become operational in six months from today.

F. All other projects covered under this judgement shall be considered by the Ministry of Water Resources and NMCG on priority basis. It will be for them to decide as to which category of funding is to be adopted (i.e. 100 per cent funding by the Centre or Centre and State sharing basis and/or projects funded by the other sources) and which all projects are to be controlled by the Central Government. Such projects

shall be considered and approved with amendments or otherwise by these authorities expeditiously and with top priority. The projects so sanctioned shall be executed by the nominated State agency without any further delay and in accordance with the prescribed procedure.

G. All the works would be initiated, sanctioned, executed and maintained under the direct supervision of NMCG. The Executing Committee will directly supervise and be responsible for completion of the projects and report the matter to Principal Committee, which in turn, will submit its final report to the Tribunal.

H. We have already held that the State Governments are not only expected but it is their obligation to contribute and ensure effective implementation and operationalization of these projects."

26. After pronouncement of the above judgement on 4th January, 2016, the Tribunal decided to continue with the consultative process of the stakeholders in relation to Segment B of Phase-I. The meeting of the Chief Secretaries of the concerned States, Senior Officers from different stakeholders including the executing authorities and the CPCB and UPPCB was earlier held on earlier 23rd December, 2015. During the meeting, serious issues were raised with regard to Zero Liquid Discharge and installation of online monitoring system to be adopted by the industries across the board and the stakeholders were required to make their submissions. On 5th January, 2016,

learned Advocate General appearing for the State of Uttarakhand had made a statement that the Government and all other stakeholders had decided to implement the judgement dated 10th December, 2015 and would file compliance affidavit in a short time. The execution of the judgement dated 10th December, 2015 and compliance of the various directions issued by the Tribunal as afore-stated has been a matter of direct supervision by the Tribunal. Various compliance reports have been filed and according to Uttarakhand Peyjal Nigam, some projects had not been cleared by Central Government while some had been cleared. However, according to them, the compliance of the directions were in progress. The leaned Counsel appearing for the UKPCB, the Counsel for Uttarakhand Peyjal Nigam and State of Uttarakhand have stated that the authorities are ensuring their best to comply with the directions afore-stated. The execution of the order for the compliance of the directions continues to be *sub-judice* before the Tribunal. It is not necessary to discuss further details thereof.

The stakeholders including the applicant were directed to file their suggestions with regard to cleaning of river Ganga in Segment-B of Phase-I, i.e., Haridwar to Unnao, Kanpur. In the subsequent orders, the stakeholders including MoEF&CC, Ministry of Water Resources, CPCB and UPPCB were required to take clear instructions on various issues

that were discussed in the chamber meeting. *Vide* order dated 8th February, 2016, a Special Expert Team was constituted and was required to report to the Tribunal on various issues including, STPs, CETPs and more particularly the load in terms of quantum as well as qualitative analysis of the drains which were directly joining river Ganga. Order dated 8th February, 2016 reads as under:

> "We constitute a team of experts consisting of Member Secretary of the CPCB, Member Secretary, Uttar Pradesh Pollution Control Board, Member Secretary of State of Uttarakhand Pollution Control Board, General Manager of Jal Nigam, Director of specialised section from MoEF&CC and Professor Kazmi from IIT Roorkee and submit a report within three weeks from today.
>
> The Member Secretary of the CPCB will be the Nodal Officer and in-charge of holding the meeting proceedings of the Committee. This team of experts shall submit its report to the Tribunal on the following:
>
> 1. actual discharge from each major drain that joins River Ganga in the section from Haridwar to Kanpur.
> 2. it shall also measure the load of sewage at the point of STPs and the point where STPs are sought to be constructed.
> 3. it shall be stated, in the case of existing STP's whether they receive the entire discharged from the drain and part of the effluent directly is discharged or untreated sewage is discharged in the River Yamuna.
> 4. The Committee shall collect or cause to be collected under its supervision, the Samples from the drains and the inlet points of STPs (existing/proposed). These will be

analysed for all parameters and compared with the bathing quality water standards which will not be restricted to BOD, COD, pH etc. Analysis should also be done with regard to metals, insecticide, pesticide, Colifrom, and other phenolic compounds. This we have indicated to give a wider scope but list is not exhaustive. It will be in the discretion of the committee to have some other tests conducted as per their instructions.

5. Samples would be collected and analysed at the laboratory of CPCB and IIT, Roorkee. The Committee may adopt at least two methods for measuring the discharge.

Besides the above, the Committee shall also report as to what is actual contribution of Grossly Polluting Industries and other industries to sewage. Comments also be given as to what is the extent of water extraction from River Ganga for various usage particularly by industries.

All the learned Counsel appearing for the respective parties are directed to comply with the directions contained in the order dated 27th January, 2016 and submit a compliance report within two weeks from today. We make it clear that if directions are not complied with, we will be compelled to impose very heavy cost recoverable from the erring parties. The learned Counsel appearing for the Tannery Association prays for time to make written submissions. Let the written submissions. Let the written submissions be filed within two weeks from today with advance copies be given to the Learned Counsel appearing in this case. The Uttar Pradesh Pollution Control Board shall serve Notice upon President Secretary of textile, sugar and pulp & paper industries located in that area of segment-B of Phase-I of River Ganga. A representative of Textile industry is also present. He has been informed.

> The Committee would also offer its suggestions in regard to issues involved in Original Application No. 501 of 2014."

27. *Vide* order dated 17th February, 2016, the industries as well as all the stakeholders including Government Departments and Pollution Control Boards were required to file their written submissions on the issue of attainment of Zero Liquid Discharge, installation of online monitoring system and steps required to be taken for eradicating industrial pollution. At that time, it was stated that in this segment there were nearly 1070 seriously polluting industries which include 746 grossly polluting industries and the State Boards were required to issue appropriate directions in that behalf. *Vide* its order dated 13th May, 2016, the Tribunal directed the matter to be listed for final arguments on 20th May, 2016. However, such arguments were heard and it was felt necessary that a final meeting of the stakeholders in relation to Segment-B of Phase-I should be held. Therefore, the Chief Secretaries of the States, concerned secretaries of the State of UP, Managing Director of U.P. Jal Nigam, CEO of UP Jal Sansthan, all other senior most officers of the concerned public authorities or Government, Chairman and Member Secretaries of UPPCB and CPCB, Joint Secretaries of MoEF&CC and Ministry of Water Resources were required to attend the said meeting. This meeting was held and final

stand of the respective stakeholders was taken into consideration by the Tribunal. The purpose again was to take the final view of the respective stakeholders before the final arguments could be addressed and the Tribunal could proceed to this judgement.

28. After holding various meetings of stakeholders and hearing their arguments, certain questions of fundamental significance rose for consideration. Besides this, it was also noticed that the Tribunal has to take a clear approach on whether preference should be to clean the cities or to clean the rivers at the first instance. A detailed order was passed on 18th October, 2016, which reads as follows:

> "The Uttar Pradesh State Government, Uttar Pradesh Jal Nigam, Uttar Pradesh Pollution Control Board and Central Pollution Control Board are directed to file a comprehensive map sketch giving the following:-
>
> 1. All the drains and the Rivers joining the River Ganga or its main tributaries in Segment – B which now will be from Haridwar City Border to Unnao in District Kanpur.
> 2. The points where industrial effluents and sewage is release into the respective Rivers.
> 3. The quantum (load of BOD) of industrial waste effluent and sewage that is being discharged into the River/ drains.
> 4. The existing STPs/CETPs and whether they are functional or not and if they are functional whether they are capable of treating the various pollutants of industrial effluent, sewage and coliform.
> 5. The projected STPs/CETPs by the State itself or in collaboration with Ministry of Water Resources.
> 6. Industrial clusters falling on the

bank or near the River Ganga or its tributaries.

All these would be shown in different colours with a complete legend and shall be signed by all the concerned Authorities.

We may also notice that during course of hearing it has been brought to our notice that as per list of industries released by Government of India, there are nearly 1 Lakh industries minor and major falling in Segment 'B' of Phase–I. However, according to the Uttar Pradesh Pollution Control Board and the Central Pollution Control Board there are nearly 1070 Seriously Polluting Industries (SPIs) and Grossly Polluting Industries (GPIs). However, it is not clear as to whether there are other industries and if so what manufacturing or other activity they are carrying on and what kind of trade effluent do they discharge. Let Uttar Pradesh Pollution Control Board in consultation with other Authorities including Government of Uttar Pradesh and Central Pollution Control Board file a correct statement giving number of industries falling in Segment - 'B' of Phase–I. It should also be stated if the industries are registered with Directorate of Industries or not or whether they have been granted consent by the Uttar Pradesh Pollution Control Board to operate or not.

We are in the process of hearing arguments on Segment 'B' which has been expanded a little to the extent that it would start from the boundary of Haridwar to Unnao instead of limit of Kanpur. This is for the reason that tannery industries, which is one of the main cause of releasing pollutants into the River Ganga in this Segment, are located at Unnao and will have to dealt with at parity with the tannery industries at Jajmau, Kanpur. The working of the Authorities is pathetic with the passage of time huge amount of public money has been spent by these public authorities, but while they are only and only adding to the greater

> and severe load of pollution to River Ganga and its tributaries. Even today it cannot be informed to us as to how many drains carry industrial effluents, sewage and other discharge to the River Ganga or its tributaries. There are other factors which create a serious doubts about the very intent of the State of U.P. or its public authorities in an effort to clean River Ganga in a systematic and proper way.
>
> Since we are hearing the matter and the basic question that the Tribunal would have to answer amongst other is whether the approach of cleaning of city or cleaning of River at the first instance is the approach to be adopted. Ill-planning, unscientific approach and no future estimation has lead to chaos in which the River Ganga today is.
>
> We therefore direct that during the course of hearing the State of Uttar Pradesh and its Public Authorities and Nigam will not carry out any major project of sewage, establishment of STPs/CEPTs except day-to-day maintenance work of the pipelines and the plant in Segment 'B' without the specific directions of the Tribunal.
>
> We grant liberty to the concerned authorities to move the Tribunal if any specific work they are desirous of executing during the pendency of this application."

In furtherance to the above order, by a subsequent order, the specially constituted committee comprising of Member Secretary, CPCB, Chief Engineer of UPJN, Sr. Most Chief Environmental Officer of UPPCB and representative of Ministry of Water Resources were directed to pay a personal visit and provide complete details in relation to quality, quantum of flow in the drains which were joining river Ganga and its tributaries. Some details had been

provided but were required to be confirmed and further details were required to be provided in relation to Segment-B of Phase-I.

29. During the course of hearing, it came to light that even the data collection had not been done appropriately and there were major discrepancies between the data of UPJN and Joint Inspection Team. To resolve this issue, further inspections were directed. *Vide* order dated 25th October, 2016, it was noticed that a joint affidavit should be filed by the Ministry and other stakeholders in relation to the drains falling between Haridwar to Unnao, Kanpur in relation to Ganga and its tributaries giving their complete details so as to enable the Tribunal to arrive at a fair conclusion and to provide proper remedial steps that are required to be taken. *Vide* order dated 17th November, 2016, the Ministry was directed to file the report of IIT Consortium and the Secretaries of Government of India on Phase-I and II. On 18th November, 2016, the Tribunal was informed that in Jajmau there are nearly 400 tannery industries and in Unnao there are 42 tannery industries. It was also conceded before the Tribunal that there was no Chromium Recovery Plant and the CETPs provided at this site were violating all prescribed parameters and were ineffective. On 2nd December, 2016, professors from different IITs had appeared before the Tribunal and made submissions at length with regard to the work done by the

Consortium of 7 IITs. It will be useful to reproduce the order dated 2nd December, 2016 to put the matters with complete clarity on record and to devise proper mechanism free of earlier deficiencies and to ensure effective steps to be taken with regard to rejuvenation of river Ganga.

> "In furtherance to our order dated 22nd November, 2016, Professor Vinod Tare, Professor Gusain, Professor S.P. Singh, IIT Roorkee and Professor Indrajit Dubey, IIT, Kharagpur were present yesterday and had made submissions at length before the Tribunal with regard to the work done by the consortium of seven I.I.T.s and the report submitted by them and the recommendation made. The Tribunal had heard the group of these professors at length and the matter continued for today when Professor Vinod Tare and Professor Gussain are present. We consider it appropriate to record the gist of what had been submitted by them and deliberated upon at length with assistance of all the Learned Counsel appearing in this case.
>
> We may notice that Government of India and Ministry of Environment, Forest and Climate Change on its own had constituted the consortium of the seven IITs. The Memorandum of agreement was executed between the I.I.T.s and the Government of India to prepare Ganga River Basin Management Plan. They had submitted various reports commencing from 2010 and the consolidated final report was submitted in the year 2015. It is obvious that these reports were hardly acted upon and they remained part of Govt. archive. It appears that there has been hardly any implementation on this report, the Learned Counsel appearing for Central Pollution Control Board and Uttar Pradesh Pollution Control Board submits that the report was never shared with them and the report did not form the basis for preparation of

Joint Action Plan.

Be as that it may, we would like to record the gist of what has been stated by the experts of IIT consortium in response to the specific questions that had been framed by the Tribunal.

1. To the query made regarding data collection and confirmation of data placed before the consortium, it was stated before us that no primary data had been collected by the consortium of IITs. In fact, it did not even form the part of the assigned job. They also did not verify the collected data which had been submitted to them by various agencies during the implementation of their project in the year 2010. However, in relation to Water Resources, some verification was done. It is further stated that IITC (IIT Consortium) did not collect primary data on industrial/domestic sewage discharges (or other need based data) which were to be provided to us by the government. However, IITC did conduct a very limited number of field measurements of River flows and cross-section, aquatic biodiversity, wastewater discharges, etc., primarily to get a rudimentary idea about such aspects, whenever secondary data was completely absent or was judged to be of poor quality. The first of its report was submitted to the Government in 2010 it recommended that it was necessary to have detailed investigation in each field as it was a pre-requisite for the purpose of proper result oriented reports. However, till 2015, the submission of the final report, no primary and customised data or details were either collected or provided to the Indian Institute of Technology consortium.
2. One of the main reasons for high pollution of River Ganga was excessive extraction of water at Haridwar downstream. This was on

two counts, one diversion of major part of the River flow to the canals, secondly indiscriminate, unregulated extraction of groundwater for agricultural, domestic and industrial purposes in the entire basin particularly in the section from Haridwar to Kanpur. Nearly 80% of the water was being extracted in different forms. Besides this, heavy industrial and domestic effluent was being discharged into the River thus bringing its pollution to a very high scale and little flow was left in the River of her natural water or her tributaries.

3. In the opinion of the consortium and even today, the expert advice is that there should be complete projects prepared for smaller sections rather than planning the cleaning of River Ganga from one stretch to another at one stroke. In other words, complete urban plan should be prepared for a town to ensure that pollutant do not enter the River rather than cleaning the River without paying any attention to the drains and small Rivers flowing through urban areas which carry high polluting effluents to the River. To be more clear, it would be appropriate to clean the city drain as well as the River and not only clean River and leave the city drain. All drains particularly the drains flowing in Segment-B of Phase-I are drains carrying mixed waste that is the drain which in fact are storm-water drains carry sewage, industrial, domestic effluent as well. There is inaccuracy in the data relied upon in as much as to give example of River Assi in Varanasi. It is stated that 50 MLD of different effluent are carried by this River while actually, it is approximately 90 MLD.
4. The multiplicity of Authorities was one of the causes for non-effective implementation of Ganga Project-I

and Ganga Project-II plan. It was for the reason that there were number of Authorities stated to prepare, implement and supervise various projects with regard to cleaning of River Ganga but there was lack of coordination, lack of proper monitoring system and also lack of administrative intent to execute the project effectively amongst them.

5. The plan and the projects under the plan should be knowledge driven and not perception driven. Appropriate technology should be adopted upon proper study keeping in view the Indian situation and ground realities in mind rather than adopting foreign or other technologies which may not be beneficial to the Indian system, on long term basis.
6. Use and recycling of the treated sewage or effluents is of paramount consideration as it would result in definite double benefit;
   a. It would reduce the load on the River and;
   b. It would provide usable waste atleast for industrial and agricultural purposes to the needy sectors. If the recycling of treated effluents is effectively implemented, it would considerably reduce extraction of fresh water from the River or from the ground.
7. Environmental flow of the River should be maintained, if necessary, by reasonable reduction in release of water to the canals and some element of regulation or even prohibition for extraction of groundwater in the entire segment.
8. Effective and definite steps for prevention and control of pollution of River Ganga should be taken. For instance while dealing with tannery industries in Jajmau, it will be appropriate to install three dedicated pipelines, one for Chromium waste, second for tannery effluent and third

for domestic sewage. All these three pipelines should be brought to the Chromium Recovery Plant, CETP and STP respectively. Chromium should be recycled as it is a valuable raw material. The industrial effluent upon treatment through CETP and STP should be recycled and not more than 25% of it should be discharged into the River if the need so arises. As a result to these processes large quantity of salt will be recovered which should be stored on a properly prepared land site upon proper segregation of salt, to recover pure salts. The remnant quantity of salt could be put into the River in the rainy season when there is high flow in the River but with complete care and caution. This will help in reducing quantum of salt at the sites and thus the sites would become manageable.

9. In the functional hierarchy and operating agency there is capacity deficiency. As a result there of any system intended to control and prevent pollution does not become effective. There is need to augment the capacity of all agencies involved so that all the data and information available can be transformed into 'technical or implementable knowledge' which can ensure successful implementation of such complex action plan.

10. Another source of high pollution of River Ganga is over utilisation of pesticides and chemical fertilisers, which meet the River through run off from catchment area.

11. The concerted efforts should not be only on the main stretch of the stream but the entire catchment and basin of the River should be equally attended to, if not on priority. There has to be a definite attempt to revive and restore the health of the River.

12. Proper data should be collected before implementation of any project or segment in that behalf.

13. It will be in the larger interest

> that the data related quality and quantity of water resources including sectoral water utilisation should be in public domain and the suggestions from the public including experts from different fields should be received and properly dealt with. It will be beneficial to involve local academic institutions in conducting all research and implementation of such large projects.
>
> 14. The water extraction is presently in very high proportion in relation to recharge of groundwater. It is therefore necessary to consider various measures for ground water recharge into consideration and implement them accordingly after collection of appropriate data.
>
> Inter-alia for above reasons, Ganga Plan-I and Ganga Plan-II were futile."

It may be noticed that the data furnished by the different authorities was at substantial variance in relation to the number of drains, load of the drains and the quantum of flow and qualitative value of the drains. Thus, the authorities and stakeholders were directed to hold a common meeting and reconcile the variations in the data furnished. The final report jointly prepared by the stakeholders was submitted before the Tribunal including the details with regard to industrial clusters. When the case was taken up on 13th January, 2017, all the stakeholders including the NMCG, CPCB, UPPCB, UPJN and UPSIDC had stated that they all are in agreement with the Joint Inspection Report filed on record and they accept the contents thereof. It was also stated before the Tribunal that there are nearly 1200 industries located on the banks

of river Ganga in this segment, out of which 700 to 800 industries were seriously polluting and fall under red or orange category of the industry. It was also stated in the Joint Inspection Report that there are nearly 86 major drains which are joining river Ganga and its tributaries i.e. Ramganga, Kali-East and Pandu. The discharge into the river was stated to be approximately 2774 MLD of mixed effluent. Certain minor drains carrying effluents of even less than 1 MLD or which were majorly dry were also pointed out. The Tribunal *vide* its order dated 16th January, 2017 directed that the six drains which are not carrying any effluents should be plugged and stopped forthwith. The Tribunal *vide* its order dated 19th January, 2017 raised the following questions to be answered by stakeholders:

> "1. There are 30 drains meeting River Ganga in Segment-B. Out of which 27 drains directly flow into River Ganga while the remaining three drains have been tapped and through pumping station are being taken to STP(s) at Kanpur.
> 2. Besides this, there are one drain Bagad even called River Bagad, which is stagnant and it only flows when the flow of effluent is high or in the rainy season, then it meets River Ganga. At the time of inspection the Joint Inspection Team found it to be stagnated, however, it is having effluent.
> 3. The 3 drains which have been tapped and taken to a STP, what is the load of these three drains individually and at the point of intake of STP, what is the quantum of discharge at the outlet of STP and what effluent besides sewage

or drain water, it contain and values thereof.
4. The capacity of the STP and composition that is capable of treating within the prescribed value as of now.
5. In relation to remaining 27 drains, the load of each drain that is quantum as well as quality of the effluent in that drain.
6. Which of these drains depending on the quality of the effluent are capable of being intercepted and joined together to be taken to nearby STP/CETP, keeping the distance and costing in mind.
7. Same question will be answered in relation to East Kali and Ram Ganga as well.
8. The Uttar Pradesh Jal Nigam shall put before the Tribunal complete data and answer forthwith in relation to STPs' functioning and three drains aforereferred, as well as 27 drains which it require to treat. It will state the technical as well as nontechnical aspects in relation thereto."

30. In the order dated 25th January, 2017, it was noticed that the CPCB had provided in the proposed draft Notification, stringent values w.r.t. BOD, TSS and FC for STPs for preventing and controlling the pollution, for example, instead of the existing values of 30 mg/L of BOD, the value of 10 mg/L was provided. Faecal coliform was required to be less than 230 MPN/100ml. It was also stated that the Chhoiya drain was carrying industrial effluents, particularly from the petrochemical industries and distilleries. Notice was directed to be issued to all such industries located in the catchment area of the drain and the Pollution Control Board was asked to take appropriate action. These industries were required to file replies,

subsequent to which they were provided with an opportunity of being heard. An environmental compensation was imposed upon them subject to compliance of the conditions/ recommendations suggested by the Joint Inspection Team within the specified timeframe. They were permitted to operate. On 10th February, 2017, since basic questions/ doubts were raised in relation to data collected by the UPJN, the contractor and the officers who had prepared the Detailed Project Report (for short, 'DPR') for establishment of 3 MLD and 6 MLD STPs at Garh drain were directed to be present before the Tribunal with complete records. On 14th February, 2017, these officers and the contractor had appeared and it was pointed out that nearly ₹ 31 crores have already been spent on laying of sewer lines and for construction/installation of STPs in the area of Brijghat and Garhmukteshwar. According to the joint inspection, a single drain was joining river Ganga and carrying the discharge load of 13 MLD. The officers had stated before the Tribunal that they had never carried out any survey before or after preparation of DPR for the project in question. They have never verified the quantum in any case and quality of discharge in the drain. The Tribunal noticed that public funds were being squandered by the officers who did not even consider it necessary to perform their basic function of field inspection, analysis of the

effluents, sewage in the drains and quantum thereof before preparing the DPRs and forwarding the same to the authorities. The STPs installed were non-functional because according to the executive officer of the Parishad, sewer connections had not been provided to the households and the connectivity of the sewer line was incomplete. The Joint Inspection Team was also required to sit down together and finalize the matter in relation to the detailed answer to the questions raised by the Tribunal in its order dated 28th February, 2017.

31. On 7th March, 2017, when the matter was taken up for hearing, the learned Counsel appearing for the Ministry of Water Resources in response to query raised by the Tribunal made the following statement:

> "It is stated upon instruction from the Secretary of the Ministry that the primary object of the Ministry is to clean and rejuvenate River Ganga, however, it is further added that wherever certain areas are required to be cleaned to ensure prevention and control of pollution of River Ganga, the Ministry even would do the same."

Thus, it became indubitable that cleaning of river Ganga was the paramount duty of the Ministry of Water Resources. Another factor that came to the notice of the Tribunal, which is not only appropriate, but probably the only solution for cleaning of river Ganga is that the approach of cleaning of the river as opposed to the cleaning of city should to be adopted. There are a large

number of unauthorised colonies which do not have sewer network system and there are also planned colonies where there is no sewer network and it will be a futile to imagine that drainage system will be provided for bringing the sewage and the effluents to the STP or CETP if it is constructed within the city. It is also to be noticed that there are industries in the same pocket where these unplanned colonies as well as the planned colonies exist. The Commissioner of Nagar Nigam Kanpur on 8th March, 2017 has stated before the Tribunal that there are 110 wards and 1669 colonies in the city of Kanpur. Out of them, unplanned colonies are 152, while 397 are slum colonies and remaining are planned/authorised colonies. The slums and illegal colonies have not been provided with any sewer line. Another notable disclosure that was made by the said officer before the Tribunal was that the sewer lines were 70% blocked and consequently only 30% of the sewer line was functional as shown by the Joint Inspection Team. It is stated that as and when the open drains were supposed to be cleaned, the Solid Waste Management Rules, 2016 was not adhered to. The drains are being cleaned, if at all, during 2nd March to 15 June every year but still 70% of the sewer line was blocked. On 11th April, 2017, in the chamber meeting held in furtherance to the order dated 30th March, 2017, the Senior Officers of the Ministries, State of UP and other stakeholders were

present and stand of each one of them was recorded in that order which reads as follows:

> "In furtherance to our order dated 30th March, 2017, senior officers from the Ministries, State of Uttar Pradesh and other stakeholders including Central Pollution Control Board are present.
> The stand of each of the stakeholder has been considered in the meeting and recorded upon their confirmation, which are as follows:-
>
> 1. The Additional Chief Secretary, (Environment & Forest) has stated that Uttar Pradesh Government has taken a policy decision for making all possible efforts to clean and rejuvenate River Ganga.
> 2. As far as Segment-B is concerned, the Government is quite clear that all the sources which pollute River Ganga should be treated on the basis of definite data and information.
> 3. The Government of Uttar Pradesh has, in principle, taken up decision to shift the tannery industries from Jajmau and the place to which they are to be shifted is under effective consideration. It would be identified shortly. However, the Government is also open to the idea that appropriate anti-pollution devices including Chromium Recovery Plant and Common Effluent Treatment Plant may be provided at the existing site and if the outlet provides the effluent as per the declared parameters then the water could be recycled.
> 4. The Executing Agency would be the Uttar Pradesh Jal Nigam, except for the projects which are taken on Hybrid Annuity Mode.
> 5. The State of Uttar Pradesh would have no objection in providing the Sanitary Landfill Site beyond 500 meters from the flood plain of the River. There should be complete restriction on any kind of waste being dumped into the River.
> 6. The State of Uttar Pradesh will provide complete and correct with

regard to the following, on the next date of hearing i.e. 17th April, 2017:-

i. What should be the minimum environmental flow of River Ganga in Segment-B.
ii. Whether there is excessive extraction of groundwater in this section and/or whether the water being diverted into the various Ganga Canals should be regulated so as to help maintenance of minimum flow of the River.

7. It is undisputable that two major problems are causing pollution, excessive extraction of water on the one hand while on the other high pollutants are being put into the River. Unless both are controlled, it will be difficult to restore the River to its original pristine.

8. The State of Uttar Pradesh has preference for cleaning River Ganga.

9. The Special Secretary on behalf of MoEF&CC stated that the Ministry would give all help and assistance to the State Government for the purposes of ensuring the treatment of the effluent, being discharged by Tannery industries into River Ganga.

10. The Solid Waste Management Rule, 2016 make it clear, and in fact it is a clear stand of MoEF&CC that the waste, in any form, cannot be permitted to be dumped in any form in River Ganga and there will not be any Sanitary Landfill site within the flood plain.

11. As far as the minimum environmental flow of the River as well as the excessive extraction of water intake, the Ministry would submit its comments by the next date of hearing. It can be better answered along with the Ministry of Water Resources.

12. The online monitoring system should be enforced.

13. Both the conditions i.e. ZLD as well as online monitoring system are pending consideration before NGT and MoEF&CC will comply with its

order.

14. The Chairman, CPCB stated that it will be beneficial to stop/prohibit any kind of waste being dumped into the River and Sanitary Landfill site to be located beyond the 500 meters from flood plain.

15. Jajmau poses a serious pollution issue and the present CETP is as good as non-exiting, keeping in view the load of more than 25-30 MLD of trade effluent, whereas it is for treating 9 MLD of trade effluent mixed with 27 MLD of domestic sewage. It also does not have the capacity to treat other pollutants, except BOD and COD. It needs to be replaced by new CETP which is of the requisite capacity and capable of treating all effluents, besides sewage.

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16. Dilution based treatment is the possible solution, though CPCB seeks to enforce standards and standards are technology neutral.

17. The Central Pollution Control Board would implement the parameters at the end of the pipe, which should be meeting the prescribed standards. However, establishment of individual ETP and proper enforcement could be a good solution, but implementation thereof would be a serious question. Separate Common Chromium Recovery Plant would be necessary.

18. 86 drains have been identified and most of them carry not only sewage, but even trade effluent. It is a mixed discharge which contains variety of elements including heavy metal and therefore, end of the pipeline would be proper treatment. But site selection of STP would require proper study of the longitudinal profile of drains.

19. The Executive Director (NMCG), on behalf of the Ministry of Water Resources, stated that the Ministry would be willing to render all help and assistance, but the object of cleaning of River Ganga rather than

concentrating on cleaning of cities is the first & preferred option.

20. The Ministry will finance, in terms of its scheme, for domestic sewage and industrial effluent treatment separately.

21. As per the scheme of NMCG, the first priority is cleaning River Ganga, but it would also spend through other major schemes relatable to cleaning of cities etc.

22. In terms of the Notification and as per the stand of the Ministry, Uttar Pradesh Jal Nigam is the Executing Authority for the work falling in Segment-B.

23. As far as Jajmau Tannery Cluster is concerned, if the State chooses to shift the industries to a different site, it will be its choice. However, the existing industrial clusters at Jajmau and Unnao requires establishment of an entirely new CETP with a separate Chromium Recovery Plant and separate pipelines.

24. The Technology of the CETP would be ZLD based which would only generate salt and sludge.

25. After being cleaned, part of salt will be usable and hence saleable and rest will have to be dumped.

26. The sludge deposit site has to be created which must meet scientific standards.

27. In relation to e-flow of the River, the Ministry of Water Resources had taken holistic study of various reports submitted by the expert agencies, the final view is still required to be taken. The recommendations vary from 20% to 30% depending upon the geographical location of the River and particularly it should be site specific. However, we direct the Ministry to take a stand which may be a tentative view and inform the Tribunal on the next date of hearing. There should be complete prohibition of any kind of waste being dumped in the River and on flood plain. There should be prohibition also on construction of Sanitary Landfill Site on 500 meter or

> any other reasonable distance of the high flood line, with reference to once in 25 years flood cycle.
>
> 28. All of them agree to 'Polluter Pays Principle' application for control of industrial pollution.
>
> The concerned stakeholders shall positively provide the information required as above, to the Tribunal by 17th April, 2017, during the hearing of the case on a day-to-day basis. The State of Uttar Pradesh is at liberty to file before the Tribunal, list of its priority project(s), if any, but no expenditure would be incurred on any project without leave of the Tribunal."

32. After holding the chamber meeting dated 11th April, 2017, the matter was put up for hearing on 17th April, 2017 where the learned Counsels appearing for the respective stakeholders were required to make their submissions, if any. After hearing them, the Tribunal passed the following order:

> "The special Bench has been constituted to hear the Ganga Matter on day-to-day basis. The scope of the entire Project in relation to the Segment `A' and Segment `B' of Phase-I has been discussed with the stakeholders in the Court as well as in the Chamber meeting of high officials from all the stakeholders in the Chamber meeting held on 11th April, 2017.
>
> At the threshold we have asked the Learned counsel appearing for any of the stakeholders i.e. MoEF&CC, Ministry of Water Resources, National Mission for Clean Ganga, Central Pollution Control Board, Uttar Pradesh Pollution Control Board, Uttar Pradesh Jal Nigam, Kanpur Nagar Nigam and State of Uttar Pradesh to raise any contention with regard to scope of project that was discussed in relation of all facets of prevention and control of pollution and rejuvenation of River

Ganga particularly in Segment `B' of Phase-I.

The Learned counsel appearing for Uttar Pradesh Pollution Control Board submits that there should be issue specific directions by the Tribunal in relation to the Societies, Builders, Developers and even the State Colonies which are being developed in different areas, particularly near and closer to Rivers, should have their own STP which will treat the sewage and other waste to the prescribed standards. There should be complete mechanism for dealing with the municipal solid waste, recycling of treated water and strict adherence to pollution control norms wherever applicable.

Secondly, he contends that the industries particularly tannery industries located at Jajmau should either be shifted, if not shifted then, the same should be under strict vigilance and supervision. The industries which have their own Chromium Recovery Plant and if they do not operate it, then they should be directed to be closed for a short period and subsequently, for a longer period. Similarly all other defaulting industries should also be penalized from time to time. Effective systems should be provided to treat effluents by establishment of new CETP, Chromium Recovery Plant, carriage and management of sludge generated.

It is stated on behalf of Uttar Pradesh Pollution Control Board that the new CETP i.e. ZLD, is not a desired solution as it would generate salt of the capacity which will be very difficult to store and handle and even failed to create a market for reuse, even if the 70% of the generated salt can be converted to sodium salts which is saleable by itself. It is further submitted that ZLD based CETP will not be economically viable as well.

According to Central Pollution Control Board they are technology neutral, however according to them new CETP to be established i.e. ZLD will be

technically acceptable and can operate efficiently as well as practically to prevent pollution. Technological – in terms of workability and practicability, the Board supports CETP with ZLD, however economically it will have to be examined.

According to the MoWR and National Mission for Clean Ganga the new CEPT should be with the improved technology and should be ZLD. According to them, ZLD is practical, technologically sound and a reasonably good solution for prevention and control of pollution. It is also stated that the Chennai, ZLD experience of Tannery industries is not proved very successful as far as disposal of salt is concerned and quantum of salt that it will generate is a very serious problem as of today. However to the large extent, this could be addressed by improvement of the technology. The technology that should be adopted can be that of the ultra-filtration and nano-filtration.

After certain arguments, the Central Pollution Control Board wishes to take stand that keeping in view of the proposed three pipeline system, Chromium Recovery Plant and establishment of new CETP and dealing with the sludge separately, it will be more advisable and **scientifically workable as** opposed to ZLD, if the treated CETP effluent is further diluted with treated sewage and used for irrigation purposes. However, according to the MoWR and National Mission for Clean Ganga, ZLD still would be a better option.

According to the MoWR and National Mission for Clean Ganga, it should be seriously pondered over the 10 mg/l, 10 mg/l and 230 MPN standards for BOD, Suspended Solid and Faecal Coliform respectively. The proposed standards need to be considered before they are notified, keeping in view the necessity of imposing of such stringent standards and economic viability.

The Central Pollution Control Board is of the opinion that these standards

should be enforced in the interest of prevention and control of pollution.

According to the Uttar Pradesh Jal Nigam and Kanpur Nagar Nigam, the dilution system as above should be preferred to ZLD in relation to the new CETP in view of economic principles, practical and land availability.

None of the stakeholders wish to say anything more in any aspect of the case being heard by the Tribunal. Therefore, we will proceed to examine the integrities of the projects. We pass the following directions for immediate compliance and without default:-

1. The MoEF&CC, the MoWR and the Central Pollution Control Board will take a clear stand which they were expected to inform the Tribunal today in relation to minimum environmental flow of River Ganga in Segment `B'.
2. Extraction of groundwater in this sector.
3. We direct the CEO, TWIC – Tamil Nadu Water Investment Company; Director, Central Leather Research Institute (CLRI); Member Secretary, Tamil Nadu Pollution Control Board and Professor T. Ramaswamy, Former Secretary, Government of India, Science and Technology to be present for a Chamber meeting with the Tribunal on 21st April, 2017 at 02:30 P.M.

The Registry will communicate the order of the Tribunal to all the concerned immediately. The Chamber meeting would be held on 21st April, 2017.

The MoWR and Namami Gange has not filed any document as were prayed for, they must do the needful, if they so desire, positively by 21st April, 2017."

In furtherance to the previous order, the learned Counsel appearing for the Ministry of Water Resources upon instructions from the competent authorities and Mr. N.N.

Rai, Director of Central Water Commission stated that the minimum environmental flow of river Ganga should be 20% in lean season, i.e., November to March. It should be 25% in October and April and 30% from May to September on a monthly average flow basis. The percentage should be on the flow of river Ganga's pre-diversion or extractions at Haridwar and downwards. The diversion again should not be excessive. At the maximum, it could be 75% of the flow of the river prior to the extraction on a monthly average during the lean period. The Member Secretary of the CPCB stated that a minimum environmental flow of the river in Segment-B should be 600 cusec at least. Keeping in view the statement made on the earlier occasion by the officers of the department, it was directed that the drains particularly the sewer line leading from various sections to Jajmau should be cleaned and there should not remain any sludge, silt and other waste. Bhagwat Das Ghat Drain, Sattichaura and Dabka Nallah-3 were directed to be blocked at their end and nothing should be permitted to flow from these drains to the river. The documents were placed on record before the Tribunal showing that nearly 70% of the sewer lines leading to Jajmau were non-functional and whichever drain, out of the 30 specified, the sewer lines leading therefrom, should be absolutely cleaned. Unless the pipeline is cleaned and is capable of handling the quantum of sewage and other waste that is to

be carried to the Jajmau STP, the entire exercise would be inefficacious and the project would be rendered non-functional. The learned Counsel appearing for the MoEF&CC upon instructions from Mr. R.N. Jindal, Scientist 'F' had stated that the minimum flow of Himalayan rivers should be 2.5% of the 75% dependable on annual flow expressed in cumec. During the course of the hearing of the case on 21st April, 2017, Mr. Sundeep, Director (T-II) NMCG submitted that the information provided by the Central Water Commission in relation to E-flows of river Ganga in Segment-B is acceptable to the Ministry.

As the case substantially proceeded, the approach adopted by the Tribunal was acceptable to all the stakeholders to prevent and control pollution of river Ganga. It was decided to consider the views of all the stakeholders. Thus, *vide* order dated 17th April, 2017, a meeting of all the stakeholders was ordered to be held. All the matters in issue were discussed. It was at the request of senior officers of the Ministry of Water Resources that Mr. I. Sajid Hussain, COO of Tamil Nadu Water Investments Company Limited and Dr. T. Ramasami, Former Secretary Science and Technology to the Government of India were requested to attend the meeting. Mr. I. Sajid Hussain, COO of Tamil Nadu Water Investments Company Limited after explaining the Tamil Nadu project on tanneries, suggested that the

CETP proposed to be set up at Jajmau should be Zero Liquid Discharge as opposed to dilution. He further suggested that the segment approach, as decided by the Tribunal on the common agreement of the stakeholders and experts, was better as opposed to the approach on treatment at hot spots without treating up and downstream. Dr. T. Ramasami had suggested that dilution would be a temporary and a short-term measure while ZLD would be a more permanent solution in the long run. According to them, unit specific treatment should be provided depending on the characteristics of each unit, based on which, the units should install a Primary Treatment Plant and a Chromium Management Plant of its own so that they could reutilise the chromium recovered and/or sell it in the market. The units should be asked to reduce usage of water and encourage water saving. It is also suggested that water less chromium technology would help in greater absorption of salt as well as 20% reduction in use of salt. According to him, this technology has been tried by some of the units in Jajmau. Dr. T. Ramasami also endorsed the segmental approach as opposed to the 'hot spots' approach for cleaning and rejuvenation of river Ganga, particularly in the Segment-B of Phase-I. The Member Secretary of the Tamil Nadu Pollution Control Board (for short, "TNPCB") submitted that only 10% of the tannery industries in Chennai, Tamil Nadu are non-

compliant. The industries are covered by the primary treatment plant. 10% industries have individual ZLD and the remaining 90% are connected to the CETP. 100% industries have their own Chrome Management Plant. The salt to the quantum of approximately 45000 tonnes and sludge of 3.4 Lakh tonnes (340000 tonnes) generated by these units, which are ZLD, is kept at their premises.

In the order dated 24th April, 2017, it was noticed that the officers, of the rank of Executive Engineer and Project Engineer, who were present, depicted a very sorry state-of-affairs and they had no knowledge about the design of the STP and they had not carried out any study before preparing the DPR for construction of the STP. They were unaware of the quantum and contents of the effluents put into the drain. The 12 industries which were discharging their effluents into the drains/tributaries of River Ganga were subjected to stringent inspection by the Joint Inspection Team consisting of very senior officers from the Boards and the Ministries. In the report, they pointed out the status of the various drains. All the 13 industries were ordered to be shut down vide order dated 26th April, 2017 passed by the Tribunal and were subjected to the inspection by the above referred team. The industries were given liberty to file response to the report and thereafter these cases were considered based on their own report.

33. The Member Secretary of the TNPCB also appeared before

the Tribunal on 28th April, 2017. On that date, he explained the experience particularly with regard to ZLD as opposed to the dilution system. With reference to the functioning of tannery industries in the industrial clusters of State of the Tamil Nadu, he mentioned that "Water Less Chrome Management Technology" which had been adopted in principle by 28 units in Tamil Nadu and these units had purchased the rights of the new technology. While 3 are on the trial stage, there is no definite evidence to show that it is a successful technology. According to him, the use of salt is stated to be reduced by 2% (from 8% to 6%), if the new technology for tanning is adopted. The units are essentially trying to adopt a new technology as of now. The salt so generated from ZLD-MEE is being stored as there is hardly any disposal or sale of the salt generated. Approximately 45,000 tonnes of total salt has been generated so far which has been stored and no part thereof has been disposed in relation to Vellore Cluster. This relates to the figures for the last 5 years. Out of 45,000 tonnes of salt generated, not even 1 kg. has been sold or reutilised. This salt even has chrome content. Vellore Clusters have nearly 436 tannery units while in the entire Tamil Nadu, there are 776 tannery units. This technology has been introduced on 5th June, 2016 and therefore, it is at a very nascent stage and no scientific data and analysis is available to support the technology as an absolute

proposition.

The cumulative effect of the information provided by the Member Secretary of TNPCB is that the new technology is untested and has not proved to be very successful even in that area and a huge quantity of salt generated is being stored which remains unutilised, unsold and has never been recycled.

Dumping of E-waste is another very pertinent issue particularly, at the Moradabad site, where the agencies, which are handling the E-waste, are dumping it on the riverbank, which finally flows into the river stream. Being a hazardous waste, it is an incessant source of serious pollution that should be handled in accordance with the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 (hereinafter, "Hazardous Waste Management Rules"). Certain directions on that behalf were passed *vide* order dated 3rd May, 2017. The Tribunal having adopted, in principle, the methodology for treating of drains which are causing pollution of the tributaries falling in Segment-B of Phase-I, dealt with each of the drains separately. Various stakeholders i.e. MoEF&CC, Ministry of Water Resources, CPCB, UPPCB, UPJN and other concerned stakeholders and local authorities were directed to express their views on each of the drains falling under the project in relation to management, treatment, setting up of an STP or other

incidental works that would help in preventing and controlling of pollution of river Ganga and its rejuvenation. In the later part of the judgement, we would deal with all individual drains.

At this stage, it suffices to note that various stakeholders had submitted a common list giving details of the drains, pollution load and contents thereof along with the manner in which they should be treated. The orders dated from 10th February, 2017 to 31st May, 2017 deal with 86 drains of river Ganga and its main tributaries, i.e., Ramganga, Kali-East & Pandu and on 31st May, 2017, itself, the case was reserved for judgement.

SEGMENTAL WATERSHED BASED APPROACH, CLEANING OF RIVER – PRIMARY DUTY OF NMCG AND TREATMENT – AT THE END OF THE PIPELINE OF EACH DRAIN-ONLY SOLUTION: REASON THEREOF

34. We have referred above in detail the extent of pollution to which river Ganga is being exposed to with no signs of improvement. Day by day, pollution of river Ganga has amplified in all respects i.e. pollution by industrial waste, sewage, domestic discharge, indiscriminate dumping of different wastes on the banks of river Ganga including municipal solid waste, E-waste and even sludge. Where the total discharge flow of river Ganga was 285.9 MLD from industrial effluents and 2683.6 MLD from sewage and other sources in the year 2008-09, it is 669 MLD from industrial effluents and 10705.28 from sewage in the year

2016-17.

Lack of efforts for abatement of pollution of river Ganga and simultaneous increase in extraction of groundwater from the riverbank and diversion of Ganga water has led to tremendous pressure on the health of the river in terms of its biodiversity, aquatic life, flow of the river and groundwater. Given the length of river Ganga is 2525 kilometres, it is neither humanly possible nor scientifically acceptable that the entire river could be treated at one go. This, in fact, would not even be economically viable. Arguments raised before the Tribunal is that the approach adopted by the Department for treatment with reference to pollution should be 'Hot Spots' rather than segmental approach, as adopted by the Tribunal. This argument, to say the least, is fallacious. If you start treating the river with reference to the 'Hot Spots approach', where the focus is on some identified areas which are highly polluting without following the basic approach of treating the pollutants of the river, both upstream and downstream of the hotspot, the purpose of cleaning the river would *ipso facto* stand frustrated.

The pollutants from upstream and/or downstream will keep flowing into the drain and the treated effluents from STP/CETP, which are located in the heart of the city, would again get mixed with such untreated effluents resulting in persistent pollution. By the time, it reaches

the river through different drains in the city, the discharge would not be able to rid itself of the pollutants and would ultimately again pollute the river. Furthermore, the hot spots approach is impracticable in existing conditions in our country. There is not only unplanned, haphazard development in the catchment areas of the river basins but even in the catchment areas of the drains/tributaries, which ultimately lead to the river Ganga. We have noticed above, in the statement of one of the officers of UPJN that there are 1669 colonies, out of which 152 are unauthorised colonies and 397 are slums. They are not provided with any planned sewer line and/or sewage system. Furthermore, even some of the developed colonies in Kanpur itself have not been provided with sewer line and connections. In such a situation, it is not possible to clean the cities atleast in the near future. The only possibility is to clean the drains, particularly, at the end of the pipe where they meet the river. This could be possible only when each of the drain is intercepted and through the sewer line taken to the established or proposed STP or CETP, as the case may be. The other is to put up an STP or CETP, as per the requirement keeping in view the flow of the drain, its quantum and contents, after due study and analysis.

The segment approach makes it possible that atleast one component of the river could be cleaned and to that extent

the river is rejuvenated at one time under one project. This is scientifically feasible, economically viable and leads to better utilisation of resources, ensuring cleaning of the river in that particular section. No river travels against the gravity and therefore, the question of that particular segment or section getting polluted because of some pollution downstream does not arise.

35. In the present case, the Tribunal is adjudicating the issue of abatement of pollution of river Ganga. Obviously, the Tribunal is required to deal with various issues related to identification of the source of pollutant, its quantum and quality while ensuring that under no circumstance the untreated waste from either domestic or industrial sources is added to river Ganga, which will further deteriorate its water quality. Over last several years, the Government of India has undertaken several projects of sewage and industrial waste treatment under Ganga Action Plan (GAP I and GAP II) which are reported to have been completed and commissioned. However, it is regretfully noted that even after spending huge amount of money and providing for installation of several STP's and ETP's, the river is still polluted. Undeniably, there are certain factors including that of strategy, planning, designing and implementation phases of the GAP I and GAP II, which lead to the present scenario. It would be, therefore, prudent for this Tribunal to take a holistic approach by considering the experiences

from the failures of GAP I and GAP II, while keeping in mind the ultimate aim of preserving the water quality of river Ganga, while adjudicating the present matter.

36. One of the views expressed by the IIT in its report to the MoEF&CC and Ministry of Water Resources (for short, 'MoWR') is to adopt river basin approach to deal with the problem of river pollution. In fact, IIT Professors have submitted before the Tribunal that one of the major reasons why GAP I and GAP II were not successful is that they did not adopt a comprehensive River Basin Management Approach while planning, designing and executing the pollution prevention works that were undertaken. They submitted that GAP I and GAP II identified certain pollution hotspots and accordingly, pollution abatement and mitigation measures were initiated for the limited area rather than adopting a river basin approach. They, therefore, had submitted that as a result of such a scattered approach, pollution of river Ganga is still continuing and unrelentingly.

37. It would be pertinent to note that National Ganga River Basin Authority (NGRBA) has been established through the Gazette notification of the Government of India (Extraordinary) No. 328 dated February 20, 2009 with the objectives of (a) ensuring effective abatement of pollution and conservation of river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for

comprehensive planning and management; and (b) maintaining environmental flow in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

38. NGRBA had considered starting the Mission Clean Ganga with a changed and comprehensive approach to champion the challenges posed to Ganga through four different sectors, namely, of wastewater management, solid waste management, industrial pollution and river front development. Government of India, through NMCG, not only aims to control the pollution of river Ganga but also to rejuvenate the pristine river and give pre-eminence to the health of river Ganga, in terms of its physio-chemical and biological characteristics, including the biodiversity. This would also ensure that the wholesomeness of the river which is normally understood in terms of its continuous flow, unpolluted flow, geological and ecological diversity, is rejuvenated.

39. Typically, the river basin is the portion of the land area drained by a river and its tributaries. The river basin for a major river can encompass smaller sub-basins that ultimately combine to form a river basin. River Basin Management is an integrated approach of managing water resources for quantity and quality within a river basin. River Basin Management is also a useful and proactive approach in areas without immediate problems. The

nature and quality of river basin reflects the sources of pollution that may be affecting the water quality and quantity. The river basin approach is an ongoing cycle of tasks: setting standards for surface water quality; taking measurements of the conditions; assessing the data and identifying the impairments including establishing priorities; verifying the pollution sources and developing plans for restoring water quality; and implementing pollution source controls. Pollution source controls can be things such as permits, rules, and non-point source management practices. Specific steps to this river basin approach include:

a) Planning: Determine the river basin planning unit and identify the stakeholders and resource personnel.
b) Data Collection: Collect routine water quality and quantity data at specific locations.
c) Assessment and Targeting: Compare current water quality to State and federal standards.
d) Strategy Development: Develop goals and strategies to maintain or achieve water quality standards and meet future demands.
e) Implementation: Implement goals and strategies through permits, best management practices (BMPs) and education. One would also measure progress.

During the data collection phase, routine water quality and quantity data is collected at specific locations.

Deteriorative and diminishing water quality or limited water supply is usually the reason a river basin management plan is developed. Sources that contribute to water quality include two main categories: point and nonpoint pollution sources. In fact, the total pollutant load of a lake or stream is generally expressed in the following form:

Total Pollutant Load = Total Point Source Load + Total Nonpoint Source Load

40. Point Source Pollution: Point source pollution comes from the collection of pollutants and the discharge of those pollutants at a defined point. Examples of point sources include:

a) Wastewater treatment discharges

b) Industrial waste discharges

c) Storm water collection systems

Point sources are typically monitored and regulated for quality and quantity standards by a State or a Central environmental agency or a regulatory body like SPCB. Although costly at times, implementing tougher standards at point sources is typically easier because the pollution load is restricted to limited areas.

41. Nonpoint Source Pollution: Nonpoint source pollution comes from diffused sources that are not easy to collect or treat. The most common nonpoint source pollutants are sediment and nutrients. Examples of nonpoint sources

include:

a) Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas
b) Oil, grease, and toxic chemicals from urban runoff and energy production
c) Sediment from improperly managed construction sites, crop and forest lands and eroding stream banks
d) Salt from irrigation practices
e) Acid drainage from abandoned mines
f) Bacteria and nutrients from livestock, pet wastes and faulty septic systems
g) Atmospheric deposition
h) Hydro modification (e.g. channel modification, dams, etc.)

Depending on the specific problems, nonpoint source pollution is generally controlled through the proper design, construction of appropriate anti-pollution mechanisms and maintenance of best management practices. Nonpoint source pollution is usually more difficult to control because it is not centrally collected and can be a result of numerous factors. These factors are not always specific to land areas adjacent to streams and could be a result of secondary impacts.

As mentioned above, identification of the polluting sources and their characteristics is one of the important stages of baseline data collection. Once such data is available, it

would be necessary to consider various options to control and mitigate pollution resulting from its sources. As far as the point sources, in terms of industries or specific activities, it would be obvious that the pollution needs to be controlled and mitigated at the source. This is necessary to ensure that the industrial waste which may contain various toxics as well as hazardous chemicals is properly and adequately taken care of with the full responsibility of the industry to control such pollution.

42. With industrialization and growing awareness about environment, the Industry/Corporate environmental awareness can generally be phased into three eras namely; the ignorance era, the compliance era and the strategic compliance era. The organized industries have been changing their environmental responsive mode from end-of-pipe approach to a preventive one since the early 2000, after several judicial interventions. At the industry level, the preventive approach results in better environmental performance than an end-of-pipe approach for the pollution control system operation and performance. Effective enforcement of regulations, local community pressure and updated knowledge and information are the basis of environmental management and main forces for preventing industrial pollution.

43. Waste volume reduction is the first step in industrial waste treatment plant design and planning. This can be

accomplished by a) Classification of waste, b) Conservation of wastewater, c) Changing production to decrease wastes, d) Reusing both industrial and municipal effluents for raw water supplies. Waste Strength Reduction is another important aspect of the waste treatment design and planning. Reduction in strength will achieve better efficiency of waste treatment and save treatment cost. The strength of waste may be reduced by a) Process changes/ modification (including the raw material substitution and also process stage alterations) b) Equipment modification c) Segregation of wastes d) Equalization of wastes e) By-product recovery.

44. As far as the area, sources of pollution like the municipal areas or large villages are concerned, generally the domestic waste is required to be treated in terms of its BOD and coliform. It is an admitted fact that most of the urban and rural areas do not have adequate sewerage network which would facilitate collection of sewage at a particular location so as to deal with this wastewater problem as a point source. Generally, the sewage is being diverted to the natural drains/Nallahs polluting these Nallahs and subsequently flowing and meeting the rivers. In the absence of the sewers, the design of pollution control system i.e. STP for such cities and urban areas is a complicated task as the flow in the drains vary significantly on a seasonal basis, particularly, in rainy

season and therefore, even though interception and diversion is practiced at some of the locations, the efficiency and adequacy of the STPs at such locations will be an issue in the long term.

45. Based on the efficacy, economy and consistency of waste management options, the waste management hierarchy can be placed in the following preferential order; a) Source reduction — the reactor is modified so that waste is generated or so that the waste is less hazardous. b) In — process recycles — unreacted feed is separated and recycled back to the reactor. c) On-site recycle — waste from the reactor is converted to a commercial product by a second reactor within the facility. d) Off-site recycle — waste from the reactor is separated and then transferred off-site where it is converted to a commercial product within another facility. e) Waste treatment — waste from the reactor is separated and then treated to render it less hazardous. f) Secure disposal — waste from the reactor is separated and sent to a secure disposal facility. g) Direct release into the environment — waste is separated from the product and released in to the environment.

The Tribunal does not have any hesitation in noting that it will be necessary not only to control the pollution of river but to take measures to rejuvenate its holistic existence. Internationally also, river basin approach has been adopted by several countries including China, Philippines

and Indonesia to deal with the problems of river pollution.

46. Considering the above facts, as related to the strategy and planning of the waste management practices, it is evident that the river basin approach needs to be adopted to ensure the quality of the river by taking appropriate control and mitigation measures in respect of the identified sources of pollution. Clearly, it is necessary to ensure that no pollutants are released or added in the river beyond the prescribed limits. This effectively will mean that by adopting the river basin approach, the entire planning and design of the pollution control measures within the river basin needs to be undertaken to ensure that there is an end of pipe treatment, i.e., no pollutant beyond the prescribed limits is discharged into the river. This would also mean that the identified sources of pollutants are adequately treated at the appropriate sites and cumulative impact of all the treated effluents and untreated effluents leading to a particular drain that is meeting river Ganga are considered, to ensure that there is a safeguard, at the end of the drains, to protect the river from addition of any excessive pollutants.

47. The Tribunal has been mandated by the orders of the Apex Court to deal with the issue of abatement of pollution of river Ganga. In other words, the primary aim of the present litigation is to ensure that there is no ingress of polluted water or pollutants over the prescribed standards

into the river. In this context, the Tribunal is under an obligation to adopt the end of the drain approach while dealing with individual drains/Nallahs that meet river Ganga or its main tributaries. In order to ensure this primary objective, as mentioned above, it would be prudent and necessary to adopt the basin approach for these the individual drains and simultaneously follow the principles of rivers' sub-basin management as referred above. It would be necessary to consider the topography of individual drains, the drainage patterns, hydraulic aspects including the peak and lean flows, besides identification of pollution sources for its quality and quantity. In case of industrial sources, which are generally dealt as a point source, necessary pollution control arrangements have to be provided by the industry itself and the same needs to be operated continuously and effectively by the industry. In case of cities and urban areas, the sewage is collected through sewerage network and the same is required to be treated by an STP, which will be designed at an appropriate location, considering availability of the land, infrastructure, reuse potential, and technology involved.

This approach does not contemplate that the entire waste released by the drain is treated at the end of the drain just before it meets river Ganga. The authorities are required to take a pragmatic view based on site specific conditions and techno economic feasibility to adopt suitable pollution

control system for particular identified sources. This could be either in the form of an STP for the urban areas, ETP for individual units or CETP for the industrial clusters both organised and unorganised.

The approach of the Tribunal in ensuring end of the drain treatment of pollutants, which are meeting river Ganga and its tributaries, is besides the pollution control systems that are provided and proposed to be provided in the sub-basin of the particular drains, by stakeholders concerned.

Treatment of each drain that pollutes river Ganga or its tributaries has to be individually provided for. Specific methodology will have to be adopted to ensure that the effluents from the drain which are normally mixed effluents containing sewage and industrial effluents should not be discharged into the river. The primary purpose is to protect the river from direct pollution. There are a number of drains that are not accounted for, flowing in the cities. It is beyond comprehension and any reasonable analysis that all the drains in every city are located on the bank of river Ganga which has slums, unauthorised colonies, developed colonies, without sewer line connection having a mixed discharge of sewage and industrial effluents into the drains. With installation of an STP/CETP, the local drains carrying mixed waste could be free from any pollution and be healthy storm water drains. The feasibility of end of the pipeline treatment is the goal which has to be achieved to

ensure that river Ganga and its tributaries are permitted to flow without pollutants and to make it possible for them to be rejuvenated to their original pristine state. Firstly, the segmental approach has already been adopted by the Tribunal in its judgement in the case of *Manoj Misra vs. Union of India & Ors.* (supra) in relation to river Yamuna, one of the major tributaries of river Ganga. The work of Phase-I of that project as noticed above has already started. Secondly, in relation to river Ganga itself, the judgement of the Tribunal in the case of *Indian Council for Enviro-legal Action (supra)* and *M.C. Mehta* (supra), river Ganga has already been divided into four phases. The said judgement relates to Segment-A of Phase-I from to Gaumukh to Haridwar. The judgement has been accepted by all the stakeholders i.e. MoEF&CC, Ministry of Water Resources, State of UP, CPCB and UPPCB, UPJN and all other concerned stakeholders and local authorities and the said judgement is under implementation.

48. The Consortium of 7 IITs had submitted its report and same had also been placed before the Tribunal. *Vide* order dated 22nd September, 2016, the Tribunal had requested the eminent Professors of IITs to be present before the Tribunal. They appeared before the Tribunal for explaining their report. They expounded the report and all matters in relation to cleaning of river Ganga were deliberated at length. The gist and conclusion of the said discussion was

recorded in the order dated 2nd December, 2016. In relation to segment approach, they opined as follows:

> "3. In the opinion of the consortium and even today, the expert advice is that there should be complete projects prepared for smaller sections rather than planning the cleaning of River Ganga from one stretch to another at one stroke. In other words, complete urban plan should be prepared for a town to ensure that pollutant do not enter the River rather than cleaning the River without paying any attention to the drains and small Rivers flowing through urban areas which carry high polluting effluents to the River. To be more clear, it would be appropriate to clean the city drain as well as the River and not only clean River and leave the city drain. All drains particularly the drains flowing in Segment-B of Phase-I are drains carrying mixed waste that is the drain which in fact are storm-water drains carry sewage, industrial, domestic effluent as well. There is inaccuracy in the data relied upon in as much as to give example of River Assi in Varanasi. It is stated that 50 MLD of different effluent are carried by this River while actually, it is approximately 90 MLD."

49. The consultative process meeting of the stakeholders had also decided that segmental approach is far superior to the hot spot approach or intermittent piecemeal cleaning of the cities or river Ganga. Finally, even the experts i.e. Mr. I. Sajid Hussain, COO of Tamil Nadu Water Investments Company Limited and Dr. T. Ramasami, Former Secretary to the Government of India were invited at the behest of

the Ministry of Water Resources, also stated before the Tribunal on 21stApril, 2017 that the segmental approach of the river would be a better approach as opposed to hot spot treatment. Dr. T. Ramasami specifically approved segmental approach for cleaning and rejuvenation of river Ganga, particularly, in Segment-B of Phase-I. Thus, we have no hesitation in holding that the hot spot approach should not be adopted by any of the stakeholders including the Central and the State Government and the concerned public and local authorities. The treatment on segment basis has not only stood the test of time but has actually proved beneficial, as seen from the implementation of the two different cases mentioned with satisfactory results.

Keeping in view the acceptance of segmental approach, the Tribunal has divided the entire length of river Ganga into four phases as noticed above and the present judgement deals with Segment-B of Phase-I.

The approach of the Tribunal was to give preference to cleaning of the river rather than cleaning of the city. This is so, for the reasons that we have afore-stated as it would be scientifically possible, economically viable and in terms of pollution, result oriented.

50. In terms of the Notification dated 7th October, 2016, authorities at the Centre, State and District level have been constituted to take necessary measures to prevent, control and cause abatement of pollution in river Ganga and to

ensure continuous and adequate flow of water so as to rejuvenate the river to its natural condition. NMCG will be the Executive body at the National level and is empowered with the planning, financing and executing the project pertaining to river Ganga. It has been empowered to consider and approve projects upto ₹ 1000 crores. Due diligence to the related projects would be done by evaluating and operating these projects through third party appraisal with assistance of the technical experts and the consortium of 7 IITs. The notification provides the title 'the Order may be called (River Ganga Rejuvenation, Protection and Management) Regime Authority Order, 2016'. It applies to all the States which fall in the Ganga River Basin. The entire segment of the notification directs only towards one object that is cleaning and rejuvenation of river Ganga and its tributaries. The power and functions of the respective Committees constituted also refer to cleaning of river Ganga.

The said Notification even states the principles are required to be followed and are only for protection and management of river Ganga. Under this Notification, by way of incident, the authorities can deal with cleaning and construction of the sewage system in a city but this aspect is incidental and not primary. The principal object of the authorities under the Notification is to clean river Ganga. This notification is in consonance with the Constitutional

scheme of our country. We have a federal structure which places rights and responsibilities both on the State and the Centre. In terms of the Directive Principles of the State Policy, under Article 48A of the Constitution of India, 'the State shall endeavour to protect and improve the environment and to safeguard the forest and wildlife of the country'.

51. The Fundamental Duties stated under Part-IV A of the Constitution, Article 51(A)(g) places a 'duty upon citizen to protect and improve the natural environment including forest, lakes, rivers and wildlife and to have compassion for living creatures'. Besides this, the Supreme Court has enlarged the purview of Article 21 of the Constitution of India to include Right to decent and clean environment as a fundamental right within the ambit of Right to Life. Right to protection of life includes the Right to live with dignity and was treated to be inclusive of the Right to clean environment. This is the framework of environmental triangle under the Indian Constitution. Thus, to clean river Ganga is a solemn duty of both the State/Centre and duty of the citizens as well. This comprehensive obligation under the Constitution is aimed at protecting the environment which in this context obviously would mean cleaning and rejuvenation of river Ganga. Further, the federal structure from the environmental point of view dissects the performance of functions as well as legislative

competence between the State and the Union under different heads. Article 246 provides the contours of the subject matter of law that would be enacted by the Parliament or by Legislature of the State.

52. The List-III under 7th Schedule provides the fields on which Parliament or the State legislature can enact laws. In the instant case, we will be concerned with the Entries of public health and environment. Entry 6 of the List-II entitled the State Legislature to make laws with regard to public health, sanitation, hotels, dispensaries, etc. while Entry 17 under the same list empowers the State Legislature to make laws with regard to water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of Entry 56 of List I. Entry 56 of List I empowers the Parliament to frame laws for regulation and development of interstate rivers and river valleys to the extent of which regulation and development under the control of unit is declared by the Parliament by law to be expedient in the public interest. Environment does not find a specific mention in any of the three lists.

Thus, with the aid of Article 248, the Parliament would be competent to enact laws in relation to environment and in fact, that is how the various environmental acts have been enacted by the Parliament. It requires a specific mention at this stage that *vide* Notification dated 7th October, 2016 for

issue by MoWR with the object of prevention, control and abatement of pollution in river Ganga. It was to ensure continuous and adequate flow of water in river Ganga. In terms of this Notification, NMCG is the authority to achieve that object. River Ganga would include all its tributaries and even tributaries of those tributaries which are specified. Under clause-4 of this notification, various functions are to be performed by the specified authorities and all of them relates to the three above stated objects.

53. The NGRBA including the Mission Directorate and other related matters of Ganga Rejuvenation were transferred and allotted to the Ministry of Water Resources, River Development & Gang Rejuvenation *vide* 306th amendment in the Government of India (Allocation of Business) Rules, 1961 with effect from 1st August, 2014. Further, NGRBA has been reconstituted in September, 2014 with inclusion of additional four Central Ministries i.e. Union Ministry of Rural Development, Union Ministry for Drinking Water and Sanitation, Union Ministry for Shipping and Union Ministry of State, Tourism for better coordination to ensure effective abatement of pollution and rejuvenation of the river Ganga.

54. The learned Counsels appearing for the different stakeholders with reference to the provisions of the Constitution of India, the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act,

1974 and the Notification of MoWR dated 7th October, 2016 submitted that the responsibility for cleaning of the rivers and the cities are to be shared effectively both by the Central and the State Governments. The learned Counsel appearing for UPPCB contended that cleaning of rivers is primarily the responsibility of the Central Government, particularly, under the scheme like NMCG, the city drains should be cleaned and public health taken care of by the State Government and the Public Authorities in the State. The purpose is to protect the environment including cleaning and rejuvenation of the rivers. According to the applicant, river Ganga having being declared as 'National River' gets the legal right to protect itself against industrial or sewage pollution and enshrines a duty on all stakeholders to maintain the health of the river.

According to him, the obligation primarily is of the Central Government with regard to rivers in terms of the above Notification and cleaning of cities is the responsibility of the State, alongwith the sewage system. The learned Counsel appearing for MoWR, CPCB and State of UP also support this view. However, the learned Counsel appearing for UPJN contended that the primary responsibility to clean cities as well as the rivers lies upon the Central Government. The Central Government can supervise the execution of projects in that behalf.

It cannot be disputed that under the provisions of the Act

of 1974, the statutory obligations to prevent and control pollution of water bodies including the river lies upon the State and the SPCBs. To ensure effective regulatory and supervisory regime, providing of standards and discharge of trade effluent strictly in consonance with the prescribed standards, are the basic functions which the Pollution Control Boards, including the CPCB is expected to perform. The State Boards can issue appropriate directions even to the Public Authorities that they do not cause any pollution of the environment, particularly the water.

55. From the above, it is evident that the State Governments are required to enact laws and enforce those laws for ensuring cleanliness and pollution free drainage system, canals, water storage and to provide public at large with good public health services and clean environment. All works that are incidental for performance of the above stated functions, would necessarily be the obligation of the State. The State cannot pass on that burden to another agency of the government. To look after the health of the river and maintain its cleanliness and wherever needed rejuvenate the river, is the prime obligation of the Central Government and the Central Government must aid and execute the projects which are primarily and substantially aimed at cleaning of the river. The only plausible conclusion that follows is that the Central Government and all agencies/authorities in terms of the Notification dated

7th October, 2016, must do all that is necessary for cleaning and rejuvenation of river Ganga.

56. This Tribunal in its judgement in the cases of *Indian Council for Enviro-legal Action* (supra) and *M.C. Mehta (supra)* has held as follows:

> "4. With some emphasis we must notice that River Ganga is not only a sacred River for the people of India, but it also provides life line to large number of cities which are located on its bank. On the one hand, there is tremendous decrease in natural flow of the River while on the other it is a source of irrigation and drinking water for larger section of population in cities and villages along River Ganga. The Prime Minister of the country, considering cleaning of River Ganga as a paramount national project, provided Rs. 20,000/- Crores for the coming 5 years. This being the object and aim of the Government, we see no reason why there is delay in its execution. There should not be any deficiencies or impediments resulting from any source whatsoever. India is a country of federal structure with greater role of the Central Government. The Constitution of India mandates, the Central and the State Governments, to provide both, clean and decent environment and clean drinking water for the people of India. The Hon'ble Supreme Court of India has extended the dimension of Article 21 of the Constitution of India by declaring the right to a decent and clean environment as a Fundamental Right. The framers of the Constitution even prescribed duty upon the citizens to make every effort to keep the environment clean and to protect its forests, Rivers, water-bodies and to have compassion for the living creatures.

> That is the constitutional scheme in relation to protection of environment with particular reference to Rivers and water streams."

On the analysis of the above, it is clear that the paramount duty of NMCG is to clean river Ganga and not the cities falling exclusively under the jurisdiction of the respective State Governments. The State Governments are expected to make their contribution and incur expenditure for complying with their constitutional duty as aforestated.

We have to keep in our mind that this judgement should primarily deal with cleaning of river Ganga which is the soul of the subject matter pending adjudication before the Tribunal.

57. The next question that follows is the approach that the Tribunal should adopt in dealing with this issue. There is complete unanimity between all the stakeholders i.e. MoEF&CC, Ministry of Water Resources, CPCB, UPPCB, UPJN, and all other local authorities that the project should provide drain-wise treatment and tackle major industrial pollution separately. Most of these drains carry mixed effluents and need to be treated appropriately. There are drains, which carry metals but within the permissible limits. There are drains which carry very heavy industrial pollutants so they need to be treated at the CETP which should have the requisite capacity as well as technology to deal with the contents of the industrial

effluents. The STPs should be provided either at the end of the pipe or the drain should be intercepted and taken to a nearby STP, keeping all relevant factors in mind including technical and economic viability. Once the industrial effluents and sewage are treated, it should be principally recycled, reused for industrial clusters, cooling of power plant, cleaning purposes, etc. While determining the path of this project, the Tribunal has kept in mind the opinion of all the stakeholders, Principal Committee, Experts and Professors from the IIT Consortium and all the stakeholders including executing agencies. The ongoing projects in the area which could be covered under the scope of this project have also been dealt with, to prevent any wastage of resources and public funds. In this judgement, we will deal with each and every drain that meets river Ganga or any of its tributaries and would provide a complete and comprehensive solution which is scientifically executable, economically viable and would attain the fundamental objective of cleaning river Ganga.

DRAWBACKS, WEAKNESSES OF GANGA ACTION PLAN-I AND II AND THE WAY AHEAD

58. Ganga Action Plan-I was introduced in the year 1986. It was launched in 25 selected towns located alongside the river in Uttar Pradesh, Bihar and West Bengal. GAP-II was launched in the year 1993, while continuing with the programme it included work of tributaries of river Ganga

like, Yamuna, Damodar and Mahanadi. The Supreme Court of India started issuing directions in relation to cleaning and rejuvenation of river Ganga in *M.C. Mehta's* case in the year 1985. After lapse of 32 years, it is observed that there has not been any significant change in the water quality of river Ganga. On the contrary, there has been increase in pollution load on river Ganga, both in terms of quantum and in terms of quality. Lack of co-ordination and implementation of the schemes under these two projects and non-compliance of the directive and orders issued by the Supreme Court, has led to the present degenerated status of river Ganga and its tributaries.

As we have already stated in GAP-I, the Government of India allocated about ₹ 949 crores out of which ₹ 451 crores was released by the Government to the States of UP, Bihar and West Bengal and for GAP-II, ₹ 279 crores was released to the five States i.e. UP, Bihar, Uttarakhand, West Bengal and Jharkhand prior to year 2007. The Supreme Court in its order dated 10th October, 2006 while referring to the report of CAG of India in relation to GAP for the year ending March 2000 had recorded that, collateral finding reveal further deterioration of water quality of Ganga in all its parameters. The Ministry did not take action on recommendations of the Expert Committee for control of bacterial load. There was unchecked increase in the industrial pollution, over 18% of the industries, which

had installed ETPs, did not function properly, and did not meet the prescribed standards, and they were discharging industrial effluents to the quantum of 2667.16 MLD into the rivers. This was despite the fact that the State had spent a major part of the allocated fund. In fact, in GAP-I nearly ₹ 587.63 crores had been spent by the States, as in 2006 itself.

To put it succinctly, GAP-I and GAP-II did not produce the desired results. On the contrary, pollutant levels in river Ganga touched new heights. The Ganga Jal, which had the capacity even to purify the added water from other sources, has become water full of faecal material, metals and other pollutants. These new dimensions of pollution of river Ganga became a matter of serious concern not only for the concerned stakeholders but for the public at large resulting in multi-faceted litigation and social resentment at different levels. The matter was treated as non-adversarial litigation and as a matter of general environmental concerns in the larger public interest. The Government declared it as a national project and allocated specific funds for ensuring cleaning and rejuvenation of the holy river Ganga.

The projects of this dimension to be successful, would need to have the following essential factors:

A. Vision

B. Capacity to plan

C. Capacity to perform

Once these features are effectively executed with exactitude, the results are bound to be favourable. As far as vision of cleaning of river Ganga and its rejuvenation is concerned, it is amply clear and in fact is a national vision. The capacity to plan is exhibited by virtue of the fact that various agencies and authorities like NRGBA, NMCG and other Central and State level authorities in terms of the Notification of 7th October, 2016 were created. All these authorities had designated functions to perform and complete planning in regard to GAP and its implementation at the Central and in the five concerned States.

The most crucial part is capacity to perform. Capacity to perform is not merely a relative term, but it must adhere to the basic standards of performance, be it at the Central level or it at the State level. Planning and implementation thereof is like a chain reaction. Each segment must perform to ensure that the mechanism provided works in result oriented manner. It is only when the entire set up functions in co-ordination and harmony that favourable results can be achieved. It is to ensure proper assimilation of data, proper preparation of project reports, due co-ordination between different authorities and responsible execution of the work. Capacity to perform is directly linked with these factors and include elements of proper

supervisory control and verification of such assimilated data. In GAP-I and GAP-II where the vision was clear, capacity to plan had inbuilt infirmity, while capacity to perform had multi-faceted deficiencies and drawbacks.

59. Now, let us examine some of the reports which have been placed on record of the Tribunal by different stakeholders in relation to weaknesses and drawbacks of GAP-I and GAP-II. The MoEF&CC had signed a Memorandum of Understanding dated 6th July, 2010 with a consortium of 7 IITs (IITs of Bombay, Delhi, Gauhati, Kanpur, Kharagpur, Madras, Roorkee). A detailed study by the Consortium noticed the strength and weaknesses of GAP. After detailed analysis, they prepared SWOT analysis of GAP. This identified the Strength, Weaknesses, Opportunities and Threats of the Plan. Rather than referring the report in any greater detail, we consider it appropriate to refer to the conclusive part of the report which deals with aspects of strength and weaknesses as well as opportunities and threats in a tabular form.

Table: Strengths, Achievements and Weaknesses of the GAP

Aspects	Strengths	Weakness
Design of the GAP	• Initial Vision • The Strategy of Interception and Diversion of Nallahs	• Limited scope of issues addressed • Inadequacy of standards of assessing water-quality • Influence of aid on planning in general, and prioritization of programmes and selection of technologies in

		particular • Inappropriate choices of treatment technologies • Inappropriate policy of discharging treated effluent and sewage into the River • Lack of a clear policy legal and institutional frame work
Implementa-tion of the GAP	• Creation of the institutional infrastructu re	• Political motivations behind GAP • Inordinate delays in creating assets • Partial coverage in collection, coverage and treatment of sewage across cities in Gang Basin • Overdesigned STPs
Operation and Maintenance of the GAP	• Forcing ULBs and State-governments to pay for he O&M	• Irregular Maintenance • Sub-optimal functioning of assets • Unclear, unviable finance models
Monitoring, Evaluations and Regulation of the GAP	• Peer review and monitoring by various stakeholders • Appointment of independent agencies for water quality monitoring	• Neglect of monitoring of other aspects other than River quality • Failure to utilize available monitoring data • Failure in monitoring and regulating, thereby controlling industrial pollution • Weak monitoring by central institutions • Failure in establishing Citizen's Monitoring Committees • Flaws in design of Citizen's

		Monitoring Committees
Other aspects Strengths/Achievements		
• Creation of knowledge base • Awareness building among government agencies • Awareness building among civil society actors		

Table: Opportunities and Threats before River Restoration Programmes

Opportunities	Threats
• Opportunity to learn from experiences of technologies such as UASB • Adoption of River basin approach • GOIs commitment to raise adequate funds • Awareness and inclination of civil society to contribute	• Divergence of River action plans with broader development policies • Challenges in experimenting with newer institutional models such as regulatory authorities • Influence of Bilateral and Multilateral financers on program and policy-design • Capacity issues and lack of incentive structures for ULBs • Wastage of Funds • The complexity in monitoring of technical parameters • Inadequate analytical foundation for future plans • Evolving a robust regulatory framework and institutional model

60. Inordinate delay in creating assets was stated to be one of the main causes for lack of success of these action plans. Under that the following details were provided :

> "1. Confusions and tensions among the central and state governments over the issue of funding for assets to be created under GAP. For GAP-II, initially, the arrangements were

50:50 cost-sharing basis, then it was changed to 70:30 pattern and, finally the central government provided 100% funding (except the land costs). Even after these changes, the funding pattern was again changed many times under the 10th Five Year Plan.

2. The selection of towns under GAP II was completely left to the state-level decision making, which resulted in non-uniformity in the selection as well as delayed the process of preparation of project-proposals.
3. Majority states could not acquire or provide land for constructing the sewage treatment plants and pumping infrastructure within the prescribed time which delayed the implementation of the program.
4. The state governments could not prepare the Detailed Project Reports (DPRs) in time, and according to the guidelines issued by the NRCD, MoEF&CC. The quality of the DPRs was poor, and due to the discrepancies in them, the sanctioning process could not be conducted in the stipulated time.
5. Problems created by court-cases, contractual issues, and inadequate capacities in the local bodies/implementing agencies came in the way of speedy implementation.
6. Cost-overruns and re-sanctioning of the schemes also led to time-wastage and further delayed the process."

61. Partial coverage for collection, transportation and treatment of sewage across the cities in the river basin, inadequate maintenance, unviable financial models, sub-optimal functioning of the assets, failure to utilise available monitoring data, non-utilisation of central institutions and

flaws in the design of citizen's monitoring committees were amongst other primary causes stated by the Consortium of IITs. During the course of hearing, the Consortium of IITs was also requested to address the Tribunal. This direction had a dual object. Firstly, the weaknesses should be made absolutely clear, technically as well as in terms of the implementation. Secondly, identifying the best way forward by providing due caution against the errors of the past. The Professors of IIT Consortium appeared before the Tribunal and submitted a synopsis. Following are some relevant extracts of that report :

> Throughout the period of project executive, IITC held regular internal discussions as well as wide-ranging consultations with stakeholders, A primary consequence of these efforts was the envisioning the River Ganga's "wholesomeness" in terms of four key features: Aviral Dhara ("Continuous Flow"), Nirmal Dhara ("Unpolluted Flow"), Ecological Entity, and Geologic Entity. IITC identified several local/ regional anthropogenic causes to have deeply impacted the Ganga basin's natural resource dynamics in modern times, namely (i) *over-use of natural resources (especially water);* (ii) *discharge of pollutants into terrestrial and aquatic ecosystems;* (iii) *reduction in water-holding capacities and replenishment rates of water bodies;* (iv) *mutilation of Rivers by piecemeal engineering operations; and* (v) *threats to geological integrity of the basin. The major types of human activity causing the above damages were identified as:* (i) *industrialization,* (ii) *urbanization,* (iii) *lifestyle changes,* (iv) *agriculture & other rural activities, and* (v) *deforestation/denudation.*
>
> On the basis of extensive thematic

studies of the Ganga basin's hydrological, ecological, fluvial and geological characteristics as well as the multi-pronged impacts of anthropogenic activities as assessable from available data, practicable measures to counter or compensate the negative impacts were finally worked out and grouped under eight GRBMP Missions (or main thrust areas for action): (1) *Aviral Dhara,* (2) *Nirmal Dhara,* (3) *Ecological Restoration,* (4) *Sustainable Agriculture,* (5) *Geological Safeguarding,* (6) *Basin Protection Against Disasters,* (7) *River Hazards Management, and* (8) *Environmental Knowledge-Building and Sensitization.* GRBMP also recommended appropriate legal and instrumental mechanisms for executing a long-term revival plans.

Multiplicity of Authorities in the implementation of GAP:

Lack of coordination amongst many central, state and local institutions and authorities that are responsible for policy and planning, execution, and regulation and/or monitoring is the main cause for ineffectiveness of GAP.

The multiplicity of institutions, especially at the local level and their conflicting/overlapping roles, have been discussed in the GRBMP Thematic Report titled "Strength, Weakness, Opportunity and Threat (SWOT) Analysis of Ganga Action Plan (GAP)" [Report Code: 006_GBP_IIT_GEN_ANL_01_Ver 1_Dec 2011]. Following are some of the major specific weaknesses/deficiencies of GAP that have been attributed to the multiplicity of institutions.

- Non-performing assets (STPs) and under utilization of assets created.
- Lack of adequate monitoring and accountability.
- Project formulation without collation of necessary data/information

Whether data was collected directly by the IITC on industrial/ domestic sewerage discharge?

> IITC (IIT Consortium) did not collect primary data on industrial/domestic sewage discharges (or other needed basin data) which were to be provided to us by the government. However, IITC did conduct a very limited number of field measurements of River flows and cross-sections, aquatic biodiversity, wastewater discharges, etc., primarily to get a rudimentary idea about such aspects when secondary data were completely absent or were judged to be of poor quality.

While making its recommendations and precautions that should be taken while preparing an executable project for cleaning and rejuvenation of river Ganga, it was recommended that there should be sustainable agricultural, geological safeguarding, basin protection, river hazards management, environmental knowledge building and sensitization.

62. On 2nd December, 2016, Professor Vinod Tare, Professor A.K. Gusain, Professor S.P. Singh, IIT Roorkee and Professor Indrajit Dubey, IIT, Kharagpur had appeared before the Tribunal. The Tribunal had advantage of knowing the expert views on all facets of the project. Even the proposed project was deliberated upon. However, greater emphasis was placed upon the non-achievement of GAP-I and GAP-II. The primary data had not been collected by the Consortium of IITs. In fact, the job was not within the scope of their work. The data collected was not subject to any verification. The Consortium of IITs had conducted a very limited number of field measurements of river flows

and cross-section, aquatic biodiversity, wastewater discharges, etc., primarily to get a rudimentary idea about such aspects, whenever secondary data was completely absent or was judged to be of poor quality. One of the main reasons for high pollution of river Ganga was excess extraction of water at Haridwar and downstream. It was pointed out that nearly 80% water was extracted in one form or the other. The Consortium of IITs and the Professors present, advised that there should be complete project prepared for entire river basin, rather than planning of cleaning of river Ganga from one stretch to another at one stroke. It was suggested that it would be appropriate to deal with the drains in Segment-B of Phase-I which are carrying sewage, industrial and domestic effluents. The inaccuracy of data should be avoided. Multiplicity of authorities was stated to be one of the main causes for non-effective implementation of GAP-I and GAP-II. Lack of proper supervision in implementation, lack of co-ordination, lack of administrative identity to execute the project were the other reasons given for such failure. Appropriate technology should be adopted to deal with the pollution, use and recycling of treated sewage effluents was stated to be of paramount consideration. Great emphasis was laid on environmental flow of the river that should be maintained all through the year. Reasonable reduction in release of water to the canals and some element of

regulation or even prohibition for extraction of groundwater in the entire segment should be considered. Effective and definite steps for prevention and control of pollution of river Ganga should be taken, for instance, dealing with tannery industries in Jajmau, three pipeline system, one for chromium waste and other for trade effluents and third for domestic effluents. Proper data should be collected before implementation of any project or segment. In the functional hierarchy and operating agency, there is capacity deficiency. As a result thereof, any system intended to control and prevent pollution does not become effective. Over utilisation of pesticides and chemical fertilisers and extraction of groundwater should be prevented.

63. The Government of India had set up a Group of Secretaries (for short, "GoS") on 6th June, 2014 who examined the Action Plan for Ganga Rejuvenation. It referred to noticing the significance of river Ganga and while terming it as Mother Ganga and talking about the pollution of different kinds inflicted upon it, the GoS observed as under:

> 3.1 One of our eighth century documents, the Brahmanda Purana, has laid down clearly man's actions on the Riverbanks. Even at that time our ancestors knew the importance of the River and laid down guidelines to protect it and it prohibited 13 types of activities on the sacred banks of the Ganga, which included ablutions, defecation, discharge of water, throwing of used floral offerings, rubbing filth, etc. Despite this, the present-day rituals

are by and large, exact opposite of what has been prohibited in our scriptures.

3.2 Rivers have a self-cleansing ability, which allows for assimilation and treatment of biological waste. But in the current context, where withdrawal from the River is for drinking, irrigation, industrial and power generation purposes is high inevitably the quality of water in the River goes down. The diversion of water has led to severe depletion of its flow, particularly, during lean season.

3.3 The CPCB report (2012) states that in the upper reaches of the River, where the oxygenating abilities of the River are the highest, there are growing signs of contamination, which suggests that even here, water withdrawal for hydroelectricity is endangering the health of the Ganga. As the River reaches the plains, the water withdrawal peaks for irrigation and drinking water. In the stretch of the River-from Rishikesh to Allahabad, during winter and summer months, there is almost no water. In other words, the River stops flowing. But wastewater flow does not ebb.

3.4 The pollution is being caused by several factors ranging from untreated and inadequately treated/untreated municipal sewage, flow of untreated industrial waste including chemicals, inappropriate solid waste management, pollution on account of non-point source like use of chemical pesticides and fertilizers from agriculture fields, open area defecation along the River banks/along Nallah-tributaries as also drains, dumping of burnt and unburnt human dead bodies, immersion of idols, etc.

64. The GoS also noticed that GAP-I was launched in the year 1985 and declared closed on 31st March, 2000. Expenditure incurred by the States was stated to be ₹ 433.30 crores as against revised sanction of ₹ 462.04

crores. 260 projects were stated to be completed. Under GAP-II, the launch was in the same year 1993. Revised sanction was for ₹ 462.04 and amount spent and utilised was ₹ 392.26 crores and 264 schemes were stated to be completed.

Despite such heavy expenditure and such large number of projects having been completed, it remains beyond comprehension, as to why the water quality of river Ganga has not improved, much less, it has not been cleaned or rejuvenated to its original pristine form. The annexures to this report can be usefully reproduced at this stage:

ANNEXURE I			
GANGA ACTION PLAN PHASE-I			
.	YEAR OF LAUNCH	:	JUNE1985
.	SCHEDULED COMPLETION DATE	:	Declared closed on 31.03.2000
.	ORIGINAL SANCTIONED COST	:	Rs. 256.26 crores
.	REVISED SANCTIONED COST	:	Rs. 462.04 crores
.	EXPENDITURE INCURRED BY STATES	:	Rs. 433.30 crores
.	DATE OF REVISED APPROVAL	:	August, 1994
.	TOWNS COVERED	:	25 class I towns . 6 in U.P. . 4 in Bihar . 15 in West Bengal
.	**Physical Progress** No. of Schemes Sanctioned Completed	 : :	 Total 261 260
Capacity Commissioned for			

Interception, diversion & Treatment		
.	Total wastewater estimated from class-I towns (1985 basis)	1340 MLD
.	Quantity to be Intercepted, Diverted and Treated (1985 basis):	873 MLD
.	Total sanctioned capacity of STP's (Revised):	882 MLD
.	Capacity commissioned for treatment:	869 MLD

ANNEXURE II		
GANGA ACTION PLAN PHASE-II		
		(Rupees in Crores)
Year of Launch	:	June 1985
Original Sanctioned Cost	:	Rs. 256.26
Revised Sanctioned Cost	:	Rs. 462.04
Fund Released (till3/13)	:	Rs. 522.11 (inclusive of areas ordered by Apex Court)
Fund Utilized (till3/13)	:	Rs. 392.26
No. of Schemes Sanctioned	:	314
No. of Schemes Completed	:	264
States Covered	:	5
Towns Covered	:	59
Rivers Covered	:	2
STP Capacity Sanctioned	:	308.41 MLD
STP Capacity Created	:	229.31 MLD

ANNEXURE III	
National Ganga River Basin Management Authority (NGRBA)	
Formulated in	2009 for Ganga Basin
River covered	Main stem of Ganga so far
States	All 5 Main stem States (Uttarakhand, Uttar Pradesh, Bihar, West Bengal and Jharkhand)
Towns covered	48 so far

Sanctioned Schemes	76 (including 6 institutional development schemes) NON EAP-49 World Bank-26 JICA-1 (Varanasi)
STP Capacity Sanctioned	659.23 MLD
Sewer Network Sanctioned	2469.53 KM
No of Projects Completed	16
STP Capacity Created	110.50 MLD
Sanctioned Amount	Rs. 4974.79 Crores
Expenditure till June, 2014	Rs. 910.57 Crores

65. We have discussed in great detail the deficiencies in execution of GAP-I and GAP-II, by referring to supporting Reports and data. Thus, we have to find a way ahead which is devoid of such deficiencies and is capable of attaining the object of cleaning and rejuvenating River Ganga. The IIT Consortium, other technical experts, the stakeholders' consultative process, the Principal Committee constituted by the Tribunal and finally the Tribunal itself find that adhocism was one of the principal factors for rendering GAP I and GAP II ineffective and unsuccessful. There is no use of treating only the hot spots or treating one or two segments in a city located at the riverbank and leaving all the drains, which are carrying mixed waste to join the river. Even the point where STP/CETP is constructed to treat the effluents or sewage, it joins other bigger drains downstream and thus, even the

treated water again gets highly polluted. There has to be a systematic approach, which will help in cleaning the entire segment on a watershed basis rather than the particular spot, which may be a highly polluting spot, but treating it by itself without taking other required steps for prevention and control of pollution would be of no consequence and without effective results. The Tribunal has to take a holistic view and not a view, which will not stand the test of scrutiny, technically, scientifically and in terms of implementation. The experience in the past must educate all stakeholders not to repeat the mistakes and spend public funds in an indiscriminate manner and thus avoid improper utilization of public funds on the one hand and increase of pollution on the other. The growing population, unplanned and even planned development with industrialisation enhancement itself will in a big way cause the pollution levels to go up, unless appropriate steps are taken without delay and default and in a planned manner. We have dealt with the end of the pipe treatment in great detail, the need of the hour is to clean the river as a priority and for that, treatment of the drains which are meeting the river and are carrying mixed effluents should be of antecedence. This also fits in with the river basin approach where entire river basin alongwith the tributaries and storm drain joining the river, being treated as one organic entity. The Tribunal had discussed in great detail

with all the stakeholders and the only rational conclusion that emerges and is most appropriate is that the drain-wise treatment should be adopted in preference to cleaning of cities, particularly when the cities consists of all kind of planned, unplanned, haphazard development and slum areas. Even the drains of a particular city can hardly be counted with certainty. Thus, we would deal with all the drains which are joining the river Ganga and its tributaries in Segment B of Phase-I.

DIMENSIONS OF THE PROJECT FOR CLEANING AND REJUVENATION OF RIVER GANGA IN SEGMENT-B OF PHASE-I

66. Though Segment-B of Phase-I primarily falls in the geographical limits of State of UP but it was considered appropriate to involve all the stakeholders in finalizing the scope of the project and facets of its implementation in relation to Segment-B. The primary stakeholders are MoWR, NMCG, MoEF&CC, CPCB, UPPCB, State of UP and UPJN. The Principal Committee had been constituted by the Tribunal *vide* its order dated 14th November, 2014 consisting of Senior Most officers of above stakeholders i.e. MoWR, NMCG, MoEF&CC, CPCB, UPPCB, State of UP and UPJN and most importantly the experts from IITs particularly IIT Delhi and IIT Roorkee. The purpose was to receive input of the highest echelons in the field of technology for treatment and consequential use of treated water, while ensuring cleaning of river Ganga in preference

to cleaning of cities. There was complete unanimity of all these stakeholders and the committees including the Principal committee constituted under the judgement that there should be treatment of the segment of the river Ganga (Segment-B), each drain falling into river Ganga should be treated and there should be end of the pipeline treatment in so far as it is technically feasible and economically viable dealing with preferential concerns for environmental issues.

The different stakeholders had filed affidavits providing their own data in relation to the number of drains, quantum of discharge and the quality of effluents. The one aspect which was undisputed between the stakeholders was that the majority of the drains carry mixed effluents. In the data provided by the various stakeholders these factors were at considerable variance. For instance, in Chhoiya drain which is nearly 60 km long and meets river Ganga, according to the Joint Inspection Team the quantum of discharge was 138 MLD while according to the UPJN it was 4.65 MLD. City Jail Drain, after travelling for 30 kilometres terminates into the water of river Ganga directly. The Joint Inspection Team found discharge flow in the City Jail drain to be 86 MLD at the time of inspection while according to the UPJN it was 9.33 MLD. Similarly, the drain joining river Ramganga i.e. Devarnia Nallah had a discharge load of 287.44 MLD according to

the Joint Inspection Team while according to the UPJN it was 15.678 MLD. Another drain, i.e., Manan Road Nallah in Bulandshehar which travels for 3 kilometres before it meets river Kali-East, according to Joint Inspection Team the discharge flow was stated to be 147 MLD as opposed to 5.98 MLD according to the UPJN. Besides this, substantial variance came to the surface after the stakeholders filed their documents in furtherance to the order of the Tribunal dated 18th October, 2016, wherein they were to provide specific details in relation to the pollution in Segment-B. The data collected by UPJN is relatable to the year 2011 which is certainly not a recent data. Secondly, the analysis of data as discussed by us above, certainly suffers from infirmities and deficiencies. It has never been cross-checked either by the officers of UPJN or by any other agency in normal course of its business. The emphasis was laid on tannery industries at Jajmau, Unnao, and other industries discharging their effluents into river Ganga and its tributaries.

67. The Tribunal in its order dated 19th October, 2016 with disappointment noticed that during the course of hearing, the parties were not even able to state with certainty as to the number of drains that were joining river Ganga and its tributaries. According to the Member Secretary, CPCB, there were 30 drains joining river Ganga directly while according to the Counsel appearing for the UPPCB there

were 172 drains out of which 150 drains directly join river Ganga or its tributaries. Still according to the Learned Counsel appearing for the UPJN, there were 151 drains out of which 83 drains directly submerges into river Ganga.

However, it was commonly conceded that it could not specifically state as to the kind of effluents each drain was carrying. During the course of hearing, it was revealed that the methodology adopted for collection of data was deficient in many ways and there was no check and balance system found on physical verification which could verify the data collected either on physical inspections or through supervisory mechanism as noticed in the IIT Consortium report as well as by the Committee constituted by the Tribunal from time to time including the Principal Committee. The variance in number of drains, quantum and quality of discharge, besides lack of functional co-ordination between the various stakeholders specified in the Notification in terms of hierarchy or otherwise, were the principal causes for unsuccessful attempts at cleaning and rejuvenating river Ganga. These deficiencies and variations were also brought to the fore in the chamber meetings of the concerned stakeholders held by the Tribunal. The Consultative Process of the stakeholders provided pretext for finalization of a project that should be free of errors committed in the past.

In light of the peculiar circumstances emerging in the case,

the Tribunal decided to put at rest the controversies arising from different stands taken by the respective stakeholders in relation to the same subject matter which could hardly have such substantial variations.

68. *Vide* order dated 19th October, 2016, therefore, the Tribunal constituted a Special Committee consisting of Member Secretary, CPCB, Chief Engineer of UPJN, senior most Environmental Engineer of UPPCB and senior representative of MoWR. This Committee was directed to personally visit the area falling in Segment-B of Phase-I, i.e., from Hardiwar to Unnao, Kanpur. They were directed to identify as to how many drains joined river Ganga or its tributaries and make observations in relation to the quantum and quality of effluents that are going into the river Ganga or its tributaries through those drains directly. Despite being a member of the Joint Inspection Team, UPJN had still pointed out certain discrepancies in the report and informed that certain drains which were joining river Ganga had not been taken note of, by the Joint Inspection Team. They referred to the drains at Moradabad and Bulandshahar particularly. The Tribunal, therefore, directed the Joint Inspection Team to sit with the senior most members of the respective organizations and reconcile the difference and take a common stand before the Tribunal. It will be useful to refer to the order dated 8th December, 2016 at this stage which reads as follows:

"It is unfortunate but true that the various authorities concerned have not till today been able to provide to the Tribunal the information/data regarding number of drains, load on drains and quality of the effluents discharged in exact terms by each drain. Under the order of the Tribunal the team lead by Central Pollution Control Board had provided some data in regard to the above. However, the Uttar Pradesh Jal Nigam then pointed out that the Joint Inspection Team to which they were a party had omitted to take note of nearly 42 drains which were falling in Segment-B, Phase-I of River Ganga in terms of the order of the Tribunal. Out of this at Bulandshahar 9 drains had not been taken note of by the Joint Inspection Team where the discharge is supposed to be nearly 22.5 MLD. However, according to the Central Pollution Control Board the total discharge even of the 3 drains that have been taken into consideration is nearly 511 MLD. Similarly at Moradabad there are 23 drains of which the Joint Inspection Team did not take note of and even 4 drains are meeting some other water body but not in River Ganga or any of its tributary particularly Ramganga, Ganga and Kali-East. However, 19 drains have been ignored and their load is not on record. At Bithoor 7 drains have not been taken note of by the Joint Inspection Team and the pollution load is nearly 2.97 MLD.

Number of times these cases have been on board for reconciliation of the differences in their version and now we are finding that data produced by each of the authorities is not based on physical verification. The Joint Inspection Team however has conducted physical inspection and collected the data in regard to number of drains' load and quality of the effluent. This again is variable to some extent as submitted by the other authority. It is necessary for the Tribunal to have correct and physically

> verified data so that it can proceed to direct the methods to be adopted for treatment of the effluents from polluted drains meeting Ganga.
> Therefore, we direct that the Joint Inspection Team shall sit with the senior officers of all the organisation including Central Pollution Control Board, Uttar Pradesh Pollution Control Board, Uttar Pradesh Jal Nigam and Ministry of Water Resources reconcile the differences interse arrive at a common version in regards to number of drains, load of drains and quality of effluent, reason for differentiation in the figure arrived at, and place the same before the Tribunal. This statement/version would be signed by the Managing Director, CEO, Member Secretaries, Executive Officers or the Joint Secretary of the concerned Ministries. The Central Pollution Control Board shall be the Nodal Officer for this purpose. This report should be prepared within one week from today. We make it clear that if this order is not complied with all these officers will be present before the Tribunal on the next date of hearing."

69. On 21st December, 2016, the Member Secretary, CPCB informed the Tribunal that the final report would be ready within a week and all other stakeholders were directed to provide full co-operation and should furnish complete details that are required in relation to the industrial clusters located on the banks of river Ganga and its tributaries in Segment-B of Phase-I.

70. Ultimately, a final assessment report dated 3rd January, 2017 jointly prepared by the above mentioned Committee consisting of all the relevant stakeholders, i.e., right from the planning to execution authorities, was submitted

before the Tribunal on 6th January, 2017. This report provided the requisite data and gave complete information with regard to each of the drains that were joining river Ganga and its main tributaries, river Ramganga, river Kali-East and river Pandu, between Haridwar to Unnao (Kanpur). The report provided description of the drains, name of the region, sources of pollution, pollutant load, catchment area, points from where the samples were collected, its location, flow of the drain, analysis report with regard to general parameters like Colour, pH, BOD (mg/l), COD (mg/l), TSS (mg/l), TDS (mg/l), Cl- (mg/l), NH_3-N (mg/l), NO_3 - (mg/l), DO (mg/l), TC (MPN/ 100 ml) and FC (MPN/ 100 ml) as well as heavy metals like Arsenic (As) mg/l, Cadmium (Cd) mg/l, Total Chromium (Cr) mg/l, Copper (Cu) mg/l, Iron (Fe) mg/l, Lead (Pb) mg/l, Manganese (Mn) mg/l, Nickel (Ni) mg/l, Mercury (Hg) mg/l, Zinc (Zn) mg/l, Antimony (Sb) mg/l, Cobalt (Co) mg/l, Selenium (Se) mg/l and Vanadium (V) mg/l.

The drain effluents were also tested for pesticides analysis report OPPs and OCPs. In other words, this was a complete, comprehensive and scientifically prepared report by a Special Expert Committee constituted by the Tribunal. It became the principal guiding factor for the Tribunal to arrive at a final conclusion.

71. When the matter came up for hearing on 13th January, 2017, the Tribunal directed each party in addition to the

above stakeholders, to make their submissions in relation to the content of the report or any other suggestions that they would like to make. The Tribunal specifically noticed in this order without any exception, that all the respondents, applicants and the concerned stakeholders admitted to the correctness of this report and did not wish to file any objection in that behalf. Therefore, the Tribunal directed that the said report be treated as the very foundation for moving further with the case and the suggestions in regard to drain-wise treatment would be considered with reference to the cleaning and rejuvenation of river Ganga on the basis of day to day hearing. With reference to the Joint Inspection Report, it was stated that there are nearly 86 drains which are joining river Ganga and its tributaries and they carry sewage, industrial and domestic mixed effluents and excess water during rainy season. These drains discharge into the river 2775.19 MLD of mixed effluents. The Committee had expressed an apprehension that there might be some other very small drains and the authorities or private persons may create new drains to discharge sewage effluents into river Ganga or its tributaries. Finding merit in the submissions, the Tribunal *vide* its order dated 16th January, 2017 passed a prohibitory order directing the State of UP, UPJN, UPPCB, all concerned authorities including the private persons to ensure that the 6 drains which are not carrying any

effluents should be plugged and stopped forthwith. They should not be permitted to carry any effluents and further prohibitory direction/order was passed that no new drains shall be created or permitted to be created for carrying sewage and any other effluents directly into river Ganga or its tributaries. Purpose of the order was to ensure that no further outlets are created for direct discharge of effluents or sewage directly into river Ganga. They could be constructed for meeting existing drains which had enough scope even for carrying increased effluents.

72. When the matter was taken up for hearing on 19th January, 2017, all the stakeholders were required to provide further clarification with specific answer in relation to the different drains in question. The directions were to cover all the three rivers that is Ganga, its tributaries Kali-East and Ramganga. The order of 19th January, 2017 reads as under:

> "It is again commonly conceded and in fact admitted by all the Learned counsel appearing before us that the report submitted by the Joint Inspection Team is the correct report in relation to number of drains, quantum of discharge and quality of discharge.
> We direct State of Uttar Pradesh, Central Pollution Control Board, Uttar Pradesh Pollution Control Board representative of Namami Gange, Ministry of Water Resources and the Uttar Pradesh Jal Nigam to have a meeting today afternoon itself and provide answer to us tomorrow on the following:-
> 1. There are 30 drains meeting River

Ganga in Segment-B. Out of which 27 drains directly flow into River Ganga while the remaining three drains have been tapped and through pumping station are being taken to STP(s) at Kanpur.

2. Besides this, there are one drain Bagad even called River Bagad, which is stagnant and it only flows when the flow of effluent is high or in the rainy season, then it meets River Ganga. At the time of inspection the Joint Inspection Team found it to be stagnated, however, it is having effluent.

3. The 3 drains which have been tapped and taken to a STP, what is the load of these three drains individually and at the point of intake of STP, what is the quantum of discharge at the outlet of STP and what effluent besides sewage or drain water, it contain and values thereof.

4. The capacity of the STP and composition that is capable of treating within the prescribed value as of now.

5. In relation to remaining 27 drains, the load of each drain that is quantum as well as quality of the effluent in that drain.

6. Which of these drains depending on the quality of the effluent are capable of being intercepted and joined together to be taken to nearby STP/CETP, keeping the distance and costing in mind.

7. Same question will be answered in relation to East Kali and Ram Ganga as well.

8. The Uttar Pradesh Jal Nigam shall put before the Tribunal complete data and answer forthwith in relation to STPs' functioning and three drains afore-referred, as well as 27 drains which it require to treat. It will state the technical as well as nontechnical aspects in relation thereto.

We have already directed the Namami Gange, Ministry of Water Resources will not take any project in Segment-B, Phase-I till we pass further orders."

73. The matter was taken up for hearing on 25th January, 2017. By that date, the Hon'ble Supreme Court had transferred the entire matter regarding cleaning of river Ganga *vide* its order dated 24th January, 2017. Keeping in view the orders of the Hon'ble Supreme Court while observing that the assistance being rendered to the Tribunal was not upto the expected standards, the Tribunal passed further directions raising queries on the analysis, to the members of the Joint Inspection Team. This was with the aim of getting further specific information required for passing of the final order. The Tribunal also issued notice to the pharmaceutical and distillery industries which were causing serious pollution of river Ganga and its tributaries through Chhoiya drain. The relevant part of the order dated 25th January, 2017 reads as under:

> "It is also informed to us that Chhoiya drain is being highly polluted because of industrial discharge from petrochemical industries and distilleries.
> Issue Notice to all the industries particularly the petrochemical, distilleries and other major industries which are polluting this drain which ultimately joins River Ganga. The Pollution Control Board shall issue Notice to them to be present before the Tribunal on 6th February, 2017 and it shall be the responsibility of the PCB to ensure their presence before the Tribunal.
> Bhagad River which because of heavy industrial pollutants has become practically a drain also needs the directions by the Tribunal in relation to

> taking up antipollution measures to ensure that there is no pollution in River Ganga. However, this River does not join River Ganga as it is stagnant. This observation is not disputed by any of the stakeholders before us, but it is pointed out that it was not meeting River Ganga at the time of inspection, however, whenever there is heavy flow, the effluent would meet River Ganga. There is no CETP fixed at this River and that it is receiving industrial pollutants from Gajraula and Bhagrala Industrial Clusters.
>
> Let Notice be issued to the industries association of both these places and all the big industries which are discharging their effluent into this River. The UPPCB shall ensure service upon them before the next date of hearing.
>
> Notice made returnable on 6th February, 2017."

We must notice at this stage that the sole purpose of passing of these specific directions which were query oriented was to bring within the scope of the project the existing infrastructure and infrastructure under construction, i.e., the STP/CETP or the sewer pipeline which were being laid by the executing authorities under different schemes of NMCG or the State schemes or the schemes funded by external agencies to be included into the project. Thus, the project was contemplated to be inclusive for achievement of the ultimate goal of cleaning and rejuvenating river Ganga and its tributaries. It was ensured that the existing treatment mechanism as well as proposed mechanism would become part of the present project except to the extent where there was proposal

which had been found to be either effectively preventive in controlling pollution or serve the goal of cleaning or rejuvenation of river Ganga.

74. Upon appropriate analysis of the data submitted before the Tribunal and the fundamental principles relating to drain treatment, providing 'end of the pipeline treatment' and ensuring recycling, utilisation of treated effluents for agriculture, horticulture, industrial, cooling and other relevant purposes to which all the stakeholders were *ad-idem,* the Tribunal took the decision of dealing with each of the 86 drains joining river Ganga and/or its tributaries. It further decided to deal with industrial pollution separately as well as to issue directions in relation to various other connected issues that were responsible for causing pollution of river Ganga. Each drain was subject matter of serious deliberations in respect to quantum, quality, effluents of drain, installation of anti-pollution devices (STPs/CETPs), its capacity and the possibilities of recycling and reutilising water upto 75% of its discharge. The Tribunal also considered the aspects of the environmental flow of river Ganga and restriction on unsustainable extraction of groundwater, permitting not more than 25% of the treated effluents to join river Ganga.

Views of all the stakeholders, invited Expert members and the report of the Joint Inspection Team were taken into consideration. Finally, the views expressed and arguments

advanced were independently examined by the Tribunal which has the benefit of both the Judicial and the Expert Members sitting together. We must notice that a special bench of six members was constituted to hear the Ganga matter to get the benefit of expertise of the maximum number of Expert members to finalise the scope, ambit and proper implementation of the project in hand.

75. In light of the above discussion, the dimension of this project in dealing with each of the 86 drains which join river Ganga and its tributaries shall be discussed at length. Once, these 86 drains are treated at the end of the pipe or are intercepted and taken to the existing and/or proposed STP/CETP, there shall be no pollutants entering river Ganga or any of its tributaries beyond the prescribed standards/parameters. Thus, we will now proceed to deal each of these 86 drains.

DRAINS WHICH ARE DIRECTLY JOINING RIVER GANGA IN SEGMENT-B OF PHASE-I (HARIDWAR TO UNNAO, KANPUR):

76. **GARH DRAIN**: This drain meets river Ganga on its right bank at Garh. It is 20 km long and falls under the regional office of UPPCB at Ghaziabad. It mainly carries domestic discharge and sewage. Its flow load is 13.30 MLD as per the Joint Inspection Report. The samples had been collected from near Brijghat in Garh Mukteshwar. The effluents were analysed and the analysis report showed the results for general parameters and heavy metals. Pesticides

and metals were found to be below detectable levels or within the prescribed limits. However, certain general parameters were found to be in violation of the prescribed norms. The Joint Inspection Team made the following observations :

> "1. Turbid.
> 2. Ichornia (sic.) growth found.
> 3. Solid wastes were found floating with the drain."

The analysis report of the drain is as follows:

(EFFLUENTS OF GARH DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.58
3.	BOD (mg/l)	:	4
4.	COD (mg/l)	:	25
5.	TSS (mg/l)	:	31
6.	TDS (mg/l)	:	376
7.	Cl^- (mg/l)	:	28
8.	NH_3-N (mg/l)	:	4
9.	NO_3^-(mg/l)	:	0.89
10.	DO (mg/l)	:	3.80
11.	TC (MPN/100 ml)#	:	$92x10^3$
12.	FC (MPN/100 ml)#	:	$35x10^3$

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

(EFFLUENTS OF GARH DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	01
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	BDL
5.	Iron (Fe) mg/l	:	1.15
6.	Lead (Pb) mg/l	:	BDL
7.	Manganese (Mn) mg/l	:	0.15
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	NA
10.	Zinc (Zn) mg/l	:	BDL

11.	Antimony (Sb) mg/l	:	NA
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

It is commonly stated and is accepted by the Tribunal with reference to the records before it that there is a 3 MLD STP constructed at Brijghat to treat the sewage from Brijghat town. Presently, the discharge from Brijghat town is going to a water body, Balwapur Jhorh. Another STP of 6 MLD is under construction and 60% work is reported to have been completed. This STP will treat the sewage generated from Garh Mukteshwar town, which is presently untreated and meeting Garh drain.

With regard to this drain and particularly in relation to area of Garhmukteshwar, we must place on record a patent deficiency in performance of functions by the local authorities. When the matter came up for hearing before the Tribunal on 14th February, 2017, the officers present on behalf of the UPJN were not able to provide satisfactory answers to the queries raised by the Tribunal. However, Mr. Keshav Gupta, General Manager informed the Tribunal that nearly ₹ 31 crores have already been spent on laying of sewage line and for construction/ installation of STPs in the areas of Brijghat and Garhmukteshwar. He confirmed for both the STPs of 6 MLD and 3 MLD, respectively. He stated that the STP of 3 MLD had not even been made operational and it had not been connected to the sewer line

and therefore, no effluent was reaching the plant. According to him, he never verified the quantum and in any case the quality of the discharge into the drain. He was incognizant whether any industrial activity is being carried on in the catchment areas of the drain. The proposed STP is supposed to treat coliform to bring its value to 230 MPN/100 ml units. According to him, the discharge in Garh drain where it meets river Ganga would be 5 to 6 MLD. In the summers, the discharge is less. The officers who had participated in the joint inspection did not raise any issue with regard to measurement being incorrect and imprecise. The Tribunal was astounding to know that none of the officers concerned, did any field inspection, analyse the quantum and quality of the effluents or take any other measurements before preparing the DPR for construction of STP or other anti-pollution devices.

Reliance was placed on the manual, which is supposed to be a guide for preparation and execution of projects. It did not provide for a field data, which has to be prepared, based on the actual ground realities. The manual even does not state whether such formula could be applied unanimously and without assimilation of proper data. The Tribunal called for the concessionaire who is supposed to have prepared the data.

Having heard the stakeholders and the Counsel appearing for all the parties, we pass the following directions:

1. The 3 MLD STP Plant at Brijghat should be made operative without any further delay.
2. The 6 MLD STP Plant that is under construction at Garh drain to treat the sewage from Garhmukteshwar should be completed without any further delay. Though, we have provided the load discharge under this drain as well as quality analysed but we direct the concerned executing agencies to ensure that the capacity and design of the plant is duly confirmed before any further construction of the plant and it should be ensured that the plant brings proposed standards of Faecal Coliform of 230 MPN/100ml.
3. No discharge shall be permitted in the Jhorh at Brijghat, henceforth. The remaining work of sewer line should be completed and each household should be connected to the sewer line without any further delay. This should be taken up by the executing agency as a project of top priority and all the concerned authorities and respondents are directed to deal with the matter accordingly.
4. The treated discharge from STP water even if chlorinated should be used for agriculture and horticulture, as far as possible. The sewer line is to be connected to the STP through the pumping station, which are still to be constructed. However, the sewer drain should be connected even during the interim

period by providing adhoc pumping arrangements or any other appropriate measures.

We would prefer to apply the end of the pipeline treatment where it is most beneficial and has a direct relation between the point of discharge and point of establishment of the STP. It should be on the basis of availability of space, convenience, accessibility and more importantly feasibility, practicability and required capacity of the plant to treat the effluents. The normal distance between the end point of discharge and establishment of STP should be between 500 to 1000 meters away from the river depending on the facts and circumstances.

All the stakeholders including MoWR, MoEF&CC, CPCB, State of UP, UPPCB, UPJN concede with these directions.

A committee appointed by the Tribunal including the Local Commissioner had also submitted a report with regard to this site and the sewer line and sewer connections. It was reported that both the sewer lines have been laid in Garh and Brijghat. It is yet to become functional as actual critical links were missing. It is reported that the sewer lines were not connected with each other and there are no connections with the new households. There exists no roadmap with respect to the sewer line connections. In absence of this, entire scheme of pollution abatement will not fulfil any purpose. It was also noticed that there was complete lack of co-ordination and the present situation

needs exigent corrective measures.

The report stated that the main causes attributable to the pollution of river Ganga are due to disposal of industrial effluents and domestic wastes. The storm water drains designated to flood out the storm water during the rainy season are now being used for disposal of sewage and trade effluents which clearly join river Ganga. It was specifically noticed that the subject matter of the report has been prepared and reviewed by the parties jointly. The drains were segregated into three categories, namely, drain carrying only storm water, drains carrying sewage, industrial effluents or mixed effluents and the drains, which are tapped and dry. While stating the procedure and method for flow measurement, sampling and analyses of the samples, it was stated that findings were based on reassessment of drains to make it absolutely clear. Stating that besides the 30 drains joining river Ganga, Bagad river like Banganga, Malan, Sot and Ishan were not considered due to their flow and characteristics. Similarly, drains having less than 1.0 MLD flow, measured by both Joint Inspection Team and UPJN at different occasions were also not considered. Out of 30 drains, 3 drains were found to be tapped and the report of each of the drain was thus separately prepared.

ANUPSHAHR STP DRAIN I & II

77. Anupshahr STP drain I discharges on the wet land near

river Ganga while Anupshahr STP drain II joins the right bank of river Ganga and both the drains are in Bulandshahar. Both these drains carry domestic waste and sewage. The catchment area of both of them is city of Anupshahr. The Joint Inspection Team collected effluents at the STP complex near Chamunda and the STP complex near Sohan Tau Ka Matth. The analysis report of these drains were analysed for general parameters, heavy metals, and pesticides. The observations of the Committee for drain I was that the treated water was discharged into a wetland situated about a kilometre away from river Ganga. While for drain II, it was stated that the treated water was discharged directly into river Ganga. However, there is a forest land situated about 250 meter away from the STP, which may be irrigated by the treated water. The metals and pesticides in both the drains were found to be either below detectable limit or within permissible limit. The general parameters were noticed as follows:

(EFFLUENTS OF ANUPSHAHR STP DRAIN-1 - GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	8.84
3.	BOD (mg/l)	:	26
4.	COD (mg/l)	:	114
5.	TSS (mg/l)	:	54
6.	TDS (mg/l)	:	704
7.	Cl^- (mg/l)	:	80
8.	NH_3-N (mg/l)	:	16
9.	NO_3^-(mg/l)	:	2.35
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	3400
12.	FC (MPN/100 ml)#	:	2200

* For Fresh water carrying drains/rivers

For sewage, mixed Drains & River

(EFFLUENTS OF ANUPSHAHR STP DRAIN-2 - GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	8.94
3.	BOD (mg/l)	:	19
4.	COD (mg/l)	:	72
5.	TSS (mg/l)	:	36
6.	TDS (mg/l)	:	536
7.	Cl^- (mg/l)	:	68
8.	NH_3-N (mg/l)	:	14
9.	NO_3^-(mg/l)	:	2.34
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	1100
12.	FC (MPN/100 ml)#	:	450

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

These drains were found to be having a flow of 1.18 MLD and 1.08 MLD, respectively. According to Uttar Pradesh Jal Nigam (for short, 'UPJN') there are two oxidation ponds already in existence of 0.81 MLD and 1.75 MLD. It is proposed by them that there were STP of 1.5 MLD and 1 MLD capacity, respectively. Oxidation ponds are performing well. The Member Secretary, CPCB submitted that the oxidation ponds should never be located near the habitation. He also stated that the oxidation ponds are incapable of meeting the current prescribed and proposed standards in relation to Coliform. It is not easy to maintain the oxidation pond and it requires a very severe regulatory and supervisory regime. It was pointed out that only four per cent of work of the proposed STP of 1.5 MLD at drain I has been done so far. While the work for the other STP has not even been started. Suggestion was that

the capacity of the STP and its technology should be so provided that the treatment of Coliform to the proposed standard of less than 230 MPN/100 ml and BOD 10mg/L should be attained. The counsel appearing for MoWR upon instructions from the Director who was present in the Court submitted that the oxidation ponds cannot attain the prescribed norms. It was stated that there should be regular power, proper sewage line leading to the STP and the discharge from the STP should be preferably used for agricultural purposes and only residuum should be permitted to enter the river through the drains.

In view of the above submissions, having analyzed the report and the views of the experts, we pass the following directions with respect to these two drains:

a) We direct that two different STPs shall be constructed, one of 1.5 MLD while other of 2 MLD capacity.

b) The work of 1.5 MLD STP has already been started for drain I, completion thereof should be expedited. The STP should be so constructed that it should satisfy, preferably, the proposed standards of Faecal Coliform of 230 MPN/100 ml and BOD 10mg/l, but in any case should conform to the existing standards.

c) The executing agency shall duly conform before the commencement of the work, the discharge in the

respective drains and quality thereof. These drains need not be intercepted and independent STPs should be constructed to provide regular source of power. Also, solar energy should be utilized.

d) The STPs should not be constructed close to the riverbed. Ideally there should be a distance of more than 500 meter from the edge of the river.

HATHIKHANA NALLAH, BARGADIYAGHAT NALLAH AND CANTT. NALLAH

78. It would be convenient to deal these three drains together. It is commonly stated that these drains have pollution load mainly from domestic discharge. The load of discharge of the first two drains according to Joint Inspection Team is 18 MLD and 3.8 MLD, respectively. According to Jal Nigam, the flow of Cantt. Nallah is 6.88 MLD. These drains join river Ganga on its right bank. They primarily carry domestic and sewage discharge.

The drains carry sewage pollutants and have high discharge flow. The report of the Joint Inspection Team has submitted the following analysis report:

(EFFLUENTS OF HATHIKHANA NALLAH-GENERAL PARAMETERS)

Sl.No.	Parameters		Results
1.	Colour	:	-
2.	Ph	:	7.76
3.	BOD (mg/l)	:	23.0
4.	COD (mg/l)	:	98.5
5.	TSS (mg/l)	:	43.7
6.	TDS (mg/l)	:	704
7.	Cl^- (mg/l)	:	94.5
8.	NH_3-N (mg/l)	:	30.7
9.	NO_3^-(mg/l)	:	1.89
10.	DO (mg/l)*	:	-

11.	TC (MPN/100 ml)#	:	2400000
12.	FC (MPN/100 ml)#	:	2400000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF BARGADIYAGHAT DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.41
3.	BOD (mg/l)	:	34.5
4.	COD (mg/l)	:	106
5.	TSS (mg/l)	:	35.2
6.	TDS (mg/l)	:	711
7.	Cl^- (mg/l)	:	86.5
8.	NH_3-N (mg/l)	:	34.5
9.	NO_3^-(mg/l)	:	2.23
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	2200000
12.	FC (MPN/100 ml)#	:	470000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

On Hathikhana Nallah, there is an STP of 2.7 MLD which is an oxidation pond. Cantt. Nallah is intercepted and diverted to Hathikhana Nallah and flow of both the drains goes to the oxidation pond. The proposal on behalf of the UPJN is that all the 3 drains are to be intercepted and Intermediate Pumping Stations (IPS) would be constructed for taking the effluent to Hathikhana Nallah where a Main Pumping Station (for short, 'MPS') will be constructed and then a pipeline would be laid down for carrying out effluent to the proposed STP of 17 MLD. For this project, even DPR has not been prepared as of now.

UPPCB, CPCB and MoWR have submitted that the effluent of the Cantt. Nallah has already been sent to Hathikhana Nallah and effluent of Bargadiyaghat Nallah is also sent to

Hathikhana Nallah. The STP should be proposed from the turning point of Hathikhana Nallah to the proposed MPS site. There would be no need to install MPS because the gradient of the drain is towards the river. The STP may be established at least 1 kilometre to 1.5 kilometres away from the river. There are no industrial clusters in the catchment area of the drain. Furthermore, there are no colonies or any habitation from the proposed MPS to river Ganga and in fact, any of the drains from the proposed Intermediate Pumping Station (IPS). It is suggested that there should be no development permitted from the point of STP till it meets river Ganga. The proposed development area should be in accordance with the laws in force and should have their own STPs/CETPs to ensure that in the remaining part of the drain, no effluent or sewage is introduced so that it meets river Ganga. The 17 MLD STP plant would take care of it in future.

In view of the information and data placed before the Tribunal, we are of the considered view that proposal of UPJN suffers from patent infirmities. Firstly, it would have to install IPS and MPS just to take effluent against the gradient of the drain which would incur heavy expenditure on establishment of STP at a much longer distance from Hathikhana Nallah. This would not be practicable, scientifically and economically prudent. The proposed STP is very close to the river which may even pollute the river

in the given situation.

Having examined the respective contentions raised on behalf of the parties as well as the applicant, we pass the following directions in relation to these three drains:

1. That the effluents from Cantt. Nallah and Bargadiyaghat Nallah shall be brought to Hathikhana Nallah at the point where presently MPS is proposed and the STP of 17 MLD capacity will be constructed.
2. This STP should have the capacity to treat and bring the values of the general parameters to the prescribed norms.
3. If any development is sanctioned by the Government or any local authority between the point of establishment of STP and the riverbank, in that event that development agency shall ensure that the STP/CETP is required to be constructed by them. In the event, if there is a colony being built by the Government or any of its agencies, then it shall not do so without construction of an STP/CETP and only the discharge from that STP/CETP would be permitted to join the Hathikhana Nallah. The 17 MLD STP shall take due care of the future demands and therefore, constructed with utmost expeditiousness and with proper technology.

PERMIYA NALLAH, RANIGHAT DRAIN, SISAMAU, TEFCO NALLAH, PARMAT GHAT, MUIR DRAIN, POLICE LINE DRAIN, JAIL DRAIN, GOLAGHAT NALLAH, BHAGWATDAS/GUPTARGHAT NALLAH, SATTI CHAURAHA, DABKA NALLAH-3 AND AIR FORCE DRAIN

79. All these drains can be conveniently dealt with together, as all of them fall within the sewage network of the city of Kanpur. Some of them are very major drains while others are minor drains. The major drains are carrying high pollutants in contrast to minor drains which are more specific in terms of their content. Majority of these drains have been partially intercepted and have been taken to other major drains. From the major drains, the effluent is being carried or is being proposed to be carried to the complex of STPs at Jajmau. Since they are interconnected, providing for a resolution thereof, they would have to form part of the same discussion. In fact, various stakeholders have also addressed their submissions on the same line.

First of all, we may examine the drain in this group which do not call for issuance of any directions. The Air Force drain is nearly a kilometre in length. It does not carry any effluent regularly. It is a storm water drain and remains dry except during the rainy season. It is the common stand of all the stakeholders that this drain does not require treatment and therefore, any directions. We accept the stand of the parties and direct that this drain does not call for any treatment or specific directions.

POLICE LINE DRAIN AND JAIL DRAIN

80. These drains have a length of 0.12 kilometres. and is 0.8 km respectively. These drains carry domestic sewage discharge only. The Police Drain has been tapped and its discharge is taken to Parmar Pumping Station. From that pumping station, the effluents of both these drains join sewer line which finally travels to the Jajmau STP. The Joint Inspection Team had inspected both these drains and did not find any sewage and therefore, it was not subjected to any analysis. The Committee even took analysis at the confluence point of Police Drain and river Ganga. At that point, the drain was dry but large quantity of Municipal Solid Waste (for short, 'MSW') was found to be thrown or dumped at that site. Similar analysis was also taken for the Jail Drain at the confluence point with river Ganga. According to the stakeholders, steps are required to be taken in relation to these two drains and consequently, no direction needs to be passed. Having heard the stakeholders and in view of the above narrated facts, we are of the considered view, that no further direction in relation to treatment of effluents be issued in view of the fact that both these drains are tapped and the effluents join the sewer line leading to Jajmau STP. What further should be ensured is that at the tapping point there is no overflow of the sewage or effluents of any kind except the

storm/rainy water and nothing should be permitted to go beyond the tapping point. Further, we issue directions to the concerned authorities that is UPJN, State of UP and Nigam Parishad and local authorities to ensure that all these drains upto and particularly beyond the point of tapping should be kept clean and no MSW should be dumped in any of the drains.

PERMIYA DRAIN

81. This drain is one of the major drains in city of Kanpur. There are 5 other drains which are enroute/join this drain. They are Kesa Colony Drain, Khewra Drain, Roadways Colony Drain, Jogeshwar Drain and Jewra Drain Tapping including Nawabganj drain. This drain originates from Kanpur barrage canal and meets river Ganga on its right bank. All these drains primarily carry sewage from the catchment areas of Vishnupur, Mandana, HBTI, Makdikheda, Kalyanpur, Indria Nagar, Khewra village, Jageswar village, Jevra village, Ranighat village The length of this drain is stated to be 2 kilometres. According to Joint Inspection Team with 0.65 factors for averaging surface velocity and drain cross section profile, the flow comes to 98.28 MLD. However, this flow has been stated to be 4.07 MLD by UPJN. The data provided by UPJN does not appear to be correct considering that it is an old data which confines itself to be within municipal limits, with no definite documentation being placed on record to show

that the discharge of such a drain which has densely inhabited areas in its catchment area. It was stated by the Joint Inspection Team that the sewage from the Nawabganj area is directly meeting Permiya drain which ultimately goes to river Ganga. The effluents collected from the drain were subjected to analysis by the Joint Inspection Team. It was found that the parameters in relation to heavy metals and pesticides were found to be below detectable levels or were within the prescribed limits. However, the general parameters which were found to be excessive are as follows:

(EFFLUENTS OF PERMIYA DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.16
3	BOD (mg/l)	:	138
4	COD (mg/l)	:	308
5	TSS (mg/l)	:	196
6	TDS (mg/l)	:	590
7	Cl^- (mg/l)	:	82.7
8	NH_3-N (mg/l)	:	52.2
9	NO_3^-(mg/l)	:	2.73
10	DO (mg/l)*	:	-
11	TC (MPN/100 ml)#	:	16,00,00,000
12	FC (MPN/100 ml)#	:	9,20,00,000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

It is pointed out that two STPs of 130 MLD and 5 MLD and one CEPT of 36 MLD are in existence at Jajmau. 1 STP of 43 MLD is under construction at Jajmau. It is stated to be covered under the sewage project in Kanpur, District-1 which has been approved by the NMCG in October 2016.

At this stage, we may also notice that the Project Manager of UPJN had appeared before the Tribunal and informed that there were 110 wards in the city of Kanpur. Each ward had 50 to 200 colonies with a population of approximately 30,000. However, even 40% of the area has not been provided with the sewer line and entire households are not connected. 38 wards did not have sewer line at all. The officer never conducted inspection in the city or any part thereof to verify the situation. He also informed that if the projects in regard to sewer line intersection and construction of 43 MLD STP are executed, even then only 5% of additional sewer line would be covered in the city of Kanpur. He also stated that there are a number of unauthorised colonies and when planning for laying down of sewer line is undertaken, unauthorised colonies are not taken into consideration. It is only the planned colonies that are taken into consideration for that purpose. However, the Commissioner of the Nagar Nigam Kanpur appeared before the Tribunal on 8th March, 2017 and informed that there were 110 wards in city of Kanpur and there were 1669 colonies. Out of them, unplanned colonies are 152, while 397 are slums. The slums and illegal colonies have not been provided with sewer line. Even the remaining 1120 unauthorised colonies do not have sewer line and sewer connections. There are commercial and industrial activities being carried on in

some of the 1120 colonies.

The five drains afore-stated come under the control of Nigam and they were stated to have been cleaned pre-monsoon 2016, but the Nigam failed to provide any answer as to why the sewer line was blocked to the extent of 70%.

Mr. Sundeep Kumar, Director (T-II), MoWR stated that in order to provide proper treatment to Permiya Drain, it will be appropriate that the gate of Ganga canal should be strengthened to ensure that there is no leakage. All the five drains carry pollutants out of which four are already intercepted and the fifth drain Nawabganj drain, should be intercepted and the effluents taken to the Jajmau STP which is presently blocked and requires major O.M. improvements. There should be no overflow from any of the intersection points. No other pollutant should be permitted to enter Permiya Drain. The drain joining Permiya Drain between Nawabganj drain and river Ganga should also be intercepted and brought to Nawabganj drain and in turn to Jajmau. Drain should be a natural drain which will carry released water of Ganga canal, nature surcharge and the rain water.

On the contrary, the Member Secretary, CPCB as well as MoEF&CC took the stand that this may not be correct treatment method of the pollution being caused by these drains. According to them, end of the pipeline treatment should be maintained. The sewer line was working only to

the extent of 30% and 70% was not functional. Thus, it will not be possible for the sewer line to carry such heavy effluents. It was also not known clearly, as to how many other drains join Permiya Drain as the Pollution Control Board inspected only the drain joining towards the end of the drain near river Ganga. The installation of STP at the end of the pipeline nearly 1 km from the river would serve the purpose of cleaning river Ganga and there should not be any unchecked development in the area or untreated effluents being added to other drain within that area of 1 km. The Tribunal was also informed that the Chairman of CPCB in the meeting held by the Secretary, MoEF&CC had taken a final decision to approve the end of the pipeline treatment as a first option. It was commonly agreed that the drains are in a very bad predicament in terms of environment and public health both.

When the matter was taken up before the Tribunal on 28th February, 2017, it was informed that out of 5 drains which join Permiya Drain, 4 have already been intercepted with the intersection of 1 more drain, these can handle even the increased capacity after strengthening the intersection point and then the discharge could be sent to sewer line leading to Jajmau STP. The flow or discharge by leakage from escape channel in other drains should be prevented by strengthening of Ganga canal. In furtherance to that order, a special meeting of the stakeholders was held on

28th February, 2017. In that meeting, both the right and left banks of Permiya Nallah were discussed and the following observations were submitted to the Tribunal :

> **"Right Bank in District-I**
>
> i. Based on the information of UP Jal Nigam and UPPCB joint inspection, 5 drains meets Permiya Nallah (Kesa Colony, Roadways, Jageshwari, Jewra and Nawabgunj). All drains except Jewra has provision for tapping and the overflow (more than the tapping capacity) finds its way to Permiya Nallah.
>
> ii. A new 3.5 MLD interception and diversion d/s-Nawabgunj drain with intercept sewer along Permiya drain is approved by NMCG, which will ensure no discharge in to Permiya drain from the right bank of Permiya Nallah.
>
> iii. The pumping station on Nawabganj drains requires upgradation, cleaning and capacity enhancement so that entire effluent could reach Jajmau STP. Proposed renovation of Nawabganj tapping facility along with rehabilitation of discharge sewer as approved by NMCG will ensure utilization of STP capacity at Jajmau to full capacity.
>
> iv. Collectively it was expressed that proper O&M of existing tapping facility along with execution of approved I&D of Permiya drain will collect discharge from all drain joining Permiya drain from right bank. The collected wastewater will be sent to STP cluster at Jajmau through Nawabganj pumping station.
>
> v. The water from escape channel is primarily of good quality and leakages are not normal conditions. Therefore, concerned authority shall be directed to ensure necessary measures are put in place to stop leakage/unintended discharge.
>
> **B. Left Bank of Permiya Nallah:**
>
> i. Presently, there is no major identifiable discharge from left bank side to Permiya Nallah. However, UPPCB clarified that consent for

> operation of STP have been issued to NRI colony for 2.21 MLD, with condition to use treated water for gardening and other agricultural uses.
>
> ii. The under construction STP of 15 MLD under JNURM AT Baniyapurwa, is primarily to cater the sewage generation from Ward No. 20 and part of Ward no 16 which is reaching River Ganga through Laakhanpur Kesa Colony—drain (already covered in tapping proposal) associated sewage network in these wards is under progress AMRUT program."

Various suggestions advanced on behalf of different stakeholders were critically examined by the Tribunal. Keeping in view the fact that 3 STPs/CETPs are already functional, though, not satisfactorily and another STP of 43 MLD is under construction. The sewer line has already been laid. The interception projects have been approved by NMCG in October 2016 and the project of sewer is in progress. We consider it appropriate that the approved project may be implemented rather than adopting a fresh course of end of the pipeline treatment in relation to the Permiya drain. However, this has to be subject to the directions which we state hereinafter:

1. The 5th drain, i.e., Nawabganj drain should be intercepted and its effluents taken to the main sewer line which goes to Jajmau STP.
2. The STP of 43 MLD at Jajmau under construction should be completed with utmost expeditiousness. All these STPs should be upgraded and should be

of an appropriate capacity so that they can treat the entire effluents left from these 5 drains and Permiya Nallah and sent to appropriate STP at Jajmau.

3. It is informed that there is sufficient land available at Jajmau for construction of STP and since the existing STPs are already there, it will be more convenient to install another STP at the same site.
4. The Local authorities, Nigam and State of UP are hereby directed to ensure that the 70% non-functional factor of the sewer line taking the sewage effluents of Jajmau should be cleaned forthwith and the flow of the drain should be 100% as opposed to 30%. This direction is necessary because if there is no proper conveyance capacity of the sewer line, the entire sewage and effluent collected would overflow or leak from the point of interception or tapping, defeating the entire project which had already been sanctioned by NMCG in 2016.
5. The STP at Jajmau should be able to treat all the effluents including BOD, COD, TSS, Coliform and the CETP should be able to treat the industrial pollutants so as to achieve the prescribed norms.
6. The treated water from the STP shall be recycled for use in industrial and agriculture purposes and

it is only the remnant that would be subjected to discharge in river Ganga. The escape channel of Ganga canal should be strengthened and it should be ensured that there is no leakage to the Permiya drain and no unintended discharge.

7. A new STP of 3.5 MLD by interception and diversion of Nawabganj drain with sewer line along Permiya drain which has already been approved by NMCG is permitted to be executed.

8. The pumping station of Nawabganj drain should be upgraded, cleaning and capacity enhancement to be carried out so that the entire effluent could reach the Jajmau without any obstruction.

RANIGHAT NALLAH, SISAMAU NALLAH AND TEFCO NALLAH

82. These drains have a length of 2.17 kilometers, 7 – 8 kilometers and 0.4 kilometer respectively. While Ranighat drain and Tefco Nallah carry domestic and sewage effluents, the Sisamau drain carries mixed effluents, i.e., domestic, sewage and industrial. The Ranighat Nallah has a flow of 1.3 MLD. This Nallah is stated to have been tapped and joins pumping station in Nawabganj. As per the Joint Inspection Team, despite tapping, sewage still flows and meets river Ganga. It is both because of overflow and leakage. The effluents were analyzed and its general parameters were found to be in violation, particularly,

Total Coliform and Faecal Coliform. The analysis report reads as under:

(EFFLUENTS OF RANIGHAT NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.37
3	BOD (mg/l)	:	173
4	COD (mg/l)	:	463
5	TSS (mg/l)	:	354
6	TDS (mg/l)	:	953
7	Cl^- (mg/l)	:	133
8	NH_3-N (mg/l)	:	76.2
9	NO_3 - (mg/l)	:	2.02
10	DO (mg/l)*	:	-
11	TC (MPN/100 ml)#	:	160000000
12	FC (MPN/100 ml)#	:	160000000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

(EFFLUENTS OF RANIGHAT NALLAH-TRACE METAL/HEAVY METAL)

Sl. No.	Parameters	Results	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	BDL
4	Copper (Cu) mg/l	:	-
5	Iron (Fe) mg/l	:	1.42
6	Lead (Pb) mg/l	:	BDL
7	Manganese (Mn) mg/l	:	0.14
8	Nickel (Ni) mg/l	:	BDL
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	0.14
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		-
14	Vanadium (V) mg/l		-

DRAIN MONITORING FORMAT

(Pesticide)

Sl. No.	Parameters	Results	
1	Water temperature (°C)	:	Awaited

Pesticide Analysis report (OPPs)			
2	Monochrotophos		
3	Dimethoate (µg/l)	:	
4	Methyl Parathion (µg/l)	:	
5	Malathion (µg/l)	:	
6	Chloropyriphos (µg/l)	:	
7	Methyl Parathion	:	
8	Ethion (µg/l)	:	
Pesticide Analysis Report (OCPs)			
9	α-BHC	:	0.08
10	β-BHC	:	0.75
11	γ-BHC	:	0.07
12	δ-BHC	:	BDL
13	Total BHC (ng/l)	:	BDL
14	Aldrin (ng/l)	:	BDL
15	Diedrin (ng/l)	:	BDL
16	α-Endosulfan	:	BDL
17	Total Endosulfan (ng/l)	:	BDL
18	β-Endosulfan	:	BDL
19	OP'DDT	:	0.08
20	PP'DDT	:	0.22
21	PP'DDE	:	BDL
22	Total DDT (ng/l)	:	BDL

As per the observations of the Joint Inspection Team, Sisamau Nallah also carries untreated wastewater from the slaughter houses at Fazalganj. The flow of this drain is found to be 130 MLD. The sample for Sisamau Nallah was collected from inside the power plant. The effluents were analyzed and the parameters were found to be excessive for both the general parameters as well as under metals. However, pesticides were below the detectable limit or within the prescribed limits. The analysis report of this drain reads as follows:

(EFFLUENTS OF SISAMAU NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results

1	Colour	:	-
2	pH	:	7.05
3	BOD (mg/l)	:	83
4	COD (mg/l)	:	251
5	TSS (mg/l)	:	187
6	TDS (mg/l)	:	604
7	Cl^- (mg/l)	:	109
8	NH_3-N (mg/l)	:	36.1
9	NO_3 - (mg/l)	:	2.71
10	DO (mg/l)*	:	-
11	TC (MPN/100 ml)#	:	-
12	FC (MPN/100 ml)#	:	-

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

(EFFLUENTS OF SISAMAU NALLAH-TRACE METAL/HEAVY METAL)

Sl. No.	Parameters	Results	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	0.06
4	Copper (Cu) mg/l	:	-
5	Iron (Fe) mg/l	:	3.32
6	Lead (Pb) mg/l	:	0.02
7	Manganese (Mn) mg/l	:	0.20
8	Nickel (Ni) mg/l	:	0.06
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	0.50
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		-
14	Vanadium (V) mg/l		-

Tefco Nallah has a flow of 0.43 MLD according to the Jal Nigam. The Joint Inspection Report states that the drain has occasional flow due to bypass sewage pumping station. The drain has been partly tapped which then flows to Jajmau STP cluster. Since the drain was found to be dry, no sample was analyzed by the Joint Inspection Team. It was observed that the two drains, namely, Ranighat and

Tefco Nallah have existing sewer line system while for Sisamau Nallah the system is proposed. These two drains have been tapped while the Sisamau Nallah has not been tapped fully as of now. The stakeholders proposal is that all the 3 drains should be fully tapped and pipeline should be strengthened appropriately so as to carry the sewage or effluent to the pumping station by gravity and finally transfer into the sewer line leading to STP at Jajmau. The capacity of the pumps installed should be appropriately analyzed and strengthened. It must be ensured that there should be no backflow from the pumps or overflow from the tapping point or bypass of it, flowing into the drains beyond the point of their tapping. There should be continuous source of energy preferably by solar energy or by DG Sets. This project has already been approved by the NMCG.

Thus, we accept the proposal and direct that all these three drains shall be fully and completely tapped wherever necessary through pumps. The discharge shall be put into the sewer line leading to Jajmau STP. All the pumps shall be provided with alternative sources of energy, i.e., solar or DG sets to ensure uninterrupted functioning of the pumps. This would ensure that there is no overflow or backflow from the pumps or point of interceptions. It should be ensured under all circumstances that no overflow of effluents or sewage enters the drains beyond the point of

tapping.

PARMATH DRAIN

83. The drain has a length of 2.18 kilometers. This drain was found to be dry where it meets river Ganga and therefore, no effluents were analyzed. The drain is stated to have been tapped from the tapping point and there is an overflow.

All the parties and stakeholders agreed that the existing tapping requires up-gradation, capacity of which is 0.2 MLD. By strengthening of tapping, it should be ensured that there is no overflow into the drain after the point of tapping and no consequent pollution of river Ganga. According to CPCB, this drain should be sealed at the end while according to MoWR it should not be sealed.

Having given our considered view, we direct that the existing tapping point shall be strengthened and upgraded. It should be ensured that there is no overflow. The drain should not be sealed at the point of confluence.

MUIR MILL NALLAH

84. This Nallah meets river Ganga on its right bank and is 2 km long. It has a flow of 8.45 MLD. The effluents of the drain were subjected to analysis and pesticides and heavy metals have been found to be below detectable limit or within the prescribed limits. However, some of the general parameters of this drain are as follows:

(EFFLUENTS OF MUIR MILL NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.38
3	BOD (mg/l)	:	85.3
4	COD (mg/l)	:	210
5	TSS (mg/l)	:	421
6	TDS (mg/l)	:	774
7	Cl^- (mg/l)	:	160
8	NH_3-N (mg/l)	:	40.9
9	NO_3 - (mg/l)	:	2.01
10	DO (mg/l)*	:	-
11	TC (MPN/ 100 ml)#	:	160000000
12	FC (MPN/ 100 ml)#	:	160000000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

(EFFLUENTS OF MUIR MILL NALLAH-TRACE METAL/HEAVY METAL)

Sl. No.	Parameters	Results	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	BDL
4	Copper (Cu) mg/l	:	-
5	Iron (Fe) mg/l	:	2.34
6	Lead (Pb) mg/l	:	BDL
7	Manganese (Mn) mg/l	:	0.16
8	Nickel (Ni) mg/l	:	0.02
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	0.28
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		-
14	Vanadium (V) mg/l		-

According to the UPJN, the drain has been tapped, however, there is an overflow of 3.13 MLD. They wish to strengthen the tapping and by gravity through pipeline be taken to Parmath pumping station and then ultimately to

sewer line laid till Jajmau. The MOWR supports this view. According to the Central Pollution Control Board, this is not proper because the over flow noticed by the Joint Inspection Team was 8.45 MLD and not 3.13 MLD. It carries sewage and even other elements. It would be better to provide treatment at the end of the pipeline, 1 kilometre away from the river Ganga. MoEF&CC &CC supports the view of the CPCB. According to the UPPCB, the tapping should be strengthened and capacity enhancement be done. It is incontrovertible that there is no land available for establishment of STP.

We would have preferred the end of pipeline treatment of this drain. However, non-availability of land is a serious impediment for construction of the STP. That be so, there being partial infrastructure in existence for tapping of the drain and carrying its effluent to Jajmau finally. As already acknowledged, the drain carries pollutants, therefore, we direct that the drain should be completely tapped so as to avert overflow from the tapping point. The tapping point should be upgraded and strengthened appropriately and subject to compliance of other general directions issued in this judgement.

GOLAGHAT NALLAH

85. This drain also meets river Ganga on its right bank. The length of this drain is 0.5 kilometre. It has the flow of 1.44 MLD and carries domestic & sewage discharge. It is not

one of the major drains joining river Ganga. However, upon the analysis of the general parameters, the drain shows to carry serious pollutants. The analysis report reads as under:

(EFFLUENTS OF GOLAGHAT NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.34
3	BOD (mg/l)	:	143
4	COD (mg/l)	:	289
5	TSS (mg/l)	:	234
6	TDS (mg/l)	:	937
7	Cl- (mg/l)	:	152
8	NH_3-N (mg/l)	:	42.9
9	NO_3 - (mg/l)	:	0.876
10	DO (mg/l)*	:	-
11	TC (MPN/ 100 ml)#	:	92000000
12	FC (MPN/ 100 ml)#	:	92000000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

(EFFLUENTS OF GOLAGHAT NALLAH-TRACE METAL/HEAVY METAL)

Sl. No.	Parameters	Results	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	0.02
4	Copper (Cu) mg/l	:	-
5	Iron (Fe) mg/l	:	1.22
6	Lead (Pb) mg/l	:	BDL
7	Manganese (Mn) mg/l	:	0.16
8	Nickel (Ni) mg/l	:	BDL
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	0.52
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		-
14	Vanadium (V) mg/l		-

Besides this, it also carries metals like chromium, iron,

manganese and zinc, etc. The proposal of the stakeholders is that the drain should be tapped and effluent be taken to Parmath pumping station or any other nearest pumping station which will send the effluent to the sewer line leading to the STP/CETP at Jajmau. Sewer system has also been proposed in the catchment area of this drain. Therefore, we direct that this drain be fully and completely tapped and the effluent be taken to Parmath pumping station or any other nearest pumping station to finally put the effluent into sewer line leading to Jajmau.

BHAGWAT DAS GHAT DRAIN/GUFTAR GHAT NALLAH, SATTICHAURA GHAT DRAIN AND DABKA NALLAH DRAIN-3:

86. All these drains have their confluence point on the right bank of river Ganga. They are nearly 1.3 kilometers, 0.7 kilometer and 1 to 2 kilometers long, respectively. They carry flow of nearly 11.5 MLD, 1.54 MLD and 1.23 MLD. We make it clear that the Joint Inspection Team while examining the Dabka Nallah, found that the water of river Ganga was flowing into the drain at the confluence point, as the drain had been tapped. The effluent of the two drains, namely, Bhagwat Das drain and Sattichaura ghat drain showed high pollutants which are as follows:

(EFFLUENTS OF BHAGWAT DAS GHAT DRAIN- GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.24
3	BOD (mg/l)	:	95

4	COD (mg/l)	:	261
5	TSS (mg/l)	:	147
6	TDS (mg/l)	:	722
7	Cl- (mg/l)	:	139
8	NH_3-N (mg/l)	:	48.7
9	NO_3 - (mg/l)	:	2.17
10	DO (mg/l)*	:	-
11	TC (MPN/ 100 ml)#	:	92000000
12	FC (MPN/ 100 ml)#	:	92000000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

AND

(EFFLUENTS OF SATTICHAURA GHAT DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.42
3	BOD (mg/l)	:	56.8
4	COD (mg/l)	:	130
5	TSS (mg/l)	:	107
6	TDS (mg/l)	:	518
7	Cl- (mg/l)	:	73.2
8	NH_3-N (mg/l)	:	26.7
9	NO_3 - (mg/l)	:	2.15
10	DO (mg/l)*	:	-
11	TC (MPN/ 100 ml)#	:	22000000
12	FC (MPN/ 100 ml)#	:	13000000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed Drains & River

The metals and pesticides were found to be below detectable limits or within the prescribed limits. The wastewater from Dabka drain was taken to the STP for treatment. It was commonly conceded before the Tribunal that no land is available for construction of an STP at the end of the pipeline. Bhagwat Das drain interception has been constructed for quite some time and it is nearly 300 meters away from the riverbed. The discharge has

increased due to large population settling on the land falling within that 300 meters. It is proposed before the Tribunal that all these three drains should be intercepted, not in excess of 50 meters from the bank of river. The interceptors should be connected to a pumping station at Guftar Ghat Nallah, where it will be connected to sewer line leading to Jajmau. In the minutes dated 28th February, 2017, similar suggestion was made. In relation to the tapping location, it is submitted that Bhagwat Das drain could be tapped at new SPS site, Sattichaura drain at district-1 and Dabka Nallah drain at the existing place. We find the proposal acceptable. However, to ensure that from the point of tapping at the point of confluence, no effluent should enter into river Ganga and no waste should be permitted to go through that channel. It is directed that besides tapping the three drains taking the effluent to the pumping station at Guftar Ghat drain and finally to Jajmau, the three drains at their end should be sealed towards the river. In fact, this order was passed by the Tribunal on 20th April, 2017 which is reiterated. The waste deposited in the drains beyond the point of tapping should be mechanically lifted and appropriately dumped at regular intervals.

HEMRAJ DRAIN

87. The drain after flowing for a length of 5 to 8 kilometres joins river Ganga on its left bank in Bijnor. The drain

primarily carries domestic waste and sewage and has a flow of nearly 91.260 MLD. The Bijnor sewage drain meets this drain. Upon analysis, the effluent of the drain was found to be polluting with high values of Total Coliform and Faecal Coliform. In fact, it was found to be containing arsenic and iron, though of a very low value. General parameters upon analysis show the following results:

(EFFLUENTS OF HEMRAJ DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.82
3.	BOD (mg/l)	:	5
4.	COD (mg/l)	:	24
5.	TSS (mg/l)	:	2.0
6.	TDS (mg/l)	:	204
7.	Cl^- (mg/l)	:	12
8.	NH3-N (mg/l)	:	07
9.	NO3-(mg/l)	:	BDL
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	92×10^4
12.	FC (MPN/100 ml)#	:	47×10^3

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

In the catchment area of this drain, is located Hemraj colony and presently there is no STP in existence. However, STP of capacity of 24 MLD is under construction at Bijnor and 60 per cent work has already been completed. Sewage network is completed, however, it is still to be commissioned. Interception of the drain is not required. It is commonly stated by all the stakeholders that this drain primarily carries water from river Ganga and the main pollutant is the Bijnor drain. Further it is suggested that the Bijnor drain be treated by interception

and the waste is pumped to the STP of 24 MLD being constructed at Bijnor. The STP should be upgraded in order to check the BOD, COD, TSS and bring the entire effluent within the prescribed standards. It is also propounded that toxic tank should be added to the STP with proper filters.

As the STP is already under construction and 60 per cent work has already been completed, we direct that the STP at Bijnor should be completed expeditiously but it must ensure that the technology provided in the STP should have appropriate capacity to be able to treat all the effluents including coliform and other pollutants as afore indicated. We direct that along with STP, soaking tank should be constructed with proper filtration system.

CHHOIYA DRAIN

88. Chhoiya drain was essentially an irrigation canal with a discharge of 138 MLD. It is a major drain and joins river Ganga on its left bank. It has a length of about 60 kilometres. There are heavy polluting industries located near this drain. There are two distillery industries and one paper and pulp industry. The Tribunal had issued notices to the industries, which are polluting this drain. Those cases are being separately dealt with. The effluents of the drain were subjected to analysis by the Joint Inspection Team and upon analysis it has been found that there are high pollutants in the effluent. The Joint Inspection Team

observed that there was heavy back flow of river in the drain. The water was slightly black and had 137.8 MLD of flow. Arsenic, iron, manganese, zinc etc. were found but were within permissible limits. General parameters provided the following upon analysis:

(EFFLUENTS OF CHHOIYA DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	--
2.	pH	:	7.73
3.	BOD (mg/l)	:	7
4.	COD (mg/l)	:	56
5.	TSS (mg/l)	:	33
6.	TDS (mg/l)	:	416
7.	CL^- (mg/l)	:	35
8.	NH_3-N (mg/l)	:	18
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	16×10^3
12.	FC (MPN/100 ml)#	:	35×10^2

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

There are three rural centres located within the catchment area of this drain. The parties agree that there are two options available for dealing with pollution generated which flows in this drain. There are three grossly polluting industries in the catchment area of the drain. Firstly, it is suggested that they should be preferably ZLD and if possible, there should be direct and regular supervision of the SPCB and other authorities to ensure that their parameters are strictly within the prescribed limits. This drain should be provided with the end of the pipeline treatment by setting up of a CETP as there is sewage, trade effluent and the effluent even contains metals. There is

use of zinc by the fertilizer industry and the discharge from them ultimately meets this drain which spells out as to how zinc has been found in the effluent. The drain should be de-silted immediately and the colour content should be removed so as to ensure that in future the drain is not polluted and does not cause colour mixing. One time cleaning of the drain on all the parameters should be prescribed.

Secondly, it is suggested that the three rural centres located in the catchment area should be provided with decentralized treatment by establishment of oxidation ponds or any other appropriate technology. The remaining then should be treated only through an STP in place of a CETP. If the effluents are appropriately treated in the three rural catchment areas which are discharging into the drain and the three industries are properly regulated by ZLD or other measures, then there arises no need for CETP to be constructed at the end of the pipeline.

Upon examining the rival contentions raised by the stakeholders, the Tribunal is of the considered view that it will be more appropriate to construct or provide the three rural areas in the catchment area of the drain with oxidation ponds. The effluent from these oxidation ponds should be taken to the STP that is proposed to be constructed at some distance from the point where Chhoiya drain meets river Ganga. The three major

industries afore-noticed should be directed to become ZLD either by incineration process or by recycling of 100% treated effluent. They should strictly comply with the prescribed standards for treatment of the trade effluent of these industries. The remnant from both these sources should be taken to STP where it should be treated. The treated effluents should be recycled and treated effluent not in excess of 25% should be discharged into the river Ganga.

Further, the drains should be dredged, de-silted and cleaned and all the effluents and colour even on the soil-bed of the drain should be removed, to ensure that there is no pollution generated in future. Furthermore, the land/area falling prior to the STP and the municipal limits, in future would not be permitted to discharge any sewage or effluents into this drain. In the area which is stated to be approximately 5 kilometres, if any, development, industrial and/or residential, is permitted then such development will not be permitted unless such development project has CETP/STP of required capacity capable of treating the effluent generated as a result of the development and it will only be the treated effluent that would be permitted to be discharged in the main Chhoiya drain. Every effort should be made to restore the drain to its original nature of being a canal.

BAGAD RIVER (DRAIN)

89. This drain, in fact, is a river and is stated to be nearly 200 kilometres long. However, it remains dry after nearly 15 kilometres from Gajraula. There are nearly 12 huge industries like sugar, chemical, fertilizer, distillery, pharmaceutical, pulp and paper, dairy and silica etc. in the catchment area of the drain. All these industries are highly polluting industries and discharge their effluents into this drain. This drain is called as Mahua drain before the confluence point with river Ganga by nearly 10 kilometres. The colour of the effluent was found to be black towards the end which is indicative of presence of high pollutants. The Joint Inspection Team collected the effluent from the drain near Jubilant industry in Gajraula and the analysis results thereof are as follows:

(EFFLUENTS OF BAGAD RIVER (DRAIN)-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	--
2.	pH	:	7.74
3.	BOD (mg/l)	:	282
4.	COD (mg/l)	:	606
5.	TSS (mg/l)	:	479
6.	TDS (mg/l)	:	7948
7.	CL^- (mg/l)	:	116
8.	NH_3-N (mg/l)	:	12
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	35×10^5
12.	FC (MPN/100 ml)#	:	11×10^5

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF BAGAD RIVER (DRAIN)-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL

3.	Total Chromium (Cr) mg/l	:	0.02
4.	Copper (Cu) mg/l	:	0.03
5.	Iron (Fe) mg/l	:	3.85
6.	Lead (Pb) mg/l	:	0.02
7.	Manganese (Mn) mg/l	:	0.32
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.17
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	0.02

(EFFLUENTS OF BAGAD RIVER (DRAIN)-PESTICIDE)

Sl.No.	Parameters		Results
1.	Water temperature (°C)	:	
	Pesticide analysis Report (OPPs)		
2.	Monochrotophos	:	-
3.	Dimethoate (µg/l)	:	BDL
4.	Methyl Parathion (µg/l)	:	BDL
5.	Malathion (µg/l)	:	BDL
6.	Chloropyriphos (µg/l)	:	BDL
7.	Methyl Parathion	:	-
8.	Ethion (µg/l)	:	BDL
	Pesticide Analysis Report (OCPs)		
9.	α-BHC	:	0.264
10.	β-BHC	:	0.149
11.	γ-BHC	:	-
12.	δ-BHC	:	-
13.	Total BHC (ng/l)	:	-
14.	Aldrin (ng/l)	:	BDL
15.	Diedrin (ng/l)	:	BDL
16.	α-Endosulfan	:	BDL
17.	Total Endosulfan (ng/l)	:	
18.	β-Endosulfan	:	BDL
19.	OP'DDT	:	1.109
20.	PP'DDT	:	0.153
21.	PP'DDE	:	BDL
22.	Total DDT (ng/l)	:	-

The Joint Inspection Team noticed that it carries industrial effluent and originates near Dadiyal in Amroha district, after travelling for nearly 20 kilometre from Gajraula, it becomes dry.

The industries located in the catchment area of this drain were issued notices by the Tribunal and their cases have been dealt with individually. In fact, some of these industries were ordered to be shutdown after their assurance to take all anti-pollution measures and after imposing environmental compensation, they were permitted to operate subject to inspection by the Joint Inspection Team at a subsequent day. They were required to operate their ETP without default. The UPJN has not made any other suggestions except preventing and controlling industrial pollution of this drain. All the stakeholders commonly submitted that the sewage drain constructed by Nagar Palika Parishad of Gujraula near NH-24, there should be an STP constructed at the end of that drain. All the 12 industries should operate strictly in terms of the conditions of the 'Consent to Operate'. The conditions of consent should ensure that they do not cause any pollution or discharge effluent in excess of the prescribed parameters. If they are found violating, the prescribed norms and conditions of the consent, they should be ordered to be closed. One industry M/s. Insilco is itself discharging 6 MLD of effluent every day. Thus, we

issue the following directions in relation to this drain:

a) The Bagad river (drain) inclusive of Mahua, should be cleaned, dredged and maintained as a river or storm water drain.

b) All the 12 industries located in the catchment area of this drain, which are highly polluting should be put under strict surveillance by the UPPCB as well as the Joint Inspection Team.

c) The Joint Inspection Team has already been directed to inspect these industries to conform with appropriate conditions for permitting and operating all these functions.

d) These industries have been directed to comply with the conditions of the consent order and directions issued by the Joint Inspection Team under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and Environmental (Protection) Act, 1986.

e) In the event of these industries not complying with such directions, they shall be liable to be closed without any further notice.

f) The Joint Inspection Team and the UPPCB shall submit compliance report in relation to these industries before the Tribunal upon regular intervals.

PHULDERA DRAIN

90. Phuldera drain is about 35 kilometres long and primarily

carries industrial effluent with a load of 14 MLD approximately. This drain meets river Ganga on its right bank in Ghaziabad. The source of the effluent is attributed to the distillery, sugar, food and dairy industries. During the inspection, the Joint Inspection Team observed that solid waste was floating in the drain. The Committee also found Eichhornia growth in the drain. The effluent sample was collected near Bahadurgarh village after confluence of drain into Siyana escape. Upon analysis, the metals and pesticides were noticed either below the detectable limit or within the permissible limit. However, the general parameters were found to be violative of the prescribed standard and read as follows:

(EFFLUENTS OF PHULDERA DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	N/A
2.	pH	:	7.25
3.	BOD (mg/l)	:	42
4.	COD (mg/l)	:	96
5.	TSS (mg/l)	:	51
6.	TDS (mg/l)	:	268
7.	Cl^- (mg/l)	:	27
8.	NH_3-N (mg/l)	:	7
9.	NO_3^-(mg/l)	:	1
10.	DO (mg/l)	:	NIL
11.	TC (MPN/100 ml)#	:	16×10^8
12.	FC (MPN/100 ml)#	:	11×10^7

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

Siyana Escape channel carries effluent of sugar and distillery mills as they are discharging the same into the Phuldera drain. In fact, the distillery industry was directed to be closed down, however the sugar mill has been

operative. In the case of *Krishna Kant Singh*, O.A. No. 299 of 2013 (supra), the Tribunal had not only closed down Sambhaoli sugar mills and distillery but had even imposed a compensation of ₹ 5 crores and they were permitted to operate their sugar unit only after complying with the conditions imposed by the Joint Inspection Team. Such stringent measures should be taken by the concerned Boards against all such industries to ensure that they are not permitted to pollute the drain which meets the river. All these industries should be directed to strictly adhere to discharge effluents in consonance with prescribed parameters, failing which they should be ordered to be shut down. Decentralized system should be provided to similar drains that join Siyana escape and once the industrial pollution is controlled satisfactorily, there would be no need for construction of STP at the end of the pipeline. UPJN has also not suggested anything else, except preventing and controlling the industrial pollution and their ETPs and OCEMs to be made effective and functional. We accept the submissions jointly made on behalf of all the stakeholders and order accordingly that the Joint Inspection Team and UPPCB shall maintain strict vigil over the functioning of these industries and submit appropriate representation before the Tribunal.

BHAIROGHAT/TOKAGHAT DRAIN AND DHINAPUR DRAIN

91.

Both these drains after flowing for a distance of 6 to 7 kilometres and 1.5 kilometres approximately, join river Ganga. They carry a load of 22.1 MLD and 1.62 MLD which is stated to be 24 MLD and 3 MLD respectively by UPJN. The first drain is a major drain while the latter is a minor drain. The Joint Inspection Team collected the samples for analysis near Bhairav temple in Bhairavghat and the analysis report shows the general parameters highly violative of the prescribed norms that read as under:

(EFFLUENTS OF BHAIROGHAT DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.67
3.	BOD (mg/l)	:	28
4.	COD (mg/l)	:	108
5.	TSS (mg/l)	:	195
6.	TDS (mg/l)	:	1082
7.	CL^- (mg/l)	:	221
8.	NH_3-N (mg/l)	:	37
9.	NO_3^-(mg/l)	:	BDL
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	7,90,000
12.	FC (MPN/100 ml)#	:	1,40,000

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

In relation to Dhinapur drain it was stated that Bhairoghat Drain carries mixed effluents, particularly, from the dairy industry. Besides sewage, the general parameters of Dhinapur Drain were found to show adverse results which read as under:

(EFFLUENTS OF DHINAPUR DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.34

3.	BOD (mg/l)	:	35.4
4.	COD (mg/l)	:	136
5.	TSS (mg/l)	:	35.4
6.	TDS (mg/l)	:	865
7.	Cl^- (mg/l)	:	144
8.	NH_3-N (mg/l)	:	38.1
9.	NO_3^-(mg/l)	:	3.03
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	14,00,000
12.	FC (MPN/100 ml)#	:	7,00,000

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

There are small dyeing units having their own ETP at Farukhabad city. These industries have been directed to be shifted to the Textile Apparel Park being built up by the Textile industry. The proposal, in relation to these two drains for an STP of 30 MLD, is to be constructed at Dhinapur, at a site which is 1 kilometre away from the river, and there is no habitation in the area. After treatment, the treated water should be recycled for agricultural purposes and remnant discharged into the river. The industrial effluent is of a very mild nature and falls within the prescribed parameters. In light of the above submissions we direct as follows:

a) An STP of 30 MLD is to be constructed at Dhinapur at the proposed site.

b) The area bereft of habitation shall not undergo any development unless and until the developer or the concerned agency, whether governmental or otherwise install/construct its own STP so that no further effluents are added to the drain after the point

where the STP is being constructed and at the confluence point.

c) The water from STP should be recycled and reutilized for agricultural purposes.

d) The proposed CETP at Farukhabad should be constructed without any further delay but before clearance of the project, the concerned stakeholders shall ensure that the load quality of the effluent arriving at the CETP is completely analysed with reference to the capacity and technology of the CETP.

SHEETLABAZAR DRAIN, BUDHIYA GHAT DRAIN AND WAZIDPUR NALLAH

92. All these three drains join river Ganga on its right bank and flow for approximately a distance of about 1 kilometre each. They carry a flow of nearly 15.6 MLD, 6.5 MLD and 11.7 MLD, respectively in Jajmau catchment. These drains carry highly polluted mixed effluents. Around 400 tannery units located in Jajmau cluster discharge their effluents into these three drains. The colour of the effluent before it joins river Ganga was found to be black. It will be appropriate to refer to the analysis reports which read as under:

(EFFLUENTS OF SHEETLABAZAR DRAIN)

1.	Charact-eristics	Colour	:	Black
		pH	:	8.09
		TSS	:	887
		TDS	:	6065
		Cl^-	:	35.5
		SO_4^{2-}	:	1198
		S	:	36.9
		P	:	8.95

		Nitrate as N	:	22.6
		Nitrite as N	:	BDL
		Am Nitrogen	:	232
		O&G	:	12.6
		BOD (mg/l)	:	35.5533
		COD (mg/l)	:	1649
2.	Heavy Metals	Arsenic (As) mg/l	:	BDL
		Cadmium (Cd) mg/l	:	BDL
		Total Chromium (Cr) mg/l	:	11.04
		Copper (Cu) mg/l	:	-
		Iron (Fe) mg/l	:	0.88
		Lead (Pb) mg/l	:	BDL
		Manganese (Mn) mg/l	:	0.22
		Nickel (Ni) mg/l	:	BDL
		Mercury (Hg) mg/l	:	
		Zinc (Zn) mg/l	:	0.28
		Antimony (Sb) mg/l	:	
		Cobalt (Co) mg/l	:	BDL
		Selenium (Se) mg/l	:	
		Vanadium (V) mg/l	:	
3.	DO (For Fresh water carrying drains/rivers)		:	NA
4.	For sewage, mixed Drains & River	TC (MPN/ 100 ml)	:	1.7×10^7
		FC (MPN/ 100 ml)	:	1.3×10^7

The Joint Inspection Team also noticed that these drains were carrying tannery effluent along with inseparable

sewage. Part of the effluent was being sent to CETP at Jajmau while surplus was being discharged in river Ganga without any treatment. The Committee further observed that treatment of the wastewater, which is being directly discharged into river Ganga, should be taken care of on an urgent basis.

The UPJN was not able to furnish the requisite data to the Tribunal and therefore, their Project Manager was directed to be present before the Tribunal. On 21st April, 2017, he appeared before the Tribunal and provided information to the Tribunal which was duly recorded. We may refer to the relevant part of the order dated 21st April, 2017:

> "It is submitted that, these three drains are highly polluting drains. They carry tannery effluent, sewage, other waste and pesticides as well. It is stated that there are nearly 13 unauthorised colonies and 18 slums located in the catchment area of these three drains. Total area is round about 13.5 Sq. Km. and distance between these three drains is maximum 4.5 Km. There is a population of more than 2 Lakhs and about 16 thousand sewer connections have been provided and nearly 25% of the area population remains unconnected to the sewer connection. Keeping in view the entire load of these drains in mind and the attendant circumstances according to the Nigam, all three drains should be tapped and the effluents pumped to the main CETP/Chromium Plant to be established at the Jajmau Plant area. He submits that end of the pipeline treatment may not be feasible, because there is no land available on the either side of the drains as they are densely populated.
>
> The Learned Counsel appearing for the

> Ministry of Water Resources upon instructions from the Director submits that they support the view taken by the Nigam and would prefer interception of these drains and pumping of the waste to the main treatment plant, to be established at Jajmau and end of the pipeline treatment may not be possible in relation to these three drains. Tapping has been provided in the channels and not on the main drain. So the drains carry their own effluent as well as there is overflow from the tapping provided through this channel. The Learned Counsel appearing for Uttar Pradesh Pollution Control Board stated that physically it is not possible to provide at the end of the pipeline treatment to Drain No. 26, 27 and 28, for the reasons already stated by the other stakeholders and these all need to be intercepted and taken to the main plant at Jajmau. There has to be a separate Chromium Recovery Plant and CETP capable of treating quality of effluent that is being generated in this area. It is also stated that drain should be blocked at the end of the pipe to ensure that even in the case of overflow etc. effluent does not enter into River Ganga normally.
>
> The Member Secretary, Pollution Control Board also supports this view subject to the main plant become fully operative."

From the information afore provided, it became evident that the end of the pipeline treatment of these three drains was not possible. Keeping in view the limitation afore stated, the scope and dimensions of the pollutants that are being generated in the catchment area of these three drains, it was suggested that these drains need to be tapped and finally taken to the CETP of an appropriate capacity and quality, and there has to be a separate

Chromium Recovery Plant.

We would be discussing the pollution load, treatment to be provided and the methodology to be adopted for preventing and controlling the pollution generated from these three drains as all of them are located in Jajmau. It will be more appropriate to discuss that aspect in relation to these drains as well as other drains in the part of the judgement that deals with Jajmau exclusively.

CITY JAIL DRAIN

93. The drain meets river Ganga downstream of Unnao, Kanpur. This drain meets with river Ganga on its left bank. All the stakeholders (MoEF&CC; MoWR; CPCB; UPPCB; UPJN and all other stakeholders) agree that the drain shown as City Jail drain is 30 Kilometres long and has discharge of 86 MLD as per the Joint Inspection Team. However, according to the UPJN within the municipal limits the discharge is 11.5 MLD. This drain carries industrial effluent of 47 tannery units and other units. The units have ETPs which are not at all operating satisfactorily. The parameters of Inlet samples are as follows:-

CETP AT BANTHAR

Sl. No.	Parameter	Value
1.	TDS	14,578 mg/l
2.	BOD	1,250 mg/l
3.	COD	2,231 mg/l
4.	Total Chromium	21.10 mg/l
5.	Oil & Grease	64.60 mg/l

CETP AT UNNAO

Sl. No.	Parameter	Value
1.	TDS	13,982 mg/l
2.	BOD	1,152 mg/l
3.	COD	1,962 mg/l
4.	Total Chromium	27.60 mg/l
5.	Oil & Grease	72.70 mg/l

It carries high pollutant such as chromium and pesticides etc. which are very injurious to the health of the river, environment and public health. The drain directly meets river Ganga and therefore, it is source of direct pollution.

It carries effluent from tannery, textile, edible oil, steel and chemical industries, slaughter houses, leather boards, etc. Its total load as per Joint Inspection Team near Unnao bypass, Atta village is 85.82 MLD while according to the UPJN it is 9.33 MLD. However, the said discharge does not meet river Ganga but is within the municipal limits. The data collected by UPJN is quite old and documentation in support thereof has not been produced before the Tribunal. Therefore, we will proceed with the data provided by the Joint Inspection Team as it is based on physical verification and has been collected by experts in the field. Thus, it would be safe to take the flow of the drain as 85.82 MLD. In the catchment area of this drain, Magarwara and Leather Technology Park Banthar and

CETP Banthar are located. The sample from the drain, collected at Unnao was found to be almost dark black/brown. After travelling along the drain for about 20-25 km, it was observed that the water quality of the drain improves. Thus, the major source of pollution of this drain is the industrial effluents from Banthar and domestic waste discharge from Magarwara. There are nearly 47 units at Banthar. Though, majority of them have their own ETPs but they are hardly performing. Some are members of the CETP itself, which is practically inoperative for all intents and purposes of controlling pollution. The Joint Inspection Team collected the samples of the effluents at the bypass of Unnao N.H. 25 and analysis reports paint a very grim picture, indicating very high pollutants, particularly, in relation to general parameters. The analysis reports of the effluents can be usefully reproduced hereunder:

(EFFLUENTS OF CITY JAIL DRAIN-GENERAL PARAMETERS)

Sl. No.	**Parameters**	**Results**	
1	Colour	:	-
2	pH	:	7.38
3	BOD (mg/l)	:	109
4	COD (mg/l)	:	441
5	TSS (mg/l)	:	277
6	TDS (mg/l)	:	5266
7	Cl- (mg/l)	:	1906
8	Sulphate		1260
9	Sulphide		16.3
10	Oil & Grease		12.4
11	NH_3-N (mg/l)	:	-
12	NO_3 - (mg/l)	:	-
13	DO (mg/l)*	:	-
14	TC (MPN/ 100	:	7,90,000

	ml)#		
15	FC (MPN/ 100 ml)#	:	4,90,000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed drains & river

(EFFLUENTS OF CITY JAIL DRAIN-TRACE METAL/HEAVY METAL)

Sl. No.	**Parameters**	**Results**	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	2.24
4	Copper (Cu) mg/l	:	-
5	Iron (Fe) mg/l	:	1.48
6	Lead (Pb) mg/l	:	BDL
7	Manganese (Mn) mg/l	:	0.52
8	Nickel (Ni) mg/l	:	0.02
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	3.02
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		-
14	Vanadium (V) mg/l		-

(EFFLUENTS OF CITY JAIL DRAIN-PESTICIDE)

Sl. No.	**Parameters**	**Results**	
1	Water temperature (°C)	:	Awaited
Pesticide Analysis report (OPPs)			
2	Monochrotophos		
3	Dimethoate (µg/l)	:	
4	Methyl Parathion (µg/l)	:	
5	Malathion (µg/l)	:	
6	Chloropyriphos (µg/l)	:	
7	Methyl Parathion	:	
8	Ethion (µg/l)	:	
Pesticide Analysis Report (OCPs)			
9	α-BHC	:	BDL
10	β-BHC	:	0.53
11	γ-BHC	:	BDL
12	δ-BHC	:	BDL
13	Total BHC (ng/l)	:	BDL
14	Aldrin (ng/l)	:	BDL
15	Diedrin (ng/l)	:	BDL
16	α-Endosulfan	:	BDL

17	Total Endosulfan (ng/l)	:	BDL
18	β-Endosulfan	:	BDL
19	OP'DDT	:	BDL
20	PP'DDT	:	BDL
21	PP'DDE	:	BDL
22	Total DDT (ng/l)	:	BDL

The suggestion of all the stakeholders along with the Association operating the CETP is that the said CETP should be upgraded in both terms of capacity and technology. It should be fully equipped to deal with various pollutants including the metals etc. Besides this, an STP of 12.5 MLD is proposed. This STP would treat the sewage coming from Magarwara. The STP is to be located at a distance of 17 kilometers away from the river. There is sufficient land available and there is no habitation in this stretch. Both the CETP and STP should operate effectively to prevent pollution of river Ganga. The industries located across the National Highway which are distillery, textile and tannery units should be directed to establish their own anti-pollution devices and the effluent discharged from these industries should not exceed the prescribed parameters. In the event of default, it is proposed that the industry should not be shut down but should be subjected to regular joint inspection as well as supervisory inspection by the UPPCB.

The matters in relation to grant of 'consent to operate' to these industries should be dealt with expeditiously, strictly incorporating the conditions for consent to operate. There

have been serious deficiencies in the implementation of the regulatory regime of all these industries which are highly polluting industries. The analyzed sample at the inlet of the CETP of 4.5 MLD afore-stated clearly show that all these industries are discharging effluents containing high pollutants in violation to the conditions stated in consent to operate.

The directions to be issued by the Tribunal in this case in relation to this drain have to be very specific, covering the concerned areas for controlling pollution. Therefore, we issue the following directions:

1. The existing CETP of 4.5 MLD should be upgraded in terms of capacity, design and quality so as to meet the prescribed parameters. The entire effluent from these industries, containing high pollutant load should be diverted to the CETP and treated to bring the effluents within the prescribed norms.

2. There should be construction of a Chromium Recovery Plant prior to the CETP, where the entire chromium should be recovered, recycled and sold for use to the tannery industries or in the market at large. There is no dispute that chromium has enough market, particularly in that area. The industries which are not complying with the prescribed parameters and/or do not become

members of the CETP shall be ordered to be shut down by the UPPCB.

3. The STP as proposed, of 12.5 MLD should be constructed and the entire sewage from that area, particularly, Magarwara and other places should be brought to the STP and treated. The treated sewage water should be recycled in industries such as industrial, agriculture, horticulture and other purposes in that area.

4. The Regulatory Regime and Supervisory control of UPPCB and other concerned authorities including the Association of CETP has failed to bring the desired results. The industries should be asked to bring their parameters within the prescribed limit as well as to ensure that chromium is sent to the Chromium Recovery Plant, prior to it being mixed with the sewage. In fact, the industrial effluent and the sewage are proposed to be dealt with separately which all the stakeholders, particularly, the executing agency should enforce without default.

5. Both CETP and STP should operate to their optimum capacity and effectively to prevent pollution of river Ganga.

6. The CETP and all the industries located in the catchment area of this drain should be subjected

to proper supervisory control by the UPPCB.

7. All the industries of any kind which are water polluting industries located in this area within the catchment area of this drain shall pay 25% of the total cost of up-gradation of CETP and construction of STP as afore-stated.
8. The Association running the CETP shall be responsible for proper O&M of the CETP. Every industry located in that area whose effluents are being sent to the CETP shall be member of the CETP association and would be liable to pay such monthly amount as may be determined by the State of UP in consultation with the Association of the CETP.
9. The CETP and all the industries located in the catchment area of this drain should be subjected to proper supervisory control by the UPPCB.
10. There shall be a separate chromium recovery plant before the CETP, the chromium so recovered shall be recycled and utilized for tannery purpose and/or sold in the open market. The industries which are not complying with the prescribed parameters and/or do not become members of the CETP shall be ordered to be shut down by the UPPCB.
11. If any development by a government agency or a

private stakeholder is undertaken at any point of time in future, the said development would not be permitted to be carried out unless and until the said development be it industrial or residential has first installed a STP/CETP as the case may be from that CETP/STP only treated effluent strictly as per prescribed norm should be recycled, reused for agriculture, horticulture purposes and the remnant of the treated discharge should alone be permitted to be put into the drain/river.

LONI DRAIN

94. This drain flows for a length of about 150 kilometers before it confluences with river Ganga at village Bhiti in District Raebareli. The drain carries mixed effluents with a load of 21.67 MLD as per the Joint Inspection Team. However, according to the UPJN, flow is 0.8 MLD within the municipal limits. Unquestionably, the remnant of the effluents comes to the drain at the end of the municipal limit or thereafter. But in any case, this data is quite old. The drain is polluted, however, towards the end where it meets river Ganga, water is little green in color. Industrial area site-I and II fall in the catchment area of this drain. This drain has tributaries that carry sewage. The proposal of the stakeholders as well as the industrial association is to upgrade the existing CETP of 2.15 MLD run by Unnao Tannery Association. This CETP is not working properly

and the effluent discharge is in violation of the prescribed norms. The Joint Inspection Team collected the samples of the drain from near Loni drain bridge and the pollutants were found to be as follows:

(EFFLUENTS OF LONI DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.4
3	BOD (mg/l)	:	736
4	COD (mg/l)	:	1439
5	TSS (mg/l)	:	5274
6	TDS (mg/l)	:	4466
7	Cl- (mg/l)	:	25.8
8	Sulphate		258
9	Sulphide		11
10	Oil & Grease		10.4
11	NH_3-N (mg/l)	:	-
12	NO_3 - (mg/l)	:	-
13	DO (mg/l)*	:	-
14	TC (MPN/ 100 ml)#	:	33,00,000
15	FC (MPN/ 100 ml)#	:	33,00,000

*For Fresh water carrying drains/ Rivers
#For sewage, mixed drains & river

Besides this, it contains chromium to the value of 0.2 mg/l, iron 0.58 mg/l, manganese 0.20 mg/l and zinc 1.24 mg/l. Having heard the stakeholders and the other industries as well, we direct as follows:

1. The existing CETP of 2.15 MLD run by Unnao Tannery Association shall be upgraded in terms of capacity, design and quality so as to conform to the prescribed parameters upon due study.
2. The tributaries of Loni drain that carry sewage would be intercepted and taken by gravity or by pumping to Jail drain where STP of 12 MLD and the STP capacity

of 12.5 MLD should be constructed taking into consideration the inflow after interception of tributaries of Loni drain.

3. Industrial effluents of Loni drain should be treated by upgrading the CETP.
4. All the industries, slaughter houses and tannery industries should become members of the CETP at Unnao to upgrade the CETP. It shall be operated effectively and it should be ensured that it brings the trade effluent parameters within the prescribed limits. All the industries located in the catchment area of Loni drain shall contribute 15% cost of the up-gradation of the CETP and would also pay monthly O&M charges to the CETP Association as may be determined by State of UP in consultation with UPPCB and the Unnao Tannery Association.
5. The interception of the drain should take place at the end of the Housing Board drain where it meets Loni drain.
6. There shall be a separate Chromium Recovery Plant before the CETP, the chromium so recovered shall be recycled and reutilized for tannery purpose and/or sold in the open market. The industries which are not complying with the prescribed parameters and/or do not become members of the CETP shall be ordered to be shut down by the UPPCB.

DRAINS JOINING RAMGANGA AND DIRECTIONS THEREOF

95. River Ramganga is one of the major tributaries of river Ganga. Unfortunately, it is also the highly polluted river. It has a length of 596 kilometers with total discharge flow of 728.13 MLD and BOD load of 41.12 TPD from 25 drains. The river is polluted by heavy discharge from sugar industries, distillery industries, pulp & paper industries, textile and dyeing industries etc. Strangely, another paramount source of pollution in river Ramganga is dumping of electroplating waste on its floodplains. It carries effluents beyond prescribed limit with regard to BOD, COD, TDS, metals like Copper, Cadmium, Zinc, Nickel, Lead and also contains extremely high Faecal Coliform. The total Faecal Coliform in drains is in range like $35x10^8$ MPN/100 ml and in the river it ranges from 24,000 to 35,000 MPN/100 ml. The pollution in river Ramganga had been a matter of concern before the Tribunal on different occasions. When the matter came up for hearing on 9th May, 2017, the Tribunal passed the following order:

> "All the stakeholders have made a common suggestion to be implemented for preventing and controlling of pollution and rejuvenation of River Ram Ganga which is a major tributary of River Ganga. There are 25 drains as per the Joint Inspection Team, of these 19 drains come from different parts of the city of Moradabad, particularly from Zone-1 and Zone-2 of Moradabad. It is stated that the collective discharge of all these drains is

148.09 MLD as per joint inspection report, however as the report of the Uttar Pradesh Jal Nigam it is 52.45 MLD, measured in the year 2011 as opposed to the measurement of the Joint Inspection Team in November, 2016. Most of these drains carry mixed effluent, they contain majorly sewage, treated effluent, consisting of various chemicals and metals including Arsenic, Iron, Copper, Lead, Mercury, Nickel, Cadmium, Aluminium and other pesticides etc. The Uttar Pradesh Jal Nigam had proposed two STPs of 25 MLD and 58 MLD for Zone-2 and Zone-1 respectively. It is surprising that the STP have been designed which are incapable of even treating coliform which is running in Crores against the value of 235. In our opinion, this is wastage of public money and it has been designed and approved even by the Ministry of Water Resources without any proper application of mind.

It is proposed that all these drains may be tapped and their discharge be collectively taken through a common pipeline to the respective STPs, one near Prabhat Market of 58 MLD while other near Moksha Dham, where besides construction of the proper STPs with specification which are capable of treating the waste and sewage, chemical pre-treatment should be provided before the effluent can be permitted to be the processed at the STP. Once pre-chemical treatment is given which will remove metal and other chemical pollutants then the sewage for the purposes of treatment of BOD, COD, TSS and Coliform can be sent to the respective STPs. The existing STP is stated to have been constructed, therefore, it would require upgradation, even without having operation for a single day, for treatment of Coliform. This reflects inefficiency on the part of the concerned stakeholders.

It is vehemently argued by Mr. M.C. Mehta and all the Learned counsel appearing for their respective respondents that there are large number of metal, electroplating and pickling industries which are operating in Zone-1

and Zone-2 of Moradabad city. These industries are discharging untreated effluent, which is even toxic, into the drain which joins Ram Ganga, ultimately through these 19 drains. According to the Learned counsel appearing for the Uttar Pradesh Pollution Control Board, there are numerous industries which are illegally operating without consent of the Board even in the residential areas, causing environment and public health issues. According to him, they have no support from other organs of the State to enforce their directions for closer of these industries. In fact according to him, it has become even difficult to regulate the industries operating in this area which has not obtained consent of the Board and are operating in violation thereof and causing pollution. It is stated by the Member Secretary, Uttar Pradesh Pollution Control Board that they are unable to execute the directions and in fact find themselves helpless as there is least cooperation from the Administration and from the police departments.

In light of the above and in the interest of justice, further steps for controlling and preventing pollution of these drains, consequently Ram Ganga and finally River Ganga, are required to be taken and accordingly following directions are issued:-

1. We direct that all the industries operating without consent of the Board or without permission of the Competent Authority or in the residential areas or does not have any ETP, shall be closed forthwith in Zone-1 and Zone-2 of district Moradabad, i.e. the catchment area of these 19 drains.
2. The District Magistrate and SSP, Moradabad are hereby directed to provide all assistance and police protection for execution of this order. The primary responsibility of closing of these industries would be that of Uttar Pradesh Pollution Control Board, but they shall immediately be provided with all the administrative assistance, infrastructure and police

force to ensure closure of the industries.

3. The Learned counsel appearing for the Uttar Pradesh Jal Nigam submits that they have paid 2.99 Crores to railways for laying down pipelines and the railways has not taken any action which is resulting in delay for completion of project for interception and fixation of pipeline at intercepting point in these 19 drains. He also submits that PWD is not granting permission. Let the General Manager, Northern Railways and the concerned Chief Engineer of the PWD be present before the Tribunal day after. The Pollution Control Board and Uttar Pradesh Jal Nigam shall inform the respective authorities of today's order.
4. The Electricity Authority/Board and the Corporation of Muradabad are directed to fully cooperate with the Uttar Pradesh Jal Nigam and the Pollution Control Board for compliance of this direction. No work contrary to the order of the Tribunal shall be executed by any authority.
5. Mr. Sarvan Gupta and Mr. Amit Kumar accompanied by Senior Scientist of Central Pollution Control Board and UP pollution control Board shall inspect the site of newly constructed STP and operate it tomorrow to analyse the trade effluent. Report be submitted before the Tribunal on the next date of hearing. 6. If the STP is not in operation, this team shall submit complete and comprehensive report as to why the STP is not operative despite the fact that it had been constructed in 2015; its designed efficiency in terms of BOD, coliform etc. and whether all the functional units as per the approved design have been provided."

In furtherance to above order, a report was submitted which stated that the STP was non-operational. However, facility of using chlorine gas through chlorinators is

available. The chlorine is expected to reduce the Faecal Coliform to 100 MPN/100ml. It was noticed that there is no sewage inflow in the STP. The Civil work, electric work and piping work, etc. had been done. However, some of the components still remain to be installed. The reasons for no inflow of sewage were that the work of laying down of sewer line to the main pumping station (MPS) had not been completed as it was to undergo through the railway line and MPS is to pass through the road for which cutting permission was required. In this regard, it also may be noticed that the Tribunal had even passed directions and the railway authority has been directed to provide permission for taking the pipeline across the railway track. From the report it is evident that the STP is not functioning satisfactorily and effectively. We have already noticed that there are 25 drains joining river Ramganga, which bring different kind of pollutants into the river. Thus, it will be useful to deal with each of the drains separately, as has also been suggested by different stakeholders.

NOHRA DRAIN

96. After flowing for approximately 3 kilometers, it confluences with river Ramganga on its left bank carrying flow of approximately 15 MLD. This drain carries mixed effluents much of it comprising of domestic waste and sewage. Dhampur and Bijnor are located in the catchment areas of

this drain. The sample was taken and the drain effluent was analyzed in which and the analysis report showed the following results:

(EFFLUENTS OF NOHRA DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.67
3	BOD (mg/l)	:	3
4	COD (mg/l)	:	19
5	TSS (mg/l)	:	14
6	TDS (mg/l)	:	180
7	Cl- (mg/l)	:	23
8	NH_3-N (mg/l)	:	NT
9	NO_3 - (mg/l)	:	0.55
10	DO(mg/l)*	:	---
11	TC(MPN/100 ml)#	:	$13x10^3$
12	FC(MPN/100 ml)#	:	$33x10^2$

*For Fresh water carrying drains/ Rivers
#For sewage, mixed drains & river

These metals and pesticides were found to be either below detectable limit or within the prescribed permissible limit. This drain is not proposed to be intercepted as per the stakeholders. It is suggested that STP of 5 MLD capacity should be set up at outskirts of Sheohara town to ensure that domestic waste and sewage is properly treated before it meets the drain. It is stated that this drain should be provided with a filter system at its end and ensure that the solid waste does not enter the river by putting up screen traps. No other treatment is stated to be required as the BOD is low. The two industries, namely, the distillery industry and the sugar industries located in the catchment area of this drain should strictly adhere to the prescribed

norms. They should be directed to put up proper ETPs which should function regularly and effectively. In the event of default, the industry should be ordered to be closed down. Therefore, we direct as under:

1. An STP of 5 MLD should be constructed at the outskirts of Sheohara town and the entire sewage should be treated before it meets Nohra drain.
2. There shall be installed filter system at the end of the drain nearly, 200 meters away from the river to ensure that no waste of any kind enters the river by putting screen traps or otherwise.

The distillery and sugar industries located in the catchment area of this drain should be required to put up their own ETP and install all necessary anti-pollution devices. They should strictly ensure that effluents in drain are within the prescribed parameters. Further they are directed to recycle and reuse their treated water. The industries should be inspected by the Joint Inspection Team of the UPPCB and appropriate conditions in the consent to operate should be imposed upon them. In the event of default or discharging effluents beyond the prescribed limit, they should be ordered to be shutdown.

RAMPUR DRAIN

97. This drain travel for 30 kilometers before it meets river Kosi and ultimately river Ramganga, which is a major tributary of river Ganga. It is stated to have a flow of 34.31

MLD. It contains mixed discharge primarily domestic waste and sewage. The effluent was subjected to analysis by the Joint Inspection Team and the results are stated to be as follows:

(EFFLUENTS OF RAMPUR DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.51
3	BOD (mg/l)	:	58
4	COD (mg/l)	:	201
5	TSS (mg/l)	:	43
6	TDS (mg/l)	:	876
7	Cl- (mg/l)	:	169
8	NH_3-N (mg/l)	:	34
9	NO_3 - (mg/l)	:	7.97
10	DO(mg/l)	:	-
11	TC(MPN/100 ml)#	:	$16x10^5$
12	FC(MPN/100 ml)#	:	$92x10^4$

*For Fresh water carrying drains/ rivers
#For sewage, mixed drains & river

The metals are also found but below detectable limit or within permissible limit. Rampur city is in the catchment area of this drain. The present population of this area is stated to be around 4 lakh. Two STPs of 15 MLD and 14 MLD, respectively, have been constructed in Zone-I and II of the city. They were constructed more than two years back and are not efficient, as they cannot treat Faecal Coliform. They also do not receive required quantity of sewage for treatment as houses have not been provided with the connections to the main sewer line. There is a proposal for connecting the households to the sewer line and ultimately bringing the waste to the STPs. It is stated

that Zone III and IV of the city contributes mixed waste into the drain.

There are five major industries in the catchment area of this drain, Rampur Distillery which is in operation, discharging effluent contains pollutants. The sugar mill and the meat processing plant are closed. The mechanical slaughter house are also closed. The metal surface finish industry is in operation and has 2 KLD discharge which contains pollutants. Three industries, i.e., sugar mills, slaughter house and meat processing unit should remain closed and should not be permitted to open without specific orders of the Tribunal. They should be directed to comply with stringent conditions of prevention and control of pollution before they are permitted to restart their operations. The two industries, viz. Rampur Distillery and the Metal surface finish industry should be put under strict supervision of the UPPCB and the Joint Inspection Team. The distillery industry should be required to be ZLD and none of them should be permitted to discharge trade effluents in excess of the prescribed parameters. The UPJN should be permitted to upgrade capacity and technology of two STPs only after the houses in the city are connected to the sewer line. It is suggested that an STP should be put at the end of the pipeline that is the point where Rampur drain joins river Kosi, which ultimately joins river Ramganga. The distance between the point of joining of the

drain with Ramganga and the point where drain does not join river Kosi is nearly 3.17 kilometres having sufficient land available there. Therefore, an STP of atleast 16 MLD should be put at the said point to ensure that no untreated sewage or polluted water enters river Kosi and consequently, river Ramganga. The STPs of 15 MLD and 14 MLD in Zone 1 and 2, respectively, as and when operated, the treated water should be recycled for use in agricultural activity or for any other industrial purposes as per the demand in the area.

The construction of 16 MLD STP at the end of the pipeline was acceptable to all the stakeholders. In fact, all the stakeholders have made common submission as afore-recorded. Once the 3 STPs, 2 nearly completed and one to be constructed, becomes operative, no untreated sewage or domestic effluent would be permitted to enter river Kosi and therefore, it would not adversely affect the pollution levels of the drain and consequently river Kosi. Having considered all concerned aspects of environment, we find that the proposal jointly made by stakeholders as afore-recorded should be implemented with utmost expeditiousness. We specifically direct the State of UP and the UPJN that the sewer connections to households should be connected with the main sewer line. This should be taken with utmost priority. Due to non-connections with sewer line, the requisite quantum of sewage is not reaching

the STPs already constructed. This would tantamount to tremendous wastage of public money and assets if these STPs are not made operational immediately. They are presently not treating the sewage and therefore even causing pollution. The concerned stakeholders, therefore, must take appropriate steps without unnecessary delay.

KARULA DRAIN

98. This drain flows for nearly 25 kilometers before it confluences with river Ramganga at its left bank. Its catchment falls in the city of Moradabad. It carries a flow of 57.12 MLD according to the Joint Inspection Team while according to UPJN carries flow of 26.11 MLD within municipal limits which means remnant part of the effluent joins it at or after the municipal limit and before it meets the river Ramganga. The data provided by UPJN was collected in the year 2015. There is open land available where presently there is no habitation. This drain carries mixed effluents but it is primarily domestic/sewage effluent. The effluent of the drain was subjected to analysis by the Joint Inspection Team and the results are as follows:

(EFFLUENTS OF KARULA DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1	Colour	:	-
2	pH	:	7.34
3	BOD (mg/l)	:	44
4	COD (mg/l)	:	128
5	TSS (mg/l)	:	67
6	TDS (mg/l)	:	548

7	Cl- (mg/l)	:	123
8	NH_3-N (mg/l)	:	38
9	NO_3 - (mg/l)	:	2.76
10	DO(mg/l)	:	-
11	TC(MPN/100 ml)#	:	$35x10^8$
12	FC(MPN/100 ml)#	:	$24x10^7$

*For Fresh water carrying drains/ rivers
#For sewage, mixed drains & river

(EFFLUENTS OF KARULA DRAIN-TRACE METAL/HEAVY METAL)

Sl. No.	Parameters	Results	
1	Arsenic (As) mg/l	:	BDL
2	Cadmium (Cd) mg/l	:	BDL
3	Total Chromium (Cr) mg/l	:	0.02
4	Copper (Cu) mg/l	:	0.04
5	Iron (Fe) mg/l	:	2.41
6	Lead (Pb) mg/l	:	BDL
7	Manganese (Mn) mg/l	:	0.41
8	Nickel (Ni) mg/l	:	0.07
9	Mercury (Hg) mg/l	:	-
10	Zinc (Zn) mg/l	:	0.11
11	Antimony (Sb) mg/l	:	-
12	Cobalt (Co) mg/l	:	BDL
13	Selenium (Se) mg/l		BDL
14	Vanadium (V) mg/l		BDL

It is suggested that an STP of nearly 35 MLD just beyond a kilometre away from the confluence point should be constructed. The treated discharge should be reutilised for the agricultural purposes or may be released in the river only if it meets the prescribed standards. Only the remnant should be used for discharge into the river provided it meets the prescribed norms.

Within the floodplain of the river, no development should be permitted. When the treated water is recycled for agricultural and other purposes, it will consequently reduce the dependency of the farmers and even the

industries on use of water by extraction of groundwater.

There are two major industries (East Coast industry and Raisin Exports) in the catchment area of this drain. Both these industries have been closed under the orders of the Pollution Control Board for various violations and for causing pollution. These industries would not be permitted to restart their operations without specific orders of the Tribunal. No industry should be permitted to start its operation in the catchment area of the drain till the time it either becomes a ZLD unit or recycles its entire treated discharge for agriculture, horticulture and its own industrial purposes. The recycling or use of same water for agriculture, horticulture purposes should be permitted only when the effluent is within the parameters, which are permissible for discharge on land, etc. The UPPCB and CPCB shall adhere to this direction.

Finally, it needs to be stated, before finalizing the design and technology of the 35 MLD STP which is to be installed and constructed, the concerned stakeholders, particularly the UPJN and UPPCB, are to jointly examine if it will be more appropriate to establish Oxidation pond and tertiary treatment in place of an STP. It must be specifically examined keeping in view, that the effluent contains tremendous level of Faecal Coliform, which is in crores MPN/100ml and even the BOD is 44mg/l in violation of the proposed standards of 10 mg/l at the end of the drain.

This decision should be taken expeditiously. The Tribunal upon due examination, approves the common suggestions of the stakeholders and directs that preferably the STP should be established considering the high content of faecal coliform and BOD in the effluents. In the event, the UPJN and UPPCB are of the contrary view, they will move the Tribunal within four weeks from the date of pronouncement of the order seeking its direction to establish Oxidation pond and tertiary treatment in preference to an STP.

NAWABPURA DRAIN 1, NAWABPURA DRAIN 2, VIVEKANAND HOSPITAL-LEFT, MORADABAD, VIVEKANAND HOPSITAL-RIGHT, MIT DRAIN, MOKSH DHAM DRAIN, TDI CITY DRAIN, CHAKKAR KI MILAK, JIGAR COLONY, KATGHAR RAILWAY STATION DRAIN, BARBALAN DRAIN, KUDAGHAR DRAIN, JAMA MASJID (LEFT) DRAIN, JAMA MASJID (RIGHT) DRAIN, GHOSIYAN DRAIN, JHABBU KA NALLAH, LALBAGH DRAIN, DATERIA/DAHERIA DRAIN AND PRABHAT NAGAR DRAIN:

99. The common proposal of the UPJN in relation to all the above drains is that all these drains except Katghar Railway Station Drain, Barbalan Drain and Prabhat Nagar Drain carry mixed effluents (electroplating waste) but primarily domestic and sewage effluents. All these drains require interception while Nawabpura Drain 1 and 2 are required to be tapped. In relation to all these drains, the STPs of various capacities are already under construction. One STP of 58 MLD is under construction and 95 % of the construction work has already been completed. Another

STP of 25 MLD is proposed. Once the tapping and interception of these drains is completed and their effluents are taken to the constructed/proposed STP, then all the above drains would not release any pollutants into river Ramganga and finally into river Ganga.

In the order dated 9th May, 2017, it was specifically recorded as the common submission of the stakeholders that drains may be tapped and their waste be collectively taken through a common pipeline to the STPs, one near Prabhat market of 58 MLD under construction while the other at Moksh Dham drain. The STPs should be capable of treating the waste and sewage, if necessary, chemical treatment should be provided before the effluent is processed at the STP. The pre-chemical treatment will remove metal and other chemical pollutants then the sewage, domestic waste for the purpose of treatment of BOD, COD, TSS and the faecal coliform would go to the respective STPs. The STP under construction does not require any up-gradation.

The applicant Mr. M.C. Mehta and UPJN had raised other issues of environmental concerns. It has been stated that there are a large number of metal, electroplating and pickling industries which are operating in Zone-1 and Zone-2 of Moradabad city. These industries are discharging untreated toxic effluent, into the drain which joins river Ramganga, through these 19 drains. On behalf

of the UPJN, it was stated that the entire project is not progressing effectively because the General Manager (Northern Railways) had not granted permission for taking the pipeline under railway track for which they had already paid ₹ 2.99 crores to the Railways for laying down pipelines. We have already reproduced the order where appropriate directions were issued to the concerned authorities and they had agreed to grant the permission. The industries which were operating without consent of the State Board in Zone 1 and 2 and were discharging toxic material into the drains were ordered to be shut down.

In light of the above discussion, in addition to the directions already passed *vide* our order dated 9th May, 2017 and other orders which are reiterated herein, we also direct and approve project put forward by UPJN in relation to tapping and interception of all the above drains and taking their effluents to the specified STPs. However, they would be provided with due mechanism and anti-pollution devices for providing pre-chemical treatment of the effluent before it is taken to the STPs. We further make it clear that the industries which are operating without obtaining consent of the State Board and are water polluting industries discharging their effluent in all these drains shall be closed by the UPPCB without further delay. The administration and the police shall provide due co-operation and assistance to the UPPCB to implement this

direction.

DEVRANIYA DRAIN (RIVER)

100. Devraniya drain (River) flows for approximately 130 kilometres before it confluences with Ramganga, nearly, 0.5 kilometres away from Bareilly city at Virya Narainpur village on the left bank of the river. As per the report of the Joint Inspection Team it carries mixed waste primarily domestic and sewage from number of colonies that are in the catchment area of this drain. In terms of the Joint Inspection Report it carries a load of 287.44 MLD while according to the UPJN it is 15.678 MLD but again it is within the municipal limit and the measurement has been taken quite some time back. As of present without any treatment, this drain meets river Ramganga with all its pollutants. In terms of the Joint Inspection Report the effluent of the drain was analysed and following are the results of the analysis:

1.	Charact-eristics	Colour	:	-
		pH	:	6.99
		BOD (mg/l)	:	40.2
		COD (mg/l)	:	169
		TSS	:	104
		TDS	:	393
		$PO4^{3-}$	:	1.13
		Cl^{-}	:	28.2
		NH_3-N	:	8.38
		NO_3^{-}	:	0.6
2.	Heavy Metals	Arsenic (As) mg/l	:	-
		Cadmium (Cd) mg/l	:	BDL
		Total Chromium (Cr) mg/l	:	0.034
		Copper	:	0.008

		(Cu) mg/l		
		Iron (Fe) mg/l	:	
		Lead (Pb) mg/l	:	
		Manganese (Mn) mg/l	:	0.0086
		Nickel (Ni) mg/l	:	-
		Mercury (Hg) mg/l	:	-
		Zinc (Zn) mg/l	:	0.058
		Antimony (Sb) mg/l	:	-
		Cobalt (Co) mg/l	:	BDL
		Selenium (Se) mg/l	:	-
		Vanadium (V) mg/l	:	-
	For Fresh water carrying drains/ Rivers	DO	:	-
	For sewage, mixed Drains & River	TC (MPN/ 100 ml)	:	2,20,00,000
		FC (MPN/ 100 ml)	:	1,70,00,000

From the above analysis report, it is clear that the drain carries heavy discharge, which should necessarily be treated before the drain meets river Ramganga.

There are two industries M/s. Camphor and Allied Industry and M/s. B.L. Agro Oils Ltd. located in the catchment area of this drain. However, they are stated to be compliant and non-polluting and operating with the valid consent of the UPPCB. We hereby direct that, both these industries shall be subject to complete,

comprehensive and strict inspection by the Joint Inspection Team of CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN. This inspection team shall inspect these industries and issue directions for strict compliance to ensure that the effluent from these industries is completely recycled and if not, the effluent discharged complies strictly with the prescribed parameters without default. In the event, if they violate any of the conditions imposed by the Joint Inspection Team, these industries would be liable to be shutdown. The suggestion of the stakeholders is that the STP should be established at the end of the pipeline, where land is available, i.e. 1 kilometre before the point of confluence of the drain with river Ramganga. Technology should be finalized after collection of proper data. The Joint Inspection Team of CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN shall satisfy themselves as to the exact flow of the drain at that point. They should also consider if there should be a mechanical STP with UV technology or oxidation ponds should be constructed for removing all the effluents from the drain. This decision shall be taken within four weeks from the pronouncement of this order and approved project shall be executed appropriately, thereafter. We are giving this direction primarily to be doubly assured that no mistakes like the past are repeated and STP established is of appropriate

capacity, performs satisfactorily. The STP shall be provided with continuous and regular source of energy to ensure that the plant operates round the clock. We approve the above suggestions and issue above directions, accordingly.

CHAWARI (CHAUBARI) DRAIN

101. Chawari (Chaubari) drain travels approximately 20 kilometres before it joins river Ramganga on its left bank at Gomidpur village. The drain carries domestic/sewage and has a flow of 18.82 MLD, while according to the UPJN the flow is 1.38 MLD. The effluent of this drain was taken by the Joint Inspection Team and upon analysis it showed the following results:

1.	Charact-eristics	Colour	:	-
		pH	:	7.31
		BOD (mg/l)	:	25.8
		COD (mg/l)	:	72.5
		TSS	:	17.3
		TDS	:	710
		$PO4^{3-}$	:	2.94
		Cl^{-}	:	43.7
		NH_3-N	:	21
		NO_3^{-}	:	0.2
2.	Heavy Metals	Arsenic (As) mg/l	:	-
		Cadmium (Cd) mg/l	:	BDL
		Total Chromium (Cr) mg/l	:	BDL
		Copper (Cu) mg/l	:	BDL
		Iron (Fe) mg/l	:	-
		Lead (Pb) mg/l	:	-
		Manganese (Mn) mg/l	:	0.252
		Nickel (Ni)	:	-

		mg/l		
		Mercury (Hg) mg/l	:	-
		Zinc (Zn) mg/l	:	0.054
		Antimony (Sb) mg/l	:	-
		Cobalt (Co) mg/l	:	0.030
		Selenium (Se) mg/l	:	-
		Vanadium (V) mg/l	:	-
	For Fresh water carrying drains/ Rivers	DO	:	-
	For sewage, mixed Drains & River	TC (MPN/ 100 ml)	:	4,90,000
		FC (MPN/ 100 ml)	:	4,90,000

As is evident, this drain does not carry pollutants like TC and FC. All the stakeholders and the parties appearing commonly agreed that appropriate remedy, i.e., an STP or proper mechanism at the end of the pipeline would be provided. It would be better to provide UV technology and/or Oxidation pond in place of mechanical STP constructed on the wetland. This would be economically more sound and would environmentally protect the river. It will be much more expensive to lay down the pipeline and inspect the drain and construct an STP closer to the river. However, the technology or the STP as the case may be should preferably be 1 kilometre away from the bank of the river as far as possible. It is not disputed before us

that the land is available for that purpose. We direct the Joint Inspection Team of CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN to finalize the technology, keeping in view the load and content of the drain. The capacity should be demonstrated upon due verification. We pass this direction so that no further errors are committed in this behalf. The exercise should be completed within four weeks from the date of pronouncement of this judgement and the work should start immediately, thereafter.

NAKATIYA DRAIN

102. After covering a long distance of 100 kilometres, this drain joins River Ramganga on its left bank and its confluence point is 59 kilometres from Ramganga to Bareilly. Its flow is 170 MLD, however, according to the UPJN it is 10.4 MLD. The data has been collected from the drains joining Nakatiya drain and not of the main drain itself or anywhere near the end of the drain. The Joint Inspection Team collected samples from drain and upon analysis it showed the following values which are higher than the prescribed values.

1.	Charact-eristics	Colour	:	-
		pH	:	7.24
		BOD (mg/l)	:	24.2
		COD (mg/l)	:	56.6
		TSS	:	27.6
		TDS	:	440
		$PO4^{3-}$	:	1.58
		Cl^{-}	:	46.4
		NH_3-N	:	15.4
		NO_3^{-}	:	0.4

2.	Heavy Metals	Arsenic (As) mg/l	:	-
		Cadmium (Cd) mg/l	:	BDL
		Total Chromium (Cr) mg/l	:	BDL
		Copper (Cu) mg/l	:	0.002
		Iron (Fe) mg/l	:	-
		Lead (Pb) mg/l	:	-
		Manganese (Mn) mg/l	:	0.21
		Nickel (Ni) mg/l	:	-
		Mercury (Hg) mg/l	:	-
		Zinc (Zn) mg/l	:	0.080
		Antimony (Sb) mg/l	:	-
		Cobalt (Co) mg/l	:	BDL
		Selenium (Se) mg/l	:	-
		Vanadium (V) mg/l	:	-
3.	DO (For Fresh water Carrying drains/rivers.			:
4.	For sewage, mixed Drains & River	TC (MPN/ 100 ml)	:	17,00,000
		FC (MPN/ 100 ml)	:	17,00,000

The UPJN had proposed above that like the other two drains four mechanical STPs of 165 MLD to be constructed. There are 13 drains within the municipal limits which meet Nakatiya drain. The proposal of UPJN is neither technically sound nor economically viable. Firstly, the proposal is without collection of any appropriate data

in relation to the alleged 13 drains which joins Nakatiya drain. Secondly, their content values have not even been assessed. The STP is proposed at Jagatpur Nallah which is in the heart of the city where nearly four major drains join Nakatiya drain. Even the treated water from the STP would again be put into the same drain and would get polluted before it covers the distance of nearly 9 to 10 kilometres. It is economically not viable as four STPs would have to be established at a very high cost and still they would not produce the required result of treating the effluents of the Nallah before it meets river Ramganga. From satellite imagery, the confluence point of Nallah is still 10 kilometres.

The suggestion of all the other stakeholders together is more appropriate and acceptable. The suggestion is that as the land is available near 1 kilometre from the confluence point, the STP may be established to treat the effluent and sewage appropriately. We direct the Committee of the CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN to examine and decide on the appropriate technology that should treat 170 MLD of effluent, i.e., UV system and/or Oxidation ponds in place of mechanical STP, which would be more economically viable and environmentally better result oriented. There are agricultural lands around the proposed site, thus, the discharge from the STP should be utilized for irrigation purposes and least water should

be released into the river. In the catchment area of the Nakatiya drain there are two major industries; one is the paper mill by the name of M/s. Rama Shyama Papers Pvt. Ltd. in regard to which the Tribunal has already passed appropriate orders that the industry should strictly comply with orders, failing which the industry would be liable to be shutdown. Other industry is M/s. Mariya Agro & Forzen Foods Pvt. Ltd., which is dealing with slaughterhouse. It was also stated that it is a complying industry. This industry shall be subject to a joint inspection by the representatives of CPCB, MoEF&CC, MoWR, UPPCB and UPJN. That committee will issue appropriate directions, if needed, further to ensure that this industry does not cause pollution. If the directions are issued and if the industries are not compliant, then the said industries would be liable to be shutdown without further notice. Thus, we issue the above directions in relation to this drain.

DRAINS JOINING RIVER PANDU AND DIRECTIONS THEREOF

GANDA NALLAH, COD NALLAH AND HALWA KHANDA NALLAH (KANPUR)

103. These three drains are located at some distance from each other, however, on the same side. As of present, all these three drains directly join river Pandu, Kanpur. The three drains have a length of approximately 13.50 kilometres, 6.2 kilometres and 6.7 kilometres, respectively. Ganda

Nallah and Halwa Khanda Nallah carry domestic waste and sewage, while the COD Nallah carries mixed waste. According to the Joint Inspection Team, Ganda Nallah which is a major drain, has a flow of 210.5 MLD. With 0.65 factor for averaging of surface velocity and drain cross section profile, the flow is 136.81 MLD. The flow of COD Nallah is stated to be 78.62 MLD and of Halwa Khanda Nallah is 40.49 MLD. According to the UPJN, the flow of these three drains is 55.08 MLD, 8.81 MLD and 11.44 MLD, respectively. The data submitted by UPJN is not sound for various reasons that we have noticed under different heads. Conclusively, we would prefer to be guided by the data given by the Joint Inspection Team. The effluent samples were collected from the three drains and their analyses reports read as under:

(EFFLUENTS OF GANDA NALLAH DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.17
3.	BOD (mg/l)	:	66.6
4.	COD (mg/l)	:	203
5.	TSS (mg/l)	:	105
6.	TDS (mg/l)	:	774
7.	CL^- (mg/l)	:	117
8.	NH_3-N (mg/l)	:	55.2
9.	NO_3^-(mg/l)	:	2.87
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	54000000
12.	FC (MPN/100 ml)#	:	35000000

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF GANDA NALLAH DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results

1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	0.04
4.	Copper (Cu) mg/l	:	-
5.	Iron (Fe) mg/l	:	1.64
6.	Lead (Pb) mg/l	:	0.02
7.	Manganese (Mn) mg/l	:	0.12
8.	Nickel (Ni) mg/l	:	0.02
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.40
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

(EFFLUENTS OF COD NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.47
3.	BOD (mg/l)	:	54.6
4.	COD (mg/l)	:	145
5.	TSS (mg/l)	:	73.5
6.	TDS (mg/l)	:	787
7.	CL^- (mg/l)	:	105
8.	NH_3-N (mg/l)	:	48.9
9.	NO_3^-(mg/l)	:	2.59
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	2200000
12.	FC (MPN/100 ml)#	:	490000

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF COD NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters		Results
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	0.04
4.	Copper (Cu) mg/l	:	-
5.	Iron (Fe) mg/l	:	0.84
6.	Lead (Pb) mg/l	:	BDL
7.	Manganese (Mn) mg/l	:	0.14
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-

10.	Zinc (Zn) mg/l	:	0.22
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

(EFFLUENTS OF HALWA KHANDA NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.23
3.	BOD (mg/l)	:	82.0
4.	COD (mg/l)	:	206
5.	TSS (mg/l)	:	88.9
6.	TDS (mg/l)	:	729
7.	CL^- (mg/l)	:	99.0
8.	NH_3-N (mg/l)	:	50.6
9.	NO_3^-(mg/l)	:	2.0
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	1,70,00,000
12.	FC (MPN/100 ml)#	:	33,00,000

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF HALWA KHANDA NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	-
5.	Iron (Fe) mg/l	:	1.22
6.	Lead (Pb) mg/l	:	BDL
7.	Manganese (Mn) mg/l	:	0.18
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	2.18
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

It is agreed between all the stakeholders including UPJN

that there is already a constructed STP of 210 MLD at Bingawan, which is capable of treating all the three drains but is presently working much below its capacity. Therefore, the proposal is that all three drains should be tapped at the identified points i.e. Ganda Nallah near Tatya Tope Nagar boundary, Halwa Khanda Nallah nearly 500 meters away from the point it joins river Pandu and COD Nallah 200 meters away from the point it joins river Pandu near Hamirpur Road. Upon tapping and by gravity, the sewage of all these three drains should be brought to the STP at Bingawan through the drains. The tapping should be properly strengthened so that there is no possibility of any over flow from the tapping point into the drains leading to river Pandu. Water from the STP at Bingawan should be recycled for agricultural purposes and only the remnant of the treated water should be released into river Pandu.

The Cantonment authorities are hereby directed to lay down a proper sewer line and bring the sewage of cantonment area of Kanpur which is in the catchment area of the COD Nallah to the STP at Bingawan for treatment.

The existing ETP of the Ordinance Factory should be upgraded in terms of both capacity and technology, so as to ensure that no effluent in excess of the prescribed parameters enters the drain. After treatment, the discharge from the ordinance factory could either be put

into the COD Nallah or in the sewer line that would be constructed by the Cantonment authorities. The Ordinance Factory shall be inspected by the Joint Inspection Team and appropriate directions shall be issued within four weeks from the passing of this judgement to ensure that the effluent discharged does not exceed the prescribed parameters, under any circumstances. Thus, we pass the above directions for compliance.

If there is any industry or stakeholder operating in the catchment area of COD Nallah, the same shall be subject to an inspection by the Joint Inspection Team which shall issue appropriate directions for compliance so as to ensure that the unit is compliant and non-polluting. In the event of default, the industry or stakeholder shall be liable to be shutdown.

PANKI NALLAH (PANKI THERMAL POWER PLANT DRAIN) AND ICI NALLAH

104. Panki Nallah (also called as Panki Thermal Power Plant drain) and ICI Nallah, after flowing for nearly 1.6 kilometres and 1 kilometre, respectively, join the left bank of river Pandu. As per the stakeholders as well as the Joint Inspection Team these drains carry mixed effluent from sewage, domestic waste and trade effluent, carrying a flow of 74.17 MLD and 19.44 MLD, respectively. While according to UPJN they carry a load of 30 MLD and 40 MLD, respectively. The data of the UPJN is old, not

founded on authentic documentation as it finds effluents within municipal limits, therefore, it cannot be taken as definitive data. The data provided by the Joint Inspection Team is more reliable. The Kanpur city and particularly the Thermal Power Plant and New Transport Nagar are within the catchment area of Panki Nallah. The Joint Inspection Team had taken effluents of this drain and the analysis of the samples reflects the following results:

(EFFLUENTS OF PANKI NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.14
3.	BOD (mg/l)	:	14.0
4.	COD (mg/l)	:	41.0
5.	TSS (mg/l)	:	60.2
6.	TDS (mg/l)	:	384
7.	Cl^- (mg/l)	:	61.0
8.	NH_3-N (mg/l)	:	16.9
9.	NO_3^-(mg/l)	:	2.93
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	22,00,000
12.	FC (MPN/100 ml)#	:	11,00,000

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF PANKI NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	-
5.	Iron (Fe) mg/l	:	0.62
6.	Lead (Pb) mg/l	:	BDL
7.	Manganese (Mn) mg/l	:	0.06
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.20
11.	Antimony (Sb)	:	-

	mg/l		
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

The above analysis shows that the total TC & FC are extremely high. The UPJN proposes to construct a 75 MLD STP at Pankigaon. The proposal of the UPJN is not appropriate because setting up of the same is economically expensive and in terms of control of pollution, it does not serve the requisite ends. It is suggested that this STP is to treat the effluents both from Panki Nallah and ICI Nallah, as both these Nallahs directly joins river Pandu. Panki Thermal Power Plant Nallah joins river Pandu much upstream to ICI Nallah and there are no multiple drains joining these drains. Thus, putting up of a common STP would not be practical, feasible and economically viable. The distance between the two Nallahs is 3.5 kilometres and therefore, there is a requirement for putting up the pipeline pumping system and then a STP, the expenditure for which can easily be avoided. The main source of pollution in Panki Nallah is the Thermal Power Plant from where fly ash and the pollutants travel and meet the Sail Nallah. Thus, both these Nallahs i.e., the Panki Nallah and ICI Nallah should be dealt with independently, through a Common Treatment Plant. The suggestion of the stakeholders is more acceptable which is to put up an STP of appropriate capacity, i.e., approximately of 75 MLD at

the end of the pipeline in Panki Thermal Power Plant Nallah, just at a short distance and towards the Lucknow road for which the land is also available. The STP should be capable of treating BOD, COD and primarily Coliform, the main pollutant of this drain. Another suggestion of the stakeholders is for putting up a separate STP at the identified point between Lucknow Road and river Pandu, so that the water released from the STP can be recycled for agriculture, horticulture and more particularly for cooling purpose of the Thermal Power Plant. It is commonly conceded that the land for STP between Lucknow Road and river Pandu is also available. The effluent discharged should be appropriately treated as per the prescribed norms, before it meets river Pandu.

Thus, we direct that a separate independent STP at the identified point between Lucknow Road and river Pandu should be constructed having capacity of 75 MLD. The treated water from the STP should be recycled and utilized for agriculture and horticulture purposes and particularly for cooling of the Thermal Power Plant.

We further direct that the Thermal Power Plant shall make endeavour to ensure that the fly ash content does not cause air or water pollution and discharges effluents strictly within the prescribed norms. The Joint Inspection Team shall inspect this Thermal Power Plant and issue appropriate directions for prevention and control of water

pollution. If the issued directions are not complied with by the Thermal Power Plant within prescribed period, it shall be liable to be shutdown without any further notice.

ICI NALLAH

105. The ICI Nallah has a length of approximately one kilometre. Before it crosses Lucknow Road, the two drains i.e., Panki Nallah and ICI Nallah join together. The ICI Nallah commences its journey to join river Pandu near LML Scooter factory, Panki, Kanpur. This Nallah has a flow of 19.44 MLD according to Joint Inspection Team, while as per the UPJN it is 40 MLD. The Joint Inspection Team analysed samples of this drain near LML Scooter factory and the effluents were found to be highly polluted. The analysis results are as follows:

(EFFLUENTS OF ICI NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	8.16
3.	BOD (mg/l)	:	42.9
4.	COD (mg/l)	:	141
5.	TSS (mg/l)	:	146
6.	TDS (mg/l)	:	3122
7.	CL^- (mg/l)	:	1496
8.	NH_3-N (mg/l)	:	193
9.	NO_3^-(mg/l)	:	9.85
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	24,00,000
12.	FC (MPN/100 ml)#	:	7,90,000

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF ICI NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL

3.	Total Chromium (Cr) mg/l	:	0.06
4.	Copper (Cu) mg/l	:	-
5.	Iron (Fe) mg/l	:	2.60
6.	Lead (Pb) mg/l	:	0.22
7.	Manganese (Mn) mg/l	:	0.72
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	6.18
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

The above analysis report shows that the parameters of TDS, TC, FC and Coliform are very high. It surprisingly carries iron and zinc, much beyond the prescribed limits. Thus, this drain needs specific treatment so that no pollution of river Pandu results from this drain. The industrial effluent in this drain comes from industrial sites, namely Panki sites 1, 2, 3 and 4. There are nearly 40 highly polluting industries which include 1 fertilizer unit, 28 dyeing and textile units, 4 chemical units, 3 surface metal industries, 2 automobile industries and 2 food industries. There are other 729 industries located in this segment, but these industries are non-polluting and by and large are dry units. The polluting industries are stated to have installed ETPs but they do not appear to be operating satisfactorily, otherwise the parameters of the drain would not be so violative of the prescribed standards. It is proposed by the stakeholders that the STP of 45 MLD, should be constructed at a point between LML Scooter

factory and the confluence point of river Pandu and ICI Nallah. There is no dispute about space being available for ETP. The capacity of the plant should be 45 MLD keeping the future need in mind and it should be ensured that the technology used is such that the effluent discharged from the ETP/STP is strictly in consonance with the prescribed parameters. The Joint Inspection Team shall inspect all the 40 highly polluting industries in this segment and would issue appropriate directions to ensure that discharge from these industries is strictly within the prescribed norms. If the directions issued by the Joint Inspection Team are not carried out by these industries within the prescribed time, they shall be liable to be shutdown till compliance and subject to further orders of the Tribunal. Thus, we issue the above directions.

DRAINS JOINING RIVER KALI-EAST AND DIRECTIONS IN RELATION THERETO

106. River Kali-East is one of the tributaries of river Ganga. There are nearly 26 drains which join river Kali-East in district Bulandshahr. River Kali-East is an intermittent river and originates near Khatholi town in Uttar Pradesh. It flows through district of Meerut, Hapur, Bulandshar, Aligarh, Kasganj and finally merges with river Ganga in Kannauj, Uttar Pradesh. River Kali-East has a total length of approximately 550 kilometres. Mostly industrial and domestic wastewater is discharged into the river Kali-East.

With this background we would now proceed to deal with each of the 26 drains that join river Kali-East in Segment B of Phase-I.

MAMAN ROAD NALLAH, (BULANDSHAHR-I); AADIL NALLAH; CHANDBARI ROAD (BULANDSHAHR-II); CHEEL GHAT; NAHSAL GHAT; ADIL NAGAR-2; KASAI BADA; FAISALABAD ROAD, BEHIND SHANIDEV MANDIR; DEVIPURA; BRIDGE DHAMEDA ROAD AND BEHIND CHAMUNDA MANDIR

107. We would deal with above drains together. All these drains are located within a very short distance of each other constituting total distance of 4.3 kilometres and have catchment in Bulandshahr. These drains have a length of 150 meters to 4 kilometres approximately. As of now, these drains directly meet river Kali-East from Maman Road to behind Chamunda Mandi in the district of Bulandshahr. While 9 drains are located on the left bank of river Kali-East, remaining 2 drains are located on the right bank of the same. All these drains except Cheelghat drain carry domestic and sewage effluents, whereas Cheelghat drain carries mixed effluent, particularly, from auto mobile washing industry. The Joint Inspection Report shows that Maman Road Nallah has a length of approximately 3 kilometres. It carries blackish colour effluent and has a flow of 86.4 MLD as per last inspection and joins river Kali-East on its right bank. Samples being analysed from this drain, following parameters are shown:

(EFFLUENTS OF MAMAN ROAD NALLAH-GENERAL PARAMETERS)

Sl.No.	Parameters	Results

1.	Colour	:	-
2.	pH	:	7.56
3.	BOD (mg/l)	:	103
4.	COD (mg/l)	:	222
5.	TSS (mg/l)	:	231
6.	TDS (mg/l)	:	782
7.	CL^- (mg/l)	:	67
8.	NH_3-N (mg/l)	:	38
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	-
12.	FC (MPN/100 ml)#	:	-

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF MAMAN ROAD NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.06
5.	Iron (Fe) mg/l	:	4.58
6.	Lead (Pb) mg/l	:	0.03
7.	Manganese (Mn) mg/l	:	0.27
8.	Nickel (Ni) mg/l	:	0.13
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.19
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	0.01

AADIL NALLAH

108. The Joint Inspection Report shows that Aadil Nallah has a length of approximately 4 kilometres. It carries domestic discharge and has a flow of 15.6 MLD, as per last inspection and joins river Kali-East on its right bank. Samples being analysed from this drain, the following parameters are shown:

(EFFLUENTS OF AADIL NALLAH-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.51
3.	BOD (mg/l)	:	97
4.	COD (mg/l)	:	213
5.	TSS (mg/l)	:	219
6.	TDS (mg/l)	:	708
7.	CL^- (mg/l)	:	73
8.	NH_3-N (mg/l)	:	36
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	-
12.	FC (MPN/100 ml)#	:	-

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF AADIL NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	BDL
5.	Iron (Fe) mg/l	:	0.84
6.	Lead (Pb) mg/l	:	0.01
7.	Manganese (Mn) mg/l	:	0.08
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.09
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

CHANDBARI ROAD (BULANDSHAHR II)

109. The Joint Inspection Report shows that Chandbari Road (Bulandshahr II) drain has a length of approximately 4 to 5 kilometres. It carries domestic waste and has a flow of 91 MLD at 12:15 PM and 38.7 MLD at 2:36 PM, as per last inspection and joins river Kali-East on its right bank. Samples being analysed from this drain, the following

parameters are shown:

(EFFLUENTS OF CHANDBARI ROAD (BULANDSHAHR II)-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	Ph	:	7.56
3.	BOD (mg/l)	:	70
4.	COD (mg/l)	:	159
5.	TSS (mg/l)	:	81
6.	TDS (mg/l)	:	676
7.	CL^- (mg/l)	:	61
8.	NH_3-N (mg/l)	:	32
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	-
12.	FC (MPN/100 ml)#	:	-

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF CHANDBARI ROAD (BULANDSHAHR II)-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	0.04
4.	Copper (Cu) mg/l	:	0.12
5.	Iron (Fe) mg/l	:	10.08
6.	Lead (Pb) mg/l	:	0.04
7.	Manganese (Mn) mg/l	:	0.33
8.	Nickel (Ni) mg/l	:	0.06
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.26
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	0.02

NAHSAL GHAT

110. The Joint Inspection Report shows that Nahsal Ghat drain has a length of approximately 150 metres before meeting

Kali-East at its right bank. It carries domestic effluents and has a flow of 1.87 MLD, as per last inspection. Samples being analysed from this drain and following parameters are shown:

(EFFLUENTS OF NAHSAL GHAT-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.52
3.	BOD (mg/l)	:	336
4.	COD (mg/l)	:	808
5.	TSS (mg/l)	:	632
6.	TDS (mg/l)	:	1428
7.	Cl^- (mg/l)	:	192
8.	NH_3-N (mg/l)	:	31
9.	NO_3^-(mg/l)	:	9.62
10.	PO_4-p	:	2.96
11.	DO (mg/l)*	:	
12.	TC (MPN/100 ml)#	:	
13.	FC (MPN/100 ml)#	:	

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF NAHSAL GHAT-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.05
5.	Iron (Fe) mg/l	:	3.08
6.	Lead (Pb) mg/l	:	0.02
7.	Manganese (Mn) mg/l	:	0.41
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.23
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	0.01

ADIL NAGAR 2 DRAIN

111. The Joint Inspection Report shows that Adil Nagar 2 drain

is a dry drain and has a length of approximately 200 metres. It carries domestic effluents, as per last inspection and joins river Kali-East on its right bank.

KASAI BADA DRAIN

112. The Joint Inspection Report shows that Kasai Bada drain has a length of approximately 1.5 kilometres. It carries domestic effluents and has a flow of 7.3 MLD, as per last inspection and joins river Kali-East on its right bank. Samples being analysed from this drain, the following parameters are shown:

(EFFLUENTS OF KASAI BADA DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.56
3.	BOD (mg/l)	:	103
4.	COD (mg/l)	:	222
5.	TSS (mg/l)	:	231
6.	TDS (mg/l)	:	728
7.	Cl^- (mg/l)	:	67
8.	NH_3-N (mg/l)	:	38
9.	NO_3^-(mg/l)	:	3.72
10.	DO (mg/l)*	:	
11.	TC (MPN/100 ml)#	:	
12.	FC (MPN/100 ml)#	:	

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF KASAI BADA DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	0.01
4.	Copper (Cu) mg/l	:	0.15
5.	Iron (Fe) mg/l	:	4.84
6.	Lead (Pb) mg/l	:	0.13
7.	Manganese (Mn) mg/l	:	0.39

8.	Nickel (Ni) mg/l	:	0.02
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.23
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	0.01

BEHIND SHANIDEV MANDIR DRAIN

113. The Joint Inspection Report shows that behind Shanidev Mandir, drain has a length of approximately 600 metres. It carries domestic effluents and is a dry drain. It joins river Kali-East on its right bank.

DEVIPURA DRAIN

114. The Joint Inspection Report shows that Devipura drain has a length of approximately 150 metres and carries domestic effluents. It has a flow of 3.79 MLD and joins river Kali-East on its right bank. Samples were analysed from this drain and following parameters are shown:

(EFFLUENTS OF DEVIPURA DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.56
3.	BOD (mg/l)	:	70
4.	COD (mg/l)	:	159
5.	TSS (mg/l)	:	81
6.	TDS (mg/l)	:	676
7.	Cl^- (mg/l)	:	67
8.	NH_3-N (mg/l)	:	32
9.	NO_3^-(mg/l)	:	3.07
10.	PO_4-P	:	
11.	DO (mg/l)*	:	
12.	TC (MPN/100 ml)#	:	
13.	FC (MPN/100 ml)#	:	

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF DEVIPURA DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.04
5.	Iron (Fe) mg/l	:	1.85
6.	Lead (Pb) mg/l	:	0.02
7.	Manganese (Mn) mg/l	:	0.14
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.10
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

BRIDGE DHAMEDA ROAD DRAIN:

115. The Joint Inspection Report shows that Bridge Dhameda Road drain has a length of approximately 500 metres and carries domestic effluents. It has a flow of 1 MLD and joins river Kali-East on its right bank. Samples were analysed from this drain and following parameters are shown:

(EFFLUENTS OF BRIDGE DHAMEDA ROAD DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.35
3.	BOD (mg/l)	:	88
4.	COD (mg/l)	:	236
5.	TSS (mg/l)	:	111
6.	TDS (mg/l)	:	1084
7.	Cl^- (mg/l)	:	123
8.	NH_3-N (mg/l)	:	20
9.	NO_3^-(mg/l)	:	4.64
10.	DO (mg/l)*	:	4.83
11.	TC (MPN/100 ml)#	:	
12.	FC (MPN/100 ml)#	:	

* For Fresh water carrying drains/rivers
\# For sewage, mixed drains & river

(EFFLUENTS OF BRIDGE DHAMEDA

ROAD DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.02
5.	Iron (Fe) mg/l	:	1.57
6.	Lead (Pb) mg/l	:	0.17
7.	Manganese (Mn) mg/l	:	0.23
8.	Nickel (Ni) mg/l	:	0.11
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.09
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

BEHIND CHAMUNDA MANDIR DRAIN

116. The Joint Inspection Report shows that Behind Chamunda Mandir drain has a length of approximately 1 kilometre. It carries domestic effluents and has a flow of 1 MLD and joins river Kali-East on its right bank. Samples from the drain were analysed and following parameters are shown:

(EFFLUENTS OF BEHIND CHAMUNDA MANDIR DRAIN-GENERAL PARAMETERS)

Sl.No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.58
3.	BOD (mg/l)	:	41
4.	COD (mg/l)	:	149
5.	TSS (mg/l)	:	69
6.	TDS (mg/l)	:	876
7.	Cl^- (mg/l)	:	80
8.	NH_3-N (mg/l)	:	25
9.	NO_3^-(mg/l)	:	5.22
10.	PO_4-P	:	4.49
11.	DO (mg/l)*	:	
12.	TC (MPN/100 ml)#	:	
13.	FC (MPN/100 ml)#	:	

* For Fresh water carrying drains/rivers
# For sewage, mixed drains & river

(EFFLUENTS OF BEHIND CHAMUNDA MANDIR DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.10
5.	Iron (Fe) mg/l	:	1.61
6.	Lead (Pb) mg/l	:	0.05
7.	Manganese (Mn) mg/l	:	0.11
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.14
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

Out of these 12 drains, all but two drains i.e. Cheel Ghat Drain and Faisalabad Road Drain are on the left bank while the remaining 10 drains are located on the right bank of river Kali-East. It was proposed by the stakeholders that the Cheel Ghat Drain and Faisalabad Road Drain are to be considered either for installation of an STP at the end of the pipeline or for interception of these drains and bringing the effluents through the pipeline, along the bridge on the river Kali-East on NH-18 to the other side of the river and join the drains that would ultimately be taken up to a common STP which is proposed to be constructed. The suggestion is that near Maman Road Nallah, there is enough space for

construction of an STP. Total flow of all these 12 drains according to the Joint Inspection Team and the CPCB is nearly 207.96 MLD but according to the UPJN it is 23.20 MLD approximately. Like other data, the UPJN collected this data in the year 2015 and within its municipal limit. However, variations need explanation, which should be driven by proper scientific analysis. In principle, it is accepted that a common STP should be constructed near Maman Road Nallah. All these 10 drains should be intercepted and their effluent should be brought to Maman Road Nallah. The two drains i.e. Cheel Ghat Drain and Faisalabad Road Drain across the left bank of river Kali-East should be intercepted. Their effluent should be brought through a common pipeline to the STP which is to be constructed at Maman Road Nallah. Resultantly, it will be appropriate to establish an STP of an appropriate capacity which is capable of treating the effluent contained in all these drains. It is also apparent from the above analysis reports that some of these 12 drains either do not carry metals and if they carry the same is below the prescribed limit or not detectable. The main load in these drains is of sewage. Pollutants like BOD, COD, Total Coliform and Faecal Coliform are the pollutants that require treatment. We consider it appropriate to direct that the capacity of the STP and its technical design should be finalized after a study is carried out by the Joint Inspection

Team of CPCB, MoWR and UPPCB. They should also analyse the effluents. There should be complete and comprehensive inspection leaving nothing to imagination or rounding off of figures. The data should be collected with exactitude in relation to flow, quality and quantum of effluent. The study in all these respects must be carried out within one month from the date of pronouncement of this judgement and wherever the project is to be executed, without undue delay.

The UPJN has also proposed a common STP of 40 MLD, which would be of inadequate capacity relying on the figures provided by the Joint Inspection Team are correct. We are also of the view that putting up a STP across the river of two drains, i.e., Cheel Ghat Drain and Faisalabad Road Drain would be unduly expensive and difficult to manage as well as to operate. While laying down pipelines and bringing effluents for interception to the Maman Road Nallah, would be economically cheaper, practicable and scientifically viable. Another aspect, which requires attention of the Tribunal, is that there are a number of automobile shops, which cast off oil and grease into drains. All these automobile shops, which are located in the catchment area of some of these drains and particularly Cheel Ghat drain, are directed to make a common pit into which the oil and grease should be stored. This pit should have due lining ensuring that there is no

leachate, particularly, in relation to groundwater. At regular intervals, the hazardous waste should be extracted and taken out to an appropriate site or plant, as the case may be from the pit. We hereby issue prohibitory directions against all these owners or all these shopkeepers running such service stations from getting rid off any effluent, including oil and grease into the drains. If any of them are found to be discharging effluents into the drains after the expiry of two weeks from the date of the order, the UPPCB, and even the concerned public authorities would be liable to impose environmental compensation of ₹ 5,000/- for each violation. The said amount so collected shall be deposited with the UPPCB. Thus, we issue the above directions for compliance.

SUGAR MILL DRAIN

117. This drain flows through the city of Muzzafarnagar for a distance of 5 km before it joins river Kali-East. Its flow as per the UPJN is 5 MLD. It is stated that river Kali-East is dry in upstream of this drain and carries water mainly during rainy season. It carries the sewage of Nagar Palika Parishad, Khatauli and village Bhoor. The drain also carries effluent from sugar mills which is located in the catchment area of same. M/s. Triveni Sugar Mills is an industry that discharges its effluent into this drain. In relation to M/s. Triveni Sugar Mills, the Tribunal has already passed detailed order and even imposed

environmental compensation for not taking appropriate anti-pollution measures and not complying with the conditions imposed under consent to operate. It has been stated that this industry has taken required measures and is presently a compliant industry. However, this industry should be subject to stringent joint inspections during the season. Continuous monitoring of this industry should be conducted to ensure that it does not cause any pollution or discharges effluents into the drain. If this industry or any other industry located in the catchment area of this Sugar Mill drain is found to be violating conditions of consent to operate order or fails to adopt appropriate anti-pollution measures, the same would be liable to be shut down by the orders of the UPPCB without any further notice.

During the course of hearing before the Tribunal it was commonly agreed between all the stakeholders that considering the flow, quantum and quality of effluents being discharged into the drain, it will not be appropriate to install a mechanical STP but it would suffice to construct an oxidation pond near Khatauli, approximately 500 meters away from the river Kali-East. The effluents must be brought within the prescribed parameters after treating them in the said oxidation pond. These treated effluents should be then used for agricultural purposes and only remnant thereof, should be discharged into the river Kali-East.

ABU NALLAH-1, ABU NALLAH-2 AND ODEAN DRAIN

ABU NALLAH-1

118. As far as Abu Nallah-1 is concerned, in furtherance to the order of the Tribunal dated 17th May, 2017, the Joint Inspection had been conducted inspection and it was acceptable to all the stakeholders that Abu Nallah-1 is 35 kilometres from its origin, before it meets river Kali-East. The major part of this drain, i.e., about 60% falls in the agriculture area while remaining 40% falls in the Urban area. It has been found that 10 major sub drains joins Abu Nallah-1:

Code	Joining on	Name of Catchment	Type of Catchment
AB-1	Left Bank	Abdullapur	Mainly Agricultural field
AB-2	Left Bank	Ganga Nagar	Sub-urban
AB-3	Right Bank	Mawana Road Xing	Cantt Area
AB-4	Left Bank	Minakshipuram	Semi-urban
AB-5	Right Bank	Kaserukhera	Urban area
AB-6	Left Bank	Pallapuram	Planned Urban+ STPs
AB-7	Left Bank	Modipuram	Urban
AB-8	Right Bank	PAC/Cantt. Area	Urban
AB-9	Left Bank	Jatoli Area	Urban
AB-10	Left Bank		

The analysis report of Abu Nallah Drain 1 drain shows as

follows:

(EFFLUENTS OF ABU NALLAH-1 - GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.7
3.	BOD (mg/l)	:	55
4.	COD (mg/l)	:	163
5.	TSS (mg/l)	:	83
6.	TDS (mg/l)	:	732
7.	CL^- (mg/l)	:	146
8.	NH_3-N (mg/l)	:	55
9.	NO_3^-(mg/l)	:	3.06
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	$17x10^6$
12.	FC (MPN/100 ml)#	:	$70x10^5$

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

On a collective estimation, the flow of Abu Nallah- 1 is stated to be 39 MLD, however, there are four different STPs at Pallavpuram, Phase-1 and Phase-2, Rakshapuram and Ganga Nagar with a total installed capacity of 34 MLD, while they are receiving only 17.5 MLD for sewage and waste treatment.

All 10 drains/sub-Nallahs should be intercepted and brought to these 4 STPs depending upon their location and easy access to the concerned STP. Once the effluents of these 10 drains are brought to the 4 STPs, then the quantum of effluent set up against the existing capacity of these STPs will be required to measure upgradation. Firstly, they should be able to treat faecal coliform and bring it to the proposed norms of 230 MPN/100 ml and

secondly, at the outlet of the STP, there should be UV or Ozonation Treatment Plant, then this sewage or effluent could be brought within the prescribed parameters and should be primarily recycled for agricultural purposes as a large number of agricultural fields are stated to be on the bank or catchment areas of this Nallah, remaining part could be permitted to flow into the Nallah and join river Kali East.

Other aspect is that the Daurala Sugar Industry, Sugar Distillery Division, Durala Sugar Urban Division and Daurala Sugar Chemical Division are presently discharging their effluent into this Nallah, are not strictly adhering to the prescribed standards. The UPPCB, Namami Gange and Member Secretary, CPCB shall issue directions for strict compliance to these 4 units so that they discharge their effluents strictly in accordance with the prescribed parameters and do not cause pollution. They should be subjected to joint inspection and, if they are found to be violating the prescribed parameters and are polluting, they should be ordered to be shut down. The BOD level shall be brought down by these industries. As the STP, the BOD value of 10 mg/l should be attained irrespective of the prescribed standards. These units have already been once subjected to the Joint Inspection, and the recommendations made by the Joint Inspection Team in relation to each of the units shall be carried out positively

within three months from the date of the order, when they shall be subjected to re-inspection by the Joint Inspection Team.

All the drains including Abu Nallah-1 should be cleaned and all the waste removed, transported and disposed in accordance with the Solid Waste Management Rules, 2016. Direction be also issued to the Meerut Development Authority to recycle water of these STPs for horticulture or allied purposes and reduce the extraction of ground water.

The dredging of all the three drains i.e. Abu Nallah- 1, Abu Nallah-2 and Odean should be done and the dredged material/silt shall be removed within three days thereafter and transported to the appropriate site as to be identified.

ABU NALLAH-2 & ODEAN DRAIN

119. The Abu Nallah-2 is 43 kilometres long while the Odean drain is about 9 kilometres long and mainly flows in Meerut city where ultimately both these drains join river Kali. Two major drains i.e. City drain and Cantt. Drains join Abu Nallah-2. These two major drains are in addition to the 11 drains which join from left or right bank of Abu Nallah-2 in the city area. There are 10 or 11 small drains which join Cantt. area drain and that drain alone then meets Abu Nallah drain. It carries sewage, wastewater and industrial waste as well. It is also pointed out that the drains are full of solid wastes which need to be removed to make any project successful. It has a flow of nearly 150

MLD. There are three STPs at Sainik Vihar, Pandav Nagar and Shardhapuri of 6 MLD, 3 MLD and 6 MLD respectively. Another STP of 72 MLD has been constructed at Sarai Quazi, thus the total capacity available in the STP as of today is 87 MLD. The analysis report of this drain shows as follows:

(EFFLUENTS OF ABU NALLAH-2 - GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.4
3.	BOD (mg/l)	:	51
4.	COD (mg/l)	:	332
5.	TSS (mg/l)	:	192
6.	TDS (mg/l)	:	624
7.	CL^- (mg/l)	:	75
8.	NH_3-N (mg/l)	:	26
9.	NO_3^-(mg/l)	:	4.7
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	$70x10^6$
12.	FC (MPN/100 ml)#	:	$46x10^6$

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

Odean drain has the flow of 182 MLD. Once the 4 STPs as above stated are made completely functional that will take care of 87 MLD out of 150 MLD plus 182 MLD. There is already a proposal for construction of an STP of 210 MLD, for which there is enough land available, near the end of the drain where Odean drain and Abu Nallah-2 meet and join river Kali, adjoining the premises where 72 MLD STP has already been constructed and the proposed 210 MLD would treat the remnant: (182 + 150 – 87 = 245 MLD). The water from all the 4 STPs has to be recycled, thus to

reduce the pressure on the main drain. This should be recycled for agriculture and horticulture purposes in the city and Cantt adjoining the catchment area. The Commissioner, Meerut would hold a meeting and lay down the effluent disposal mechanism for recycling of water. All the STPs at their outlet shall be provided with Ultra-Violet or Ozonation Technology to ensure that the effluent is being treated as per the prescribed parameters. The analysis report of this drain shows as follows:

(EFFLUENTS OF ODEAN DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.3
3.	BOD (mg/l)	:	182
4.	COD (mg/l)	:	763
5.	TSS (mg/l)	:	565
6.	TDS (mg/l)	:	864
7.	CL^- (mg/l)	:	178
8.	NH_3-N (mg/l)	:	47
9.	NO_3^-(mg/l)	:	10.29
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	$35x10^6$
12.	FC (MPN/100 ml)#	:	$24x10^5$

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

(EFFLUENTS OF ODEAN DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	0.05
3.	Total Chromium (Cr) mg/l	:	0.1
4.	Copper (Cu) mg/l	:	0.11
5.	Iron (Fe) mg/l	:	5
6.	Lead (Pb) mg/l	:	0.03
7.	Manganese (Mn) mg/l	:	0.36
8.	Nickel (Ni) mg/l	:	0.07

9.	Mercury (Hg) mg/l	:	NA
10.	Zinc (Zn) mg/l	:	0.41
11.	Antimony (Sb) mg/l	:	NA
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

The Joint Inspection Team shall also recommend, if the STP which is proposed should be only of 210 MLD or should be of a higher capacity, keeping in view that there will be remnant effluent depending on the quality and quantum of the discharge in the drain. There are two industries in the catchment area of Abu Nallah-2 i.e. M/s. Sab Mailler India Ltd. and M/s. United Spirits Limited. Both these industries have been subjected to joint inspection and recommendations have been made. These industries will comply with the recommendations of the Joint Inspection Team within three weeks from today.

In the event of default, they shall be liable to be shutdown. The Joint Inspection Team shall further be entitled to issue directions for compliance under the orders of the Tribunal to these industries.

The CPCB, SPCBs, MoEF&CC and MoWR have expressed the view that the industries located in Moradabad and Meerut are primarily using Cyanide based Zinc for electroplating industries. They should be directed to use non-cyanide based technology for electroplating purposes.

We hereby direct Central Pollution Control Board to issue

directions regarding same, forthwith to the entire basin area of the river Ganga.

In relation to all these three drains, the data of the Joint Inspection Team and the UPJN does not vary substantially. The effluents of these drains have already been analysed and their contents need to be treated by installation of an appropriate STP. The UPJN has also proposed an STP as indicated above. All the existing 10 STPs which are stated to be functional should be appropriately up-graded and made effective. They should treat the sewage/effluents, while completely bringing the parameters within the prescribed limit. Once the existing STPs are made functional and effective in all respects and the proposed new STPs are constructed, having appropriate capacity and design, then there would be no pollution. The industries are also subjected to the directions as afore-stated. There will be hardly any pollution of river Kali-East from these three drains. Thus, we pass all the above directions for compliance.

CHHOIYA DRAIN

120. This drain travels nearly 50 km through District Meerut and finally joins river Kali-East in district Hapur near village Babugarh Cantt. There are villages in the catchment area of this drain. However, there are also a number of industries located in the catchment area of this drain which includes sugar, pulp and paper industries and other

highly polluting industries. These villages as well as industries discharge their effluents into the drain which carries it to some length and then the drain gets dry, before joining river Kali-East. According to stakeholders, the drain has a flow of approximately 1.6 MLD. The drain carries mixed effluents though it is stated to be not seriously polluting. This drain carries mixed effluents. Its effluents are analyzed by the Joint Inspection Team and general and the parameters for metals are found to be as follows:

(EFFLUENTS OF CHHOIYA DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.92
3.	BOD (mg/l)	:	18
4.	COD (mg/l)	:	124
5.	TSS (mg/l)	:	39
6.	TDS (mg/l)	:	908
7.	CL^- (mg/l)	:	119
8.	NH_3-N (mg/l)	:	14
9.	NO_3^-(mg/l)	:	5.84
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	$79x10^2$
12.	FC (MPN/100 ml)#	:	$49x10^2$

* For Fresh water carrying drains/rivers
\# For sewage, mixed Drains & River

(EFFLUENTS OF CHHOIYA DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/1	:	BDL
2.	Cadmium (Cd) mg/1	:	BDL
3.	Total Chromium (Cr) mg/1	:	BDL
4.	Copper (Cu) mg/1	:	BDL
5.	Iron (Fe) mg/1	:	1.2
6.	Lead (Pb) mg/1	:	BDL
7.	Manganese (Mn) mg/1	:	0.21

8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.05
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

Though, it carries metals like iron, zinc, manganese, etc. but all are below the prescribed standards. There are also some element of pesticides found in the analysis report. It is commonly agreed by all the stakeholders that this drain does not require an STP/CETP to be constructed at the end of the pipeline or otherwise. The effluents could be left to be diluted in the flow of the river without any intervention. The Tribunal is of view that specific directions are required to be issued with regard to industries located in the catchment area of this drain. These industries should be required to comply with the prescribed standards stringently and should not be permitted to cause any further pollution. The Joint Inspection Team shall conduct inspection of all the majorly polluting industries located in the catchment area of this drain and would issue appropriate directions for compliance by the industries.

The joint inspection should be completed and directions should be issued within six weeks from the date of passing of this judgement. The industries should comply with said directions of Joint Inspection Team within the prescribed

time stated in the conditions and in the event of default, they shall be ordered to be shut down by UPPCB without any further notice and delay.

The drains should be subjected to dredging, cleaning and removing of MSW. The UPPCB shall serve a notice upon all industries located in the catchment area of this drain to have effective responsibility (Corporate Social Responsibility) and to ensure that the drain is kept cleaned and no waste is permitted to be thrown into it. Thus, we issue above stated directions for compliance by all the stakeholders.

HAPUR DRAIN

121. District Hapur has three major drains. Firstly, Hapur City Drain which has a length of 4770 meters within the municipal limit and originates in Zone 3 and passes through Zone 6 to meet river Kali-East. Secondly, Gram Rampur drain which is approximately 1.6 km long, joins Hapur (Chhoiya drain) drain which is nearly 4 km long. After Gram Rampur drain joins Hapur (Chhoiya drain), it meets Khatauli drain which comes from the side of Meerut through Zone 1 and Zone 2 of Hapur and ultimately joins river Kali-East. Khatauli drain travels nearly 12 km before it joins river Kali-East. It has been proposed by the stakeholders to put up an STP of 40 MLD between the point where the Gram Rampur drain and Hapur drain meet and the point where it joins Khatauli drain. It has

been brought to the notice of the Tribunal that space is available for setting up of 40 MLD STP, which would ensure that the pollutants do not join Khatauli drain and ultimately river Kali-East. On the Hapur City drain, the proposal is to construct an STP of 10 MLD nearly 700 meters away from the edge of the river Kali-East. It has also been commonly stated that from the point where Hapur (Chhoiya drain) drain meets Khatauli drain and the point where Khatauli drain meets river Kali-East, the predominant activity is agriculture. It is also stated that there is likelihood of increased development in the command area within the municipal limit. Hence, it is directed that the concerned developer agency should be directed to set up a functional STP to treat sewage, no matter it relates to residential development or any other. Only such treated sewage should be permitted to enter Khatauli drain or any of the above drains. Furthermore, no development activity should be permitted unless an STP is installed in the concerned area.

It has also been stated during the course of hearing, there are 41 industries carrying on business of textile, dyeing, sugar, chemical, etc. out of which 34 industries fall in Meerut Cantt. area and 7 industries fall in Hapur catchment area. All these 7 industries falling in Hapur catchment area district, shall be subjected to joint inspection. The Joint Inspection Team shall issue

appropriate directions with regard to proper installation of anti-pollution devices and for taking appropriate measures so as to ensure that they are compliant and do not cause any pollution. In the event of non-compliance of directions, they shall be liable to be closed by UPPCB without further notice.

KADRABAD DRAIN

122. Kadrabad drain has a length of nearly 35 kilometres. It enters adjacent to District Meerut and passes through Modi Nagar to join river Kali-East. This drain has a discharge load of 49 MLD. There are some other drains joining this drain like Govindpuri drain, Sikhaida drain, Hanuman Puri Drain etc. All these drains carry mixed waste. However, there is inflow of industrial and domestic effluent after they meet Kadrabad drain but before finally joining river Kali-East. Therefore, the Tribunal reaches to the conclusion that setting up of STPs on any of the above stated drains would be waste of effort and public funds due to the reason that the treated water would again get mixed with the polluted sewage and trade effluent after the proposed point of interception. Likewise, it will not serve any environmental purpose unless and until there is treatment of water and absolute recycle, if possible, which has not been commonly agreed by the stakeholders. Interception of the drains is not a plausible solution as a number of drains joins this drain.

Therefore, it is proposed that at the end of the pipeline, a 50 MLD STP should be constructed. At the outlet, the resultant effluent quality is BOD= 73, COD= 154, also containing metals like Copper, Iron, Manganese etc. which are found to be within the prescribed limit.

However, to ensure that an STP functions appropriately at the end of the pipeline, it was suggested that there should be a CETP at Modi Industrial Group to treat their industrial effluents. However, to treat the sewage that is joining Kadrabad drain, near Modi Nagar, an independent STP should be setup by the Government agencies. The industrial cluster at Pilakhuwa should be directed to put a CETP on their own or in collaboration with the Government stakeholders.

The CETP/ETP at Pilakhuwa should be shared on Polluter Pays Principle, in ratio of 50% by Government of India, 25% by polluters and 25% by the Government of concerned State, as directed by the Hon'ble Supreme Court of India in the order dated 22nd February, 2017.

It would be pertinent to note that the analysis reports of the Joint Inspection Team of Kadrabad Drain:

(EFFLUENTS OF KADRABAD DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	8.08
3.	BOD (mg/l)	:	73
4.	COD (mg/l)	:	154
5.	TSS (mg/l)	:	40
6.	TDS (mg/l)	:	964

7.	CL^- (mg/l)	:	148
8.	NH_3-N (mg/l)	:	18
9.	NO_3^-(mg/l)	:	3.58
10.	DO (mg/l)	:	NA
11.	TC (MPN/100 ml)#	:	$49x10^5$
12.	FC (MPN/100 ml)#	:	$33x10^5$

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF KADRABAD DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.02
5.	Iron (Fe) mg/l	:	0.55
6.	Lead (Pb) mg/l	:	BDL
7.	Manganese (Mn) mg/l	:	0.27
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.03
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

It is directed hereby that the industries that are contributing to the pollution of the said drains, should install anti-pollution devices and take appropriate measures. The Joint Inspection Team should issue directions to these industries, stating parameters, they are required to maintain as well as the steps that they should lay hold of, to prevent and control pollution. The Joint Inspection Team should also specify the period for compliance, to ensure that these industries become compliant and non-polluting within a specified period.

Also following general directions need to be issued in relation to all the industries located in the catchment area of Kali-East river:

1. They should be strictly regulated.

2. Joint inspection should be conducted.

3. Compliance should be strictly made. If there is default in compliance within the prescribed period, which normally should not exceed 3 to 6 months, the industries should be shutdown.

GULAOTHI DRAIN:

123. This drain carries mixed waste of 7 to 8 MLD. It travels nearly 5 km before it joins river Kali-East. The effluents contain high pollutants like BOD, COD, Faecal coliform, etc. which are much beyond the permissible limit along with metals. The Joint Inspection Team pointed out that in this drain, Eichhornia growth was found and large quantity of solid wastes were also found floating with the drain. The Joint Inspection Team collected the samples of the effluents which were analyzed. The results of the analysis in relation to general and metallic parameters are as follows:

(EFFLUENTS OF GULAOTHI DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	NA
2.	pH	:	7.51
3.	BOD (mg/l)	:	139
4.	COD (mg/l)	:	282
5.	TSS (mg/l)	:	196
6.	TDS (mg/l)	:	860

7.	CL^- (mg/l)	:	130
8.	NH_3-N (mg/l)	:	38
9.	NO_3^-(mg/l)	:	3.64
10.	DO (mg/l)	:	NIL
11.	TC (MPN/100 ml)#	:	$22x10^6$
12.	FC (MPN/100 ml)#	:	$22x10^6$

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF GULAOTHI DRAIN-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	BDL
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.02
5.	Iron (Fe) mg/l	:	2.33
6.	Lead (Pb) mg/l	:	0.02
7.	Manganese (Mn) mg/l	:	0.22
8.	Nickel (Ni) mg/l	:	BDL
9.	Mercury (Hg) mg/l	:	NA
10.	Zinc (Zn) mg/l	:	0.09
11.	Antimony (Sb) mg/l	:	NA
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	BDL
14.	Vanadium (V) mg/l	:	BDL

In order to control and prevent pollution, it has been unanimously agreed between the stakeholders that the concerned State Government and the competent authority should acquire the land, which is available approximately 600 meters away from the riverbed. It is stated that between the culverts and the railway line, sufficient land is available to establish an STP. An STP of 10 MLD should be constructed which will be capable of treating BOD, COD, Faecal coliform and should duly take care that the metals remain below the prescribed parameters. The treated

sewage from six STPs should be recycled for use in agricultural and horticulture purposes and only the remnant should be released into river Kali-East. Considering the fact that only a few number of industries are located in the catchment area of this drain, the concerned Government authority should provide incentives to such industries to encourage recycling of treated water for industrial purposes.

Amongst the industries causing pollution, there are two main industries in the catchment area of this drain. Both M/s V.R.S. Food Limited Unit-3 and M/s. V.R.S. Food Limited Unit-4 are dairy units causing serious pollution. They should be directed to strictly adhere to the prescribed norms, which should be subjected to joint inspection. Detailed directions in terms of Section 33A of the Water Act read with Section 5 of the Environment (Protection) Act, 1986 should be issued. In the event of dis-obedience or non-adherence within the prescribed period, they should be ordered to be shut down.

The UPPCB should also issue notice to these industries as well as to other industries which are discharging their untreated effluents or pollutants into this drain as to why they should not be called upon to pay environmental compensation in terms of Sections 16 and 17 of the National Green Tribunal Act, 2010. The said Board in addition to the inspection by the Joint Inspection Team

along with other public authorities should conduct complete survey of this area and prepare list of the polluting industries which are discharging their effluents into this drain and submit a report to this Tribunal.

Thus, we issue the above directions for compliance by the concerned authorities and the UPJN to take steps for construction of the STP.

NEEM NALLAH:

124. This drain primarily carries domestic waste. Jahagirabad drain-1 and Jahagirabad drain-2 also join Neem Nallah at Malahpur village. Even Dibai drain 1, 2 and 3 also join Neem Nallah and it is one major drain, inclusive of all the five drains.

Neem Nallah is 102 kilometres in length, out of which 30 kilometres falls in Aligarh district and 72 kilometres falls in Bulandshahr district. Thereafter, it joins river Kali at Aligarh. This Nallah carries sewage and domestic effluent and not any industrial effluent. Five minor drains meet this Nallah.

It is stated that this drain is dry for more than 10 kilometres in length before it meets Kali. It is, therefore, suggested that on the boundary of Aligarh and Bulandshahr, at a point towards Aligarh, there should be an oxidation pond or a constructed wetland for treatment. However, this should be done after the flow is measured at

that point and the effluents are analyzed. Upon analysis, final decision should be taken. Drain should also be kept clean, as for most part of the year it remains dry and carries excessive rain water etc. in the rainy season.

As the Joint Inspection Team had not conducted inspection and taken the measurement of flow and the quality of effluent, we, therefore, direct the Joint Inspection Team to carry out measurement of flow and the quality of effluent of the drain.

It has been made clear that in the catchment of this drain there is no industry discharging its pollutants into this drain.

Even, the UPJN has proposed construction of an oxidation pond or a constructed wetland for treating sewage. Parties are in agreement that there need not be construction of a mechanical STP at the end of the drain.

KASGANJ DRAIN

125. Kasganj drain is 3 to 4 kilometres long. It mainly carries domestic effluents and sewage. The measured flow is 9 MLD. Nadrai Gate drain flows across the railway track and carries nearly 36 MLD of domestic waste. Kasgang drain finally meets river Kali. Thus, it is suggested that Nadrai Gate drain should not be intercepted. There should be two independent STPs. One 5 MLD STP should be at Nadrai Gate drain about 500 meter before it meets Kali river. Keeping in view future and projected needs, it is suggested

that 15 MLD STP should be established at the end of the Kasganj drain, about 500 meters before it meets river Kali. The places demarcated and reserved for future population near Kasganj Nallah, should be developed with an assurance that it should not over reach 15 MLD at the relevant point of time. If that be so, the sewage and domestic discharge shall be treated by the development agency for these two areas separately, before being released into the drain.

The UPPCB has not taken flow measurement of this drain. It has also not proposed any plan which should be prepared on scientifically collected data. The sample was taken near Amarpur Road pulia, Kasganj. Amarpur Kasganj area comes within catchment area of this drain. The analysis of general parameters and metals reads as under:

(EFFLUENTS OF KASGANJ DRAIN-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	6.94
3.	BOD (mg/l)	:	123
4.	COD (mg/l)	:	286
5.	TSS (mg/l)	:	176
6.	TDS (mg/l)	:	750
7.	CL^- (mg/l)	:	104
8.	NH_3-N (mg/l)	:	42.3
9.	NO_3^-(mg/l)	:	0.271
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	92000000
12.	FC (MPN/100 ml)#	:	54000000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF KASGANJ DRAIN-

TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	-
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.008
5.	Iron (Fe) mg/l	:	-
6.	Lead (Pb) mg/l	:	-
7.	Manganese (Mn) mg/l	:	0.144
8.	Nickel (Ni) mg/l	:	-
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.112
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

There is another seasonal Nallah, i.e., Salai drain which carries less than 1 MLD of discharge. It should be plugged at the end of the pipeline. It mainly carries rainwater which should be used for agricultural purpose. These STPs would have the technology for treatment of Coliform, as the Coliform value of the drain is running in crores.

PATTA NALLAH, ADANGAPUR DRAIN AND TAMMI NALLAH

126. All these Nallahs flow in the city of Kannauj and join river Kali-East. Their length is about 6 kilometres, 7.5 kilometres and 3.5 kilometres, respectively. They mainly carry sewage and domestic waste. There is hardly any other industrial effluent and wherever the same is present, it is much below the prescribed value. The general parameters and parameters in relation to the heavy metals of these drains are as follows:

(EFFLUENTS OF PATTA NALLAH-GENERAL PARAMETERS)

Sl.	Parameters	Results

No.			
1.	Colour	:	-
2.	Ph	:	7.15
3.	BOD (mg/l)	:	31.1
4.	COD (mg/l)	:	112
5.	TSS (mg/l)	:	81.2
6.	TDS (mg/l)	:	808
7.	CL^- (mg/l)	:	116
8.	NH_3-N (mg/l)	:	22.6
9.	NO_3^-(mg/l)	:	0.449
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	54000000
12.	FC (MPN/100 ml)#	:	17000000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF PATTA NALLAH-TRACE METAL/HEAVY)

Sl.No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	-
2.	Cadmium (Cd) mg/l	:	BDL
3.	Total Chromium (Cr) mg/l	:	BDL
4.	Copper (Cu) mg/l	:	0.042
5.	Iron (Fe) mg/l	:	-
6.	Lead (Pb) mg/l	:	-
7.	Manganese (Mn) mg/l	:	0.116
8.	Nickel (Ni) mg/l	:	-
9.	Mercury (Hg) mg/l	:	-
10.	Zinc (Zn) mg/l	:	0.152
11.	Antimony (Sb) mg/l	:	-
12.	Cobalt (Co) mg/l	:	BDL
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

(EFFLUENTS OF ADANGAPUR NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.45
3.	BOD (mg/l)	:	19.2
4.	COD (mg/l)	:	57.3
5.	TSS (mg/l)	:	27.8
6.	TDS (mg/l)	:	722
7.	CL^- (mg/l)	:	82.3
8.	NH_3-N (mg/l)	:	31.6
9.	NO_3^-(mg/l)	:	

10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	3300000
12.	FC (MPN/100 ml)#	:	3300000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF ADANGAPUR NALLAH-TRACE METAL/HEAVY)

Sl. No.	Parameters	Results	
1.	Arsenic (As) mg/l	:	Result awaited
2.	Cadmium (Cd) mg/l	:	
3.	Total Chromium (Cr) mg/l	:	
4.	Copper (Cu) mg/l	:	
5.	Iron (Fe) mg/l	:	
6.	Lead (Pb) mg/l	:	
7.	Manganese (Mn) mg/l	:	
8.	Nickel (Ni) mg/l	:	
9.	Mercury (Hg) mg/l	:	
10.	Zinc (Zn) mg/l	:	
11.	Antimony (Sb) mg/l	:	
12.	Cobalt (Co) mg/l	:	
13.	Selenium (Se) mg/l	:	-
14.	Vanadium (V) mg/l	:	-

(EFFLUENTS OF TAMMI NALLAH-GENERAL PARAMETERS)

Sl. No.	Parameters	Results	
1.	Colour	:	-
2.	pH	:	7.59
3.	BOD (mg/l)	:	39.6
4.	COD (mg/l)	:	120
5.	TSS (mg/l)	:	84
6.	TDS (mg/l)	:	772
7.	CL^- (mg/l)	:	107
8.	NH_3-N (mg/l)	:	19.4
9.	NO_3^-(mg/l)	:	-
10.	DO (mg/l)	:	-
11.	TC (MPN/100 ml)#	:	17000000
12.	FC (MPN/100 ml)#	:	17000000

* For Fresh water carrying drains/rivers
# For sewage, mixed Drains & River

(EFFLUENTS OF TAMMI NALLAH-TRACE METAL/HEAVY)

Sl.	Parameters	Results

No.			
1.	Arsenic (As) mg/l	:	Result awaited
2.	Cadmium (Cd) mg/l	:	
3.	Total Chromium (Cr) mg/l	:	
4.	Copper (Cu) mg/l	:	
5.	Iron (Fe) mg/l	:	
6.	Lead (Pb) mg/l	:	
7.	Manganese (Mn) mg/l	:	
8.	Nickel (Ni) mg/l	:	
9.	Mercury (Hg) mg/l	:	
10.	Zinc (Zn) mg/l	:	
11.	Antimony (Sb) mg/l	:	
12.	Cobalt (Co) mg/l	:	
13.	Selenium (Se) mg/l	:	
14.	Vanadium (V) mg/l	:	

All the stakeholders agree that keeping in view the pollutant values of the content of the drain, it will be most appropriate to have an oxidation pond/constructed wetland to reduce the BOD, mainly coliform. This remedy would be least expensive, cost effective and most beneficial. However, for the reason best known to Jal Nigam, they have an STP of the capacity of 13 MLD at the end point of Patta Nallah, which will cost several crores, and is nearing completion. Besides, sewerage network has to be laid down to provide sewage connection. They have already completed 90% work of STP and 70% of sewer network has been laid. In these peculiar circumstances, we do believe that the project of Jal Nigam, which is not study based, was avoidable. But in view of large work having already been carried out, we permit this project to be completed and 13 MLD STP should be made functional

within three months from today.

ADANGAPUR DRAIN AND TAMMI DRAIN:

127. Keeping in view the effluent values, it is commonly proposed that there should be an oxidation pond at a distance of 500 meters to 1 kilometre from the point where Nallah meets the river. Besides, due protection should be taken at the local level to ensure that the animal dung and other waste is not permitted to enter the drain so as to reduce the pressure of coliform at the end of the pipeline. Guideline for Faecal Coliform disposal need to be issued by UPPCB. There should be an oxidation pond on these drains. These drains should be kept under strict supervision and ensure appropriate functioning so as not to put pollution burden on the river which is only 6.5 kilometre away from river Ganga.

In view of the above discussion we, therefore, pass the following directions:

a) We permit the UPJN to complete the STP of 13 MLD at the end of Patta Nallah before it meets the river.

b) Directions have already been issued to complete the work within three months from the date of issue of order dated 31st May, 2017 of the Tribunal.

c) The parties would ensure the compliance as well as the discharge from the STP should be strictly within the parameters and it should be recycled, wherever possible.

d) We further direct to construct the oxidation pond/wetlands for treatment of sewage in relation to the other two drains i.e. Adangapur Drain and Tammy Nallah.

e) Since there is considerable difference between the values of the measurements taken by the Joint Inspection Team and UPJN, we direct that the Joint Inspection Team shall measure the flow of all the three drains. It should also examine if the flow is 6.5 MLD, as stated by the Joint Inspection Team and if so the possibility of other two drains being intercepted and brought to the same STP as their discharge is just 4.36 MLD and 1.52 MLD, be examined. In that event, the entire discharge could be brought to the proposed STP and treated there and consequently there should be no occasion to construct oxidation ponds/wet lands. This study should be completed within six weeks from the date of passing of this order.

GANGA–RIVER FLOW AND MINIMUM ENVIRONMENTAL FLOW:

128. The Ganga Basin, being a part of the composite Ganga-Brahmaputra-Meghna basin lies in China, Nepal, India and Bangladesh and drains an area of 10,86,000 km^2. India alone contains approximately 79% area of the Ganga basin. It is the largest river basin in the country,

constituting 26% of the country's land mass and supporting nearly 43% of its population (448.3 million as per the 2001 census).

In India, the Ganga basin extends to eleven States, namely, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Haryana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal and Delhi. The cardinal sources of water in river Ganga are rainfall and melting ice sheets as well as glaciers. Surface water resources of the Ganga (its long term mean annual flow volume as it enters the ocean) have been assessed at 525 billion cubic meters (BCM).

In the Ganga Basin, the average density of population is 520 persons per square km compared to 312 for the entire country, according to 2001 census. Major cities of Delhi, Kolkata, Kanpur, Lucknow, Agra, Meerut, Varanasi and Allahabad, which are witnessing rapidly increasing population are also are situated in the Ganga basin. Between 1991 and 2001, the urban population of India has increased by 32% and this trend is likely to continue in the coming years. This escalates the pressure on already over-allocated natural resources, including rivers. Further, the rising standard of living and exponential growth of industrialization and urbanization have exposed water resources in general and rivers in particular, to various forms of degradation.

129. Scientists have studied that water of river Ganga at its

origin is in pure state and even after being kept for several years does not get contaminated. These medicinal properties are attributed to the medicinal secretion of herbs and mineral content which get mixed with the water. Earnest Hankin, a British bacteriologist observed and reported in 1896 about the presence of marked anti-bacterial activity against Vibrio Cholera in the water of river Ganga. He suggested that by using the holy water of river Ganga, the incidence of cholera in people might be reduced. National Botanical Research Institute, Lucknow also conducted a study to validate the anti-microbial effect of Ganga water on Escherichia Coli (E. coli) – a worldwide cause of infection in humans and animals. The water of river Ganga, after being spiked by fivefold log units of E. Coli did not affect its waters' native microbial community structure. The Ganga water killed highly pathogenic E. coli manifold, more efficiently as compared to normal water and even 16 years old Ganga water was extremely effective for the same. This is attributed to the bacteriophages, a kind of viruse which resembles bacteria feeding on E coli. These findings suggest that Ganga water has certain novel antimicrobial attributes, besides its remarkable fluidity, which may provide a much-needed basis for the development of new antimicrobial compounds. (*Refer: Chandra Prakash Nautiyal: Self Purificatory Ganga water Facilitates death of pathogenic Escherichia coliO157:H57:*

Current Microbiology (2009)58:25-29 and in Asia Agri-History, Vol. 13, No.1, 2009(53-56)

130. Rivers have self-cleansing ability, primarily due to the flow velocity which permits oxygenation and decomposition of biological waste. However, as river Ganga leaves Haridwar, the flow velocity gets reduced due to flat topography and there is large scale withdrawal of water from Ganges between Haridwar and Narora, through various barrages and canals laid for agricultural and other consumptive uses in the State. A massive diversion of the water of Ganga by the upper river Ganga Canal Network off the headwork at Haridwar, Madhya Ganga Canal network at Bijnore and Lower Ganga Canal near Aligarh/Narora causes a critical fall of dry weather flow downstream and thereby downgrading its water quality. The withdrawal of water between Haridwar and Narora is as follows:

Place	**Average Flow in Cusecs**	**Diversion to**
Hardwar	30527	Upper Ganga Canal, East Ganga Canal at Bheem Gauda Barrage
Bijnor	18000	Madhya Ganga Canal Phase I, Phase II at Ch Charan Singh Barrage
Narora	13000	Lower Ganga Canal, Parallel Ganga Canal, Narora Atomic Power Plant
Kanpur	4096	Drinking water for Kanpur City
(Source: CPCB Report dated May 2016)		

The withdrawal / diversion through the canal systems

plays a significant role in sustaining the agriculture sector in the State of Uttar Pradesh. In fact, the sectoral water allocation, like other States in India, is the highest for irrigation in the State of Uttar Pradesh, i.e., about 96%.

The Upper Ganga Canal takes off from the right flank of the Bhimgoda barrage with a head discharge of 190 M^3/s, and presently, the gross command area is about 2 million hectare (ha). The Madhya Ganga canal provides annual irrigation to 178,000 ha. Similarly, the Lower Ganga Canal comprises a weir across the Ganga at Narora and irrigates 0.5 million ha.

131. Environmental flows or E flows are the flow regime in a river that describe the temporal and spatial variations in the quantity and quality of water required by the river to perform its natural ecological functions and support the aquatic and terrestrial biodiversity, meet agricultural and consumptive needs and also support the spiritual, social and cultural activities that depend on the river ecosystem.

The wholesomeness of the water of river Ganga is also viewed in the context of it being *'aviral'*, meaning 'continuous flow' and *'nirmal'*, meaning 'unpolluted'. These attributes are linked to the maintenance of continuous flow, uninterrupted by dams and barrages, along its entire length in an unpolluted and pristine form. Such attributes are considered key ingredients of the self purification properties that the water of Ganga is found to

be possessing, not only in mythological beliefs but validated by emerging scientific research.

Environmental Flows are the flow required for the maintenance of the ecological integrity of the rivers and their associated ecosystems. Environmental Flows are increasingly recognized as a vital contributor to the continuing provision of environmental goods and services upon which the livelihood of people depend.

In a nutshell, E-Flows are required for:

1. Maintaining river regimes.
2. Conservation of self-purification properties of river.
3. Maintaining aquatic biodiversity.
4. Recharging groundwater.
5. Supporting livelihoods.
6. Maintaining sediment movement.
7. Preventing saline intrusion in estuarine and delta areas.
8. Providing recreation.

Longitudinal connectivity and lateral connectivity of the river are key considerations for flows and sediment transport. If longitudinal connectivity is not maintained, the geomorphic as well as ecological functioning of the river will collapse. The survival of various species of fish like Mahseer, which depend upon migration for spawning, will be adversely affected if the longitudinal connectivity of the river is broken. Sediment and nutrient movement will

be disrupted. Even in the driest years, some floods are necessary to maintain the longitudinal and lateral connectivity.

In privation of a definite minimum flow, the movement of biota will be severely hampered and there will be adverse impacts on nutrient supply and habitat condition, as well as the channel shape and depth in the long term.

One of the yardsticks for determining E-flow is to study the survival of Flagship species, including Dolphin, Gharial, drafts and invertebrates in order to sustain the biodiversity and food-web so that the aquatic and associated ecosystem inclusively of floodplains remain intact.

It is also recommended that E-Flow is essential for improving the water quality and health of the river. Dilution is no solution to rationalize discharge of sewage and industrial effluent into the river. It should be properly treated and there should be restrictions on such discharge into the river.

132. From the perspective of water quality, the state of the river Ganga at Kanpur is of key concern. The river in this stretch receives considerable pollution from two tributaries, the river Kali-East and river Ramganga and also forms many point and nonpoint sources. The river is classified as 'C/D' due to high BOD, low DO and high TC. The water quality in this zone should be improved to Class 'B'.

The National Water Policy 2012, under clause 1.3 states:

> iv. Water needs to be managed as a common pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all.
> v. Water is essential for sustenance of eco-system, and therefore, minimum ecological needs should be given due consideration.
> vi. Safe Water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs (including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system needs. Available water, after meeting the above needs, should be allocated in a manner to promote its conservation and efficient use.

Under clause 3.3, the policy states that, "Ecological needs of the river should be determined, through scientific study, recognizing that the natural river flows are characterized by low or no flows, small floods (freshets), large floods, etc., and should accommodate developmental needs. A portion of river flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use." However, there is a long way to go, as various stakeholders still need to understand the vitality of rivers from an environmental perspective.

133. A three Member Committee set up by the MoWR,

submitted a report in March 2015. This report hails recommendations on "Assessment of Environmental Flows". The Committee concluded that the E-flows assessment (EFA) is an important step in determining the River Health Regime (RHA). Achieving a specific River Health Regime (RHA) may warrant certain policy decisions to set boundary conditions for planned action. The timeline, resources, resource requirements and challenges faced are expected to be different and may have to be based on strategic planning. It recommended adoption of the stated description of E-flows. It emphasized that E-flows are not only about the water flows. However, maintenance of the water-sediment balance is also an essential condition. It is desired that E-flows should carry suspended load and bed load in approximately the same proportions as present in virgin flow. The Committee also came up with the recommendations about how to estimate E-flows and minimum environmental requirement in rivers, depending on the River Health Regime. The report strongly recommends the Building Block Method for assessment of E-flows as robust and scientifically most suitable. The report divides the river into five health regimes: Pristine, Near Pristine, Slightly Impacted, Impacted and Degraded.

1. Flow regime inferior than the Minimum Ecological Requirement (MER) would render the river in most

degraded rivers in India (except possibly those in North East and some Himalayan tributaries in upper reaches) are already degraded since we are not maintaining even minimum flows.

2. Flow regime that is better than MER but below the E-flows will make the river Impacted.
3. Flow regime higher than E-flows but below 90% dependable flow will make the river Slightly Impacted.
4. Flow regime better than E-flows but below the average flows will mean river is in Near Pristine.
5. If flow regime matches the average flows in the river than it is considered in Pristine.

The above classification of river health status is only with respect to hydrological quantities, we need similar classification for river water quality, geomorphology and biology.

The Committee has stated that the river needs to have Environment flows higher than the MER to allow the rivers to continue to perform its basic functions.

The Committee stated that the E-Flow is not a luxury but a necessity for the people and the society. The objective of E-flow is to recognize the physical limit, beyond which a water resource suffers irreversible damage to its eco-system functions, and systematically balance the multiple water needs of society in a transparent and informed manner. E-flows are one of the central elements in water

resources, planning and management for sustainable development. The suggestions about the E-flows are neither impractical nor will the implementation have disruptive impact on our water needs and uses. The agriculture needs more water and the source is groundwater. Therefore, groundwater recharge and sustainable use should be a fixed priority. The projects related to rivers should also be subjected to proper scrutiny and compliance to the law before they can be implemented.

134. To put it simply, the Environmental Flow is a very simple concept. First of all, this term should always be used in plural, implying that a synonym to environmental flows is an ecologically acceptable flow regime designed to maintain a river in an agreed or predetermined state. Environment Flows are a compromise between water resources development, on one hand, and maintenance of healthy river or at least reasonable condition, on the other. Another useful way of thinking about E-flows is that of 'environmental demand', similar to crop water requirements, industrial or domestic water demand. Despite the simplicity of the concept, complication arose, in the actual estimation of E-flow values, primarily due to meagerness of both understanding of and quantitative data on the relationship between river flows and multiple components of river ecology.

135. Ecologists agree that the major criteria for determining environmental flow should include the maintenance of both spatial and temporal patterns of river flow. The environmental flow should not only encompass the amount of water so needed, but also when and how this water should be flowing in the river. All components of hydrological regime have certain ecological significance. The environment flow is a very pragmatic concept and it is prepared in the interest of environment and ecology to accept a bare minimum. Bunn and Arthington (2002) have formulated four basic principles that emphasize the role of flow regime in structuring aquatic life and show the link between flow and ecosystem changes:

1. Flow is a major determinant of physical habitat in rivers, which in turn is the major determinant of biotic composition. Therefore, river flow modifications eventually lead to changes in the composition and diversity of aquatic communities.
2. Aquatic species have evolved life history strategies, primarily in response to the natural flow regimes. Therefore, flow regime alterations can lead to loss of bio-diversity of native species.
3. Maintenance of natural patterns of longitudinal and lateral connectivity in river-floodplain systems determine the ability of many aquatic species to move between the river and floodplain or between the main

river and its tributaries. Loss of longitudinal and lateral connectivity can lead to local extinction of species.

4. The invasion of exotic and introduced species in rivers is facilitated by the alteration of flow regimes. Inter-basin water transfer may represent a significant mechanism for the spread of exotic species.

136. The above elucidation demonstrates the need of predetermining minimum environment flow of a river as an essential feature because of massive reduction in the flow of the river and indiscriminate extraction of groundwater, which resultantly has adverse impacts on the health of the river. The health of the rivers in India and particularly river Ganga and river Yamuna, have deteriorated considerably. Maintaining flow of river, more particularly, E-flow, have to be adhered to in the interest of environment, health of the river, its aquatic life and its benefits to the society at large as a natural resource. The Notification issued by the MoWR dated 7th October, 2016, refer in its Preamble that there is a need to maintain ecological flow in river Ganga with the aim of ensuring continuous adequate flow of water throughout its length so as to preserve its ecological, natural and pristine condition and then enable it to self-rejuvenate but Clause-5 of the Notification mandates that every State Government shall endeavor to ensure maintenance of uninterrupted flow of water at all times in

river Ganga as required, without altering natural seasonal variations. Importantly, Clause 4 (vi) also requires that the integral relationship between surface and sub-surface water (groundwater) shall be restored and maintained. The aquatic bio-diversity in Ganga basin shall be regenerated and conserved. The banks of river Ganga and its floodplains shall be considered free zones to reduce the pollution source. Thus, both the aspects in relation to maintenance of minimum environment flow and regulated extraction of groundwater as well as to prevent undue diversion of Ganga water, are matters of concerns in relation to which the Tribunal is required to pass appropriate directions.

137. Still another aspect that has to be considered which is relevant for maintaining the minimum flow of the river, is the need to check and control mining of minerals from the riverbed. It will be appropriate that except precautionary dredging of the river, no in-stream mechanical mining is permitted and even the mining on the flood plain should be semi-mechanical and preferably more manual. Indiscriminate and illegal mining on the flood plain does cause environmental degradation and adversely affect the health of the river. The aquifers in the flood plain which maintain the flow of the underground water are also adversely affected by indiscriminate and deep mining on the flood plain.

The water intensive crops like sugarcane and paddy form the main crops in Ganga River Basin and they consume excess of 20 KL per hectare under the conventional flood irrigation for sugarcane, likewise 30 KL water per hectare for paddy crop. Such irrigation is unscientific and leads to high consumption of groundwater or water drawn from other sources. This provides only 35 – 45 % irrigation efficiency leading to great loss of irrigation water whereas drip irrigation and some improved method of irrigation can enhance efficiency to as high as 95%. Thus, greatly helping in maintenance of E-flow and reducing diversion of water for agriculture purpose.

138. Before we proceed to pass these directions it will be essential to discuss the contentions of various stakeholders with regard to above stated aspects. The learned Counsel appearing for the UPPCB, upon instructions from the concerned officers stated that as per the report of WWF, the minimum flow of the river should be 45% of the average annual main run off. The learned Counsel appearing for the MoWR, upon instructions from the competent authority and the Director of Central Ground Water Commission submitted that the minimum E-flow of river Ganga should be 20% in the lean season i.e. November to March, 25% in October and April and 30% from May to September on a monthly average flow basis. Percentage should based on the flow of the river Ganga,

pre-diversion or extraction. It is also stated that excessive extraction of groundwater, is a serious issue in the floodplain and the lands falling near river Ganga in Segment-B of Phase-1. There should be reduction in extraction of groundwater as excessive extraction of groundwater directly affects the flow of river. The diversion again should not be excessive, at the maximum, it could be 75% of the flow of the river prior to extraction on a monthly average during the lean season. The Member Secretary, CPCB upon instruction stated that the minimum E-flow of the river in Segment-B of Phase-1 should be 600 cusecs. According to them, it is based upon the data of UP Irrigation Department, Notification issued by the State Government on 5th October, 2010 and the judgement of the Allahabad High Court in the case of Writ Petition No. 4003 of 2006.

139. The flow of the Ganga river at Haridwar is 13639 cusec giving a percentage of 5% and 55% of this river flow gets diverted at Haridwar itself. According to them, the discharge should be 45% while diversion 55%. According to them, there should be due check on extraction of groundwater in the Segment-B to prevent adverse impacts on the basis of flow of the river. MoEF&CC directly adopted what MoWR has said. They consider it appropriate that 20 cumecs, i.e., @750 cusecs should be minimum flow of river Ganga in Segment-B. According to them also, the excessive

groundwater extraction should be checked immediately and appropriate measures should be taken in that behalf. The Director (Technical), NMCG submitted that the information provided by the Central Water Commission which in fact is a part of their Ministry in relation to e-flow of the river Ganga is acceptable to the Ministry.

The State of UP *vide* its order dated 5th August, 2010 had issued directions that "notwithstanding anything contained in the operations manual or any standing orders in respect of Narora head Works of Lower Canal, it is hereby directed that a minimum flow of 10 cumecs (353 cusecs) shall always be released into the river, in view of the recommendations of the Empowered Committee constituted by the MoWR, Government of India, *vide* O.M. No. 3(i)-89-GB-FBI dated 12th December, 1989. It is further clarified that releases in excess of 10 cumecs, as provided in operation manual/regulation orders etc. or as per orders of the Hon'ble High Court/the Hon'ble Supreme Court, shall remain unaltered and adhered to strictly."

High Court of Allahabad on the statement made by the learned Counsel appearing for the State of UP had directed that everyday minimum 1500 cusecs water shall be released from Narora, which shall be increased to 2500 cusecs on the relevant bathing days during the Maghmela.

We may also notice here that on 2nd December, 2016, when Professors from the IIT Consortium had appeared

before the Tribunal, even they expressed the view and which they had recommended to the Government that environmental flow of river should be maintained and, if necessary, reasonable reduction in release of water to the canal and some element of regulation or even prohibition for extraction of groundwater in Segment-B be done. All efforts should be made to restore the health of the river.

The above are the contentions of different stakeholders, with the variation of percentage or cusecs of water that should be permitted to flow in the river, they are *ad-idem* that E-flow has to be maintained. There should not be unregulated and unchecked extraction of groundwater and wherever it is necessary even prohibition should be imposed for extraction of groundwater. Similarly, the diversion of river in canal and other water channels should also be regulated. The Tribunal in its judgement dated 10th December, 2015 *India Council for Enviro-Legal Action v. NGRBA & Ors.* in relation to Segment-A of Phase-1 of river Ganga had held that environmental flow of Ganga and its tributaries was affected and in turn would have extensive implications of other needs of the society and the river itself. Thus, it had directed that actions should be duly taken to maintain the environmental flow of the river.

139. In the case of '*Manoj Misra vs. Union of India*', O.A. No. 6 of 2012 (supra) in its order dated 11th June, 2015, the Tribunal held that most of the rivers in India have gone

sick primarily due to excessive diversion of their flows. The diversions have been planned and executed, without taking into consideration the survival need of nature and its riparian communities. To improve health of the river, infrastructure and development would not be in consensus, unless survival needs of the river system are made an integral factor for river planning. Noticing that indiscriminate and excessive extraction of groundwater had resulted in drastic fall in groundwater levels, all along the riparian fringes of the river, as there is no water in the river to recharge the groundwater aquifer, biodiversity (flora and fauna) which is hardly subsisting in the river or in its riparian fringes.

In the order, the Tribunal noticed that inadequacy in E-flows of river Yamuna all through the years has been a matter of concern as even stated by the Committees with great emphasis. Besides maintaining the requisite E-flows, creation of number of channel reservoirs of all cities should make it mandatory to have rain water harvesting and reuse of treated wastewater to save fresh water in the river, flood irrigation should be prevented and substituted by other economical modes of irrigation and water supply to industrial units should be strictly rationed.

Referring to the orders of the Supreme Court in that case and the agreement between the States, finally, the Tribunal directed that till the final studies are carried out and the

minimum flow is identified and notified by the Principal Committee in that case, 10 cumecs water would directly be maintained in the main stream of river Yamuna from Hathnikund barrage till Wazirabad all through the seasons.

140. Now, we may also examine the concerns in relation to groundwater. A ground water study carried out by the Directorate of Environment under a study sponsored by MoEF&CC has brought out that 659 blocks out of 820 blocks in the State are affected by ground water level decline. In fact, 179 blocks in 43 Districts are categorised as Critical/Over exploited. All the prominent urban centres like Kanpur, Meerut, Ghaziabad, Agra, Lucknow Noida and Varanasi are severely affected with depletion of groundwater level. Not only this, even the quality of groundwater is a matter of concern, as contamination is high in concentration of fluoride, iron, arsenic, chromium, magnesium and also in salinity in certain areas. This is also corroborated by the test reports submitted by the CPCB as a part of the Joint Inspection Team, carried out pursuant to the direction of the NGT. The study has estimated that in order to meet domestic, industrial and irrigation needs of a growing population, the level of groundwater extraction pollution is expected to increase from 49.48 BCM to 72.06 BCM by 2025. This is expected to put more stress on the groundwater. The impact of

climate change will further add to this critical situation and add as an additional stress.

We have already noticed that excessive extraction of groundwater can have its own adverse impacts on the environment and health of the river. The Professors representing the IIT Consortium, before the Tribunal on 2nd December, 2016 also stated that one of the main reasons for high pollution of river Ganga was excessive extraction of groundwater at Haridwar downstream. It was on two counts, i.e., one diversion of major part of the river flow to the canals. Secondly, indiscriminate, unregulated extraction of groundwater for agricultural, domestic and industrial purposes in the entire basin, particularly, in the section from Haridwar to Kanpur. Nearly 80% of the water was being extracted in different forms. The high water extraction affects the recharge of the groundwater. Besides this, all the stakeholders have also expressed the view that the extraction of groundwater is one of the principal causes for reduction of E-flows and consequential increase in pollution. It should be appropriately regulated by the CGWA.

141. According to the CGWA, the total groundwater draft (extraction) in the 60 blocks from Haridwar to Unnao alongside river Ganga is 4,70,496.16 ham (4.70 bcm). The groundwater draft for domestic and industrial uses is 47,370.32 ham (0.47 bcm). The draft towards irrigation

purposes is 4,23,125.84 ham(4.23 bcm). This shows the extent to which the groundwater is extracted for different uses. Such high industrial extraction of groundwater would definitely impact the recharging of the river and would also empty the aquifer. Constant extraction of groundwater without any precautionary measures being taken for recharging the same, is causing depletion of groundwater levels constantly. Thus, we have to pass specific directions in regard to environmental flow of the river, extraction of groundwater and the diversion of water of river Ganga into canals, etc.

1. On the cumulative analysis of the submissions made and as an interim measure, we direct that while diverting the water from Haridwar to the Ganga canal, the minimum E-flow in the main stream does not deplete below 20% of its natural stated flow, which will be referable to the status of the river at Haridwar pre-diversion. Also, the extent of diversion of water of river shall be adequately reduced and/or adjusted, in the event the flow falls below 20%. We have already noticed that the water of river canal is being wasted indiscriminately which ultimately joins various drains in Segment-B which as already directed should be prevented.
2. We direct the CGWA, Irrigation Department of State of UP, UPPCB to carry out study as to the

requirement for minimum environmental flow of river Ganga, that is essential to maintain the health of the river, its aquatic life and biodiversity. This Committee should submit the report to the Tribunal within six months from the date of passing of this judgement.

3. We direct that no person shall be permitted to extract groundwater for industrial and commercial purposes unless it has obtained permission from CGWA. The CGWA should also regulate extraction of groundwater for agriculture and other purposes as per State policy. The permission shall be granted subject to such terms and conditions as may be necessary for the purpose of preventing and controlling the pollution on the one hand and ensuring maintenance of depletion in the groundwater projects as well as ensuring measures for recharging of the groundwater levels.
4. We direct the CGWA to carry out the study and notify the areas in Segment-B of Phase-1 which are Over Exploited, Critical, Semi-critical and Safe zone. There shall be complete prohibition on extraction of groundwater in the critical areas. Further, in relation to other two areas, the CGWA shall also publicize the fundamental conditions subject to which the extraction of groundwater would be permitted and the extent thereof and if necessary would require people to fix the flow meters who are using the borewell or

tube-well for extraction of the groundwater.

DEMARCATION OF FLOOD PLAINS, DUMPING OF MUNICIPAL SOLID WASTE, BIO-MEDICAL WASTE AND E-WASTE

142. Being an integral part of the river, floodplain of the river requires protection. Floodplains play significant role in maintaining the bio-diversity and aquatic life of the river. It's significance cannot be overlooked, in terms of environment and ecology. There are numerous dimensions involved while identifying the floodplains. It is required to categorize it into different zones, namely, No Development Zone, Regulated Zone and a Free Zone for development. The principle of Sustainable Development itself justifies the classification of floodplains into such zones for protecting the river. This Tribunal in the case of *Manoj Misra* (supra) had the occasion to deal with the concept of floodplain, its zoning and management. The Tribunal held as under:

> "79. Development and regulation of floodplain of Rivers falls within the purview of the State. Floodplain is an integral part of River system even though it is used only occasionally to pass down flood flows. When floodplain is not occupied by water it forms part of the land system providing possibilities of carrying on some restricted activity. It is not possible to provide uniformity in the extent of floodplains with respect to different Rivers as well as its various reaches.
>
> 80. Floodplain zoning has been accepted as an important nonstructural strategy for flood management. The basic concept of floodplain zoning is to regulate land use of floodplains to restrict damage caused due to floods. The floodplain zoning, therefore, aims at

determination of locations so that flood damages are reduced to minimum. A very restrictive activity can be allowed in that area. It is not only to protect the areas from damage resulting from floods and failure of water protective measures, but is also useful in reducing the damage caused due to drainage congestion, particularly in urban areas. The Commission claims to have prepared a model bill relating to floodplain zoning. This model bill provides for different categories based of priorities in floodplain. Following are the recommended priorities:

1. "Defense installations, industries, public utilities like hospitals, electricity, installations, water supply, telephone exchanges, aerodromes, railway stations, commercial centres, etc buildings should be located in such a fashion that they are above the levels corresponding to a 100 years frequency or the maximum observed flood levels. Similarly, they should also be above the levels corresponding to a 50 years rainfall and the likely submersion due to drainage congestion.
2. Public institutions, government offices, universities, public libraries and residential areas. Buildings should be above a level corresponding to a 25 year flood or a 10 year rainfall with stipulation that all buildings in vulnerable zones should be constructed on columns or stills as indicated above.
3. Parks and playgrounds. Infrastructure such as playgrounds and parks can be located in areas vulnerable to frequent floods. Since every city needs some open areas and gardens, by restricting building activity in vulnerable areas, it will be possible to develop parks and play grounds, which would provide a proper environment for the growth of the city."

> 81. According to this affidavit, the National Water Policy – 2012 provides that conservation of Rivers, River corridor, water bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. Encroachments and diversion of water bodies must not be allowed and wherever it has taken place, it should be restored to the extent feasible and maintained properly. Despite declaration of floodplains, demarcation has all along been a matter of concern.
> 82. The floodplain must be demarcated, kept free from any permanent developments and wherever it is possible, it should be restored to its original position."

During the course of proceedings before the Tribunal, the stakeholders also deliberated in favour of demarcation of floodplain of river Ganga, for ensuring protection and maintenance of the health of the river. The above stated precedent of the Tribunal also has its definite reference in the Notification dated 7th October, 2016 issued by the MoWR. In sub-clause (ix) of clause 4(v) of the Notification which relates to Principles to be followed for rejuvenation, protection and management of river Ganga, states that the bank of river Ganga and its floodplains shall be a construction free zone to reduce sources of pollution, pressure on floodplains and to maintain its natural groundwater recharging properties. This clearly demonstrates that fixation of the floodplain and its demarcation is one of the principal projects for cleaning and rejuvenation of river Ganga, amongst all the

stakeholders. As already stated, the project at priority is to clean river Ganga and not to diversify financial resources to the subsidiary function of cleaning innumerable drains in the city. There are innumerable factors consequential to pollution of floodplains of the river. Indiscriminate and unplanned constructions or developments, carrying on of unauthorized and impermissible activities, dumping of municipal solid waste, bio-medical waste and E-waste in and around the floodplains, are some of the main contributors of pollution in river Ganga. Referring to the proceedings of the Tribunal dated 3rd May, 2017, where it was brought to the notice of the Tribunal that huge quantity of hazardous waste generated from E-waste processing, in powder form, is being dumped indiscriminately on the banks of river Ramganga at Moradabad. It was also fairly conceded that such hazardous waste is highly polluting and would introduce heavy metals into the river, which will be injurious to both human health and environment. It was further noticed that all the concerned authorities were eluding from their responsibility, in regard to removal of waste and its disposal in accordance with the Hazardous Waste Management Rules. The Tribunal thereupon passed the following directions:

> "We are of the considered view that it is the responsibility of the UPPCB, Uttar Pradesh Jal Nigam, Government of Uttar Pradesh, Irrigation Department in

particular and all the Local authorities responsible including Local Police. It is not an issue on which the State and its various instrumentalities should be at variance or to take recourse to the blame game and they should collectively operate to ensure protection of environment and public health. It is such a serious pollutant that it cannot be permitted to be staged on the River bank whatever be the cost, whatever be the procedure adopted. Resultantly, we hereby constitute a Committee headed by the District Magistrate, Muradabad, where a senior nominee of the Member Secretary of Uttar Pradesh Pollution Control Board, Government of Uttar Pradesh, Irrigation Department, Uttar Pradesh Jal Nigam, Muradabad Municipal Corporation and Muradabad Nagar Nigam and DSP of the concerned area would be the Members of the Committee. This Committee will ensure removal of such hazardous waste from the bank of River Ramganga within one week from today.

The hazardous waste should be transported and disposed of strictly in accordance with the Hazardous Waste Rules. It should be ensured that during the course of removal no part of this waste is permitted to go in the water of River Ramganga. The work shall be executed within the time afore-stated. Each officer including the Chairman of the Committee would be personally responsible for the compliance of this Order. The Compliance Report shall be filed within two weeks from today.

All the industries concerned there and the places where the electronic waste is being handled/processed shall be informed that any person throwing such a waste on the River bank shall be liable to pay environmental compensation of Rs. 50,000/- to Rs. 1 lakh, depending on the quantum of the waste being thrown. This cost will be recovered by the SDM of the concerned area as an arrear of land revenue, in the event of default. The Committee or any of its officer would bring to the

> notice of the Tribunal, if any person failed to deposit and pay the environmental compensation in the event of the default of compliance.
> The cost incurred for disposal of the hazardous waste by the Government and the Pollution Control Board will be recovered from all the persons who are involved in the illegal activity of handling and processing the electronic waste in the city of Muradabad. However, the environmental compensation would be released at the subsequent stage, but in the first instance, it would be incurred by the State of Uttar Pradesh and UPPCB."

The Committee had also reported that the soil samples collected in the vicinity of river Ramganga exceeded the limits in relation to heavy metals like Zinc, Chromium, Arsenic, Cadmium, Mercury etc. This shows the extent of pollution resulting from indiscriminate dumping of E-waste.

143. Similarly, there are documents and reports on record to show that MSW is being directly dumped into the river and/or on its floodplain. In fact, there are few waste dumping sites which are closely located to the floodplain of river Ganga and its tributaries.

The apparent disadvantage of dumping sites being close to the floodplain is that, during high tides, the waste is carried by the water which pollutes the river. There is documentation on record of the Tribunal to show that there is a huge disparity between the total bio-medical waste generated in the State of UP, particularly, in

segment B of phase-I and the optimal capacity of the Bio-medical Treatment Plant in the area which makes it evident that large quantity of bio-medical waste is being dumped and/or is thrown into the rivers, resulting into pollution of the river which cannot be permitted to be continued. Furthermore, the authorities concerned including the UPPCB have not discharged their duties appropriately in relation to collection, segregation and appropriate disposal of these wastes in accordance with the relevant rules. All these aspects need unambiguous directions to ensure control and prevention of pollution of river Ganga.

a) We direct and constitute a Special Committee consisting of representatives from MoWR, Senior Officer from Department of Irrigation, State of Uttar Pradesh, Revenue Department of Uttar Pradesh and Central Water Commission which shall identify and demarcate the floodplains of river Ganga in Segment B of Phase-I on one in twenty five years cycle.

b) Till the said identification and demarcation of floodplain is completed, we direct that 100 meters from the edge of the river would be designated as no development/construction zone in Segment B of Phase-I i.e. Haridwar to Unnao, Kanpur.

c) The Special Committee would also identify no development/construction zone, regulatory zone and

the activities that can be/cannot be carried on in the regulatory zone of the floodplain.

d) There shall be a complete prohibition on disposing of MSW, E-waste or bio-medical waste on the floodplain or in river Ganga or its tributaries falling in Segment B of Phase-I.

e) As directed in our order dated 11th April, 2017, for each default, the defaulter would be liable to pay Environmental Compensation of ₹ 50,000 per default for such dumping and/or throwing the waste of any kind into the river.

f) All the concerned authorities including the UPPCB, UPJN and State of UP shall be responsible for carrying out these directions as well as the directions contained in our order dated 11th April, 2017 (supra).

g) There shall be no dumping or landfill sites for any kind of waste irrespective of any technology for waste processing, within 500 meters from the edge of the river Ganga and/or its tributaries.

ZERO LIQUID DISHCARGE (ZLD), CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) AND ONLINE MONITORING SYSTEM:

144. In this judgement, the Tribunal is concerned with the identification and resolution of all sources causing contamination of river Ganga and its tributaries. The paramount source of pollution of the river is the effluent discharge from the industrial sectors. Regulation of

industrial effluents introduced directly or indirectly into the river Ganga or its tributaries is a fundamental requirement for abatement of pollution. In segment-B, highly polluting industries like sugar, distillery, textile, tannery, paper mills and slaughterhouses, amongst others are located. These industries discharge treated or in majority of cases even untreated effluents into the water bodies. All industries are required to discharge their effluents strictly in accordance with the prescribed parameters. Violation thereof, leads to consequences including closure of the units in accordance with the law. Despite such serious consequences, the industrial pollution of the river has been on escalation, since past many years. There are apparent deficiencies in the effectiveness of the regulatory and supervisory regime, provided under various environmental laws in force in the country. One of the ways to improve the regulatory regime and to ensure that the industries should adhere to the relevant environmental laws was to enforce ZLD and online monitoring system. In fact, the CPCB had issued directions to the UPPCB under section 18(1)(b) of the Water Act, 1974 for seeking action plan from industries on implementation of ZLD in identifying industrial sectors in March–April, 2015. It had even issued guidelines for techno-economic feasibility of implementation of ZLD for water polluting industries in June 2015. It required that there shall be

compliance with the environmental standards notified under Environment Protection Act of 1986 and to permit the industries to discharge effluents only after compliance. It was acknowledged that ZLD was a necessity and technically exigent. It was also stated that ZLD can be achieved by adopting conventional primary, secondary and tertiary effluent treatment and polishing by filtration and using clean water back into process or domestic use. It also provided an option to select the technical system facilitating achievement of ZLD. In other words, ZLD could be attained by recycling or by achieving no discharge at all by use of appropriate technology. Similarly, the CPCB on 5th February, 2014 had directed the State Boards to further direct the 17 categories of the industries which were highly/grossly polluting industries in Ganga River Basin States to install CETPs, common bio-medical waste treatment facility, common treatment storage, disposal facility of hazardous waste and to install online monitoring system covering 13 effluent parameters in relation to pH, BOD, COD, TSS, Flow, Chromium, Ammoniacal Nitrogen, Fluoride, Phenol, Cyanide, Temperature, AOx and 8 technical parameters, PM, CO, Fluoride, NOx, SO_2, Cl_2, HCl and NH_3. In the directions, values thereof were even provided.

145. During the course of hearing, all these aspects raised serious controversies. Some of the stakeholders including

the Industries Association, particularly, All India Distillery Association vehemently objected to the enforcement of these directions. *Vide* its order dated 17th February, 2016, the Tribunal noticed the presence of the various Associations like sugar, textile, tannery industries, etc., which were provided time to submit their written submissions in relation to attainment of ZLD and installation of online monitoring system if ordered across the board.

In response to this, written submissions were filed on behalf of the various stakeholders as well as the Industries Associations. We may briefly examine the same. The challenges to ZLD on behalf of the All India Distillery Association is that the UPPCB had issued ZLD directions to member industries of the association on 4th March, 2015 stipulating Concentration and Incineration as the only option available to industries. It is stated that the CPCB and UPPCB had not considered the negative environment impacts, burden on natural resources, economic unviability, high capital cost and long term sustainability of the directions. It is stated that the directions would result in increase in the emission levels and substantially cause air pollution from pollutants such as PM 2.5, PM 10, RSPM, NOx, SOx and Hydro Carbons. The energy required for concentration system would be un-economical and at the same time would consume huge quantity of water,

additional effluents generation as MEE. The concentrated distillery effluents incinerators are very inefficient in stalk emission norms as Electro Static Separators are not installed due to technical feasibility and specifically high moisture in flue gases. The directions would result in substantial increase in greenhouse gases. Distillery effluent is a rich source of BOD and COD, which can be anaerobically treated to generate methane gas. Control line application is one of the most plausible feasibility options that should be provided. It has been practiced in various countries including Brazil, South Africa, Indonesia, etc. One Time Controlled Land Application (OTCLA) should be applied instead of 'Ferti-Irrigation' as earlier directed by the Board. OTCLA would be applied in a controlled manner through tankers and shall be once in 3 to 5 years depending on the soil nutritional deficiency, rainfall patterns, groundwater levels and soil characteristics.

According to the affidavit filed on behalf of the Industries Association, it is also stated that it acknowledges the co-operation of the CPCB in allowing Bio-composting as an alternative method of achieving ZLD. The bio-composting and use of spent wash for agriculture is most environmental friendly and ecologically sustainable technology as it records the waste as a source and prescribes a policy shift. The CPCB estimates that an addition of ₹ 6–8 per liter of product cost shall be escalated

by installing the systems of MEE, RO+MEE with incineration. There would be different criteria for different areas in the country.

The MoEF&CC had filed an affidavit dated 4th November, 2016. It has been in compliance to the directions issued by the Tribunal. It is stated that ZLD is not insisted for those tanneries which are connected with CETPs. Any tannery unit attached with CETPs shall achieve the inlet and treated effluent quality standards as per notification dated 1st January, 2016. The stipulation of ZLD has been proposed for large scale units in environmentally sensitive/critical areas based on the approval of CPCB. Similarly, directions have been issued for large scale units of Textile Industries in relation to ZLD. It was intended to introduce self-regulation. It is also stated with regard to the concept of ZLD that there is no discharge of processed wastewater from the premises of the industries. It is to permit water resource by reuse, recycle and recovery to the extent possible. Similar stand has been taken by the MoWR. The UPPCB also filed a detailed affidavit answering the issue whether ZLD can be applied across the board in respect of all industries. It was stated that ZLD cannot be applied to all industries in segment-B. In relation to distillery units, after applying ZLD technology, the industries have become ZLD units. This seems to be factually incorrect. In relation to Sugar Industries, it is

stated that notification has been issued providing the standards for discharge of treated effluent on the land. In respect of Textile Industries, the Notification dated 10th October, 2016 has been laid down and ZLD has not been insisted upon. In respect of Paper and Pulp Industries, no final notification has been issued and as per the Charter, the Paper and Pulp units which are using agro base as raw material has to treat black liquor and they could become ZLD with Chemical Recovery Plant, where black liquor is concentrated and evaporated. For tanneries, draft Notification dated 10th October, 2016 has been issued for comments and no final notification has yet been issued. The MoWR has issued a Notification dated 7th October, 2016 issued under section 24 of the Act of 1986 where it has been stated that every endeavour will be made to ensure that uninterrupted flow of water is maintained at all the times in the river and no person shall discharge any treated or untreated sewage into river Ganga, its tributaries or on its bank, directly or indirectly. Similarly, restriction has been placed on industrial waste, bio-medical waste or any hazardous substance.

146. It needs to be noticed that there is contradiction in terms, not only between the two Notifications issued by the MOWR and MOEF&CC dated 7th October, 2016 and 10th October, 2016, respectively but also the principal statute, i.e., Water Act. The MoWR has issued a Notification dated

7th October, 2016 which requires that no person shall discharge directly or indirectly any treated or untreated sewage or sewage sludge into river Ganga, its tributaries or its bank. Similarly, it also prohibits discharge of treated or untreated trade effluent and industrial waste, bio-medical waste or other hazardous substance both directly or indirectly into river Ganga or its tributaries or their banks. On the other hand, the Notification issued by MoEF&CC dated 10th October, 2016, provides that the treated effluent as well as sewage could be discharged into the water bodies provided it satisfies prescribed standards. The Notification, particularly, in relation to the Textile Industries prescribes the standards and states that in case of direct disposal into river or in the lake, stringent standards could be provided to the satisfied standards, as already noticed on similar lines the draft Notification in relation to Tannery Industry. The provisions of the Water Act specifically permits discharge of trade effluents on land, drains, water bodies and other places if it specifies the prescribed norms. The Notification issued by MoWR, thus places a complete prohibition on discharge of sewage or trade effluent, which in terms is contrary to the statutory provisions of the Water Act and the Notification issued by the MoEF&CC in terms of Environmental Protection Act, 1986. The Notification issued by MoWR can thus hardly be given effect to and the ZLD concept

proposed can hardly be complied across the Board. What probably was intended under the Notification of 7th October, 2016 was ZLD of the industrial units by ensuring recycle and reuse of effluents for irrigation, horticulture, industrial and cooling purposes. The other Notification provides a relaxation completely to various kinds of industries in relation to the effluent that such group of industries discharge. The Notification issued by MoWR cannot override the provisions of the Water Act, Environmental Protection Act, 1986 and other statutory Notifications. However, this Notification would have to be given its plausible meaning by holding that it suggests ZLD in the above terms but does not absolutely prohibit the discharge of the industrial trade effluent, i.e., inconsonance with the prescribed standards. If the Notification is given in literal interpretation it may result in shutting down of large number of industries in the country, that certainly does not seem to be the intent of the Notification, particularly, in face of the enacted law by the Parliament. The purpose is to achieve the prescribed trade effluent and preferably means for recycle, reuse thereof, unless the conditions of the Consent to Operate order specifically provide for installation of devices like incineration or evaporation.

147. At this stage, we may also refer to the compliance statement filed on behalf of the MoEF&CC and CPCB,

jointly, in furtherance to the Chamber meeting of 8th July, 2016. The issue afore-referred was fully clarified in its minutes of meeting, filed on 3rd August, 2016. It is stated that ZLD refers to installation of facilities and systems to enable the industrial effluents for recycling and converting solute into residue into solid by adopting method of concentration and thermal evaporation. Draft standards have also been spelled out by the Ministry, which were to be put up on the website inviting comments of the people. It was stated that in the case of ZLD there will be no discharge and upto 97% water can be recovered by reuse in the process. There would be salt generation of 4 tonnes per MLD, which can be recovered for reuse and would meet the prescribed standards. While the conventional treatment system would leave discharge into surface water bodies or use for irrigation releasing high TDS. It is also convenient to operate and maintain the treated effluents which can be used for irrigation purposes after compliance. Comments were also submitted with regard to online monitoring system with the purpose to create self-regulation standards and comply with the stipulation.

In furtherance to the order of the Tribunal dated 17th February, 2016, the association of industries were also directed to make representation to the CPCB and they were to be commented upon by the Central Pollution Control Board and record was to be placed before the Tribunal. The

representation from sugar sector, tannery sector and distillery sector were also received by the Board. Common argument was that and the raw distillery effluent if directly concentrated and incinerated, would not give beneficial results. It would lead to wastage of energy produced from non-renewal sources besides loss of nutrients present in the spent wash. Bio-composting, concentration or incineration had not been tested and proven to be correct and environment friendly. The cost of the technology is very high, therefore, economically not viable. It would be impossible for the industries to adhere to this technology. Probably treated effluents could easily be used for irrigation purpose. The Small Scale Industries are not capable of meeting the ZLD and therefore, CETP would be the proper remedy. Primarily, the comments of the Boards were primarily that the incinerator or bio-composting or insulation for spent wash and disposal is optional for the industries. Some industries have adopted this technology. A minimum quality specification of the finished compost is essential to ensure that the industries practice bio-composting properly following the protocol and utilisation of finished compost in agriculture. The industries in any case should achieve the standards as per the Notification of 1st January, 2016 and textile units should be attached to CETPs. The remnant of treated effluent should be allowed to be discharged into river only after exhausting it

upon reuse for irrigation.

148. From the above discussion, on advantages and dis-advantages of the ZLD, it is evident that ZLD cannot be adopted across the board. It must have rationality as its sole criteria, should be unit centric and industry specific oriented. The Sugar or Distillery Industries may be of a huge capacity say discharging 100 MLD per day. They could be a Sugar Industry or Distillery Unit with 10 MLD discharge and thus a very small-scale unit. To apply same yardstick to all would not be feasible and result oriented. They should be assessed on their own performance and function, however, ensuring in all the situations that the effluents permitted to be discharged on land/drain, etc. should be strictly adhering to the prescribed norms. The Board in its advisory capacity may be able to suggest or guide as to the integral technology, which may be feasible for the industries for attaining the prescribed norms. To impose ZLD on such industries would neither be fair nor just. In fact, it will not be in consonance with the requirement of law under relevant Acts. An industry should be permitted to operate, subject to grant of Consent to Operate, by the concerned Board. The CPCB has the competency under law to issue directions under Section 18 of the Water Act. The purpose of empowering Boards with certain powers is to restrict and control pollution. It is not expected from the Boards to stop the natural growth or

restrict industries from operating but compliance to the environmental laws is fundamental to exercise of their powers. The Board must take into consideration of the aspects including technology, financial viability, limitations of the unit, process adopted by the industries but in all events ensuring that the discharge of effluents from the unit has to be strictly in compliance with the prescribed standards. No industries, big or small can be permitted to pollute the groundwater, drains, water bodies and environment.

To put it simply, the ZLD directives cannot be applied across the board. On the one hand, it would be violative of the rights of the parties while on the other would not be in consonance with the provisions of the relevant environmental acts. ZLD should be applied on case to case basis. The concerned boards should exercise its technical know-how to issue appropriate directions in that behalf. The ultimate purpose is prevention and control of pollution and not an internal management of the plant. Effluent discharge must be strictly within the prescribed norms and the Board in appropriate cases could issue directions with regard to recycle, reuse of the treated effluent appropriately. The ZLD as inferred from the notification dated 7th October, 2016 is incapable of being enforced across the Board without reference to the member industries and other relevant aspects afore-stated.

149. Similarly, the Online Monitoring System or Continuous Emission Monitoring System should also be applied on case-to-case basis with reference to the facts and circumstances of the given unit. They must be practicable, for instance, if there is a tannery unit which has consent for processing of hides at a day to be expected to become ZLD or to install Online Monitoring System or Continuous Emission Monitoring System would be opposed to any accepted principles of technology and safeguards of economic advancement. They would be compelled to operate and discharge their effluents only and strictly as per the prescribed norms in default. They would be liable to be shutdown. Another consequential issue that arises in this context, there has to be a specialised, technically sound and dedicated mechanism with every board including CPCB which monitors entire input of Online Monitoring System or Continuous Emission Monitoring System. This monitoring should include not only collection of data but to ensure that actions taken in default and operational deficiencies in the units are rectified within the prescribed time, failing which the unit should be ordered to be closed. The concept of self-regulation would achieve its object, only when there is an effective supervisory control. There have been serious and noticeable drawbacks, deficiencies, and omissions in regulatory regimes else, the current state of industrial

clusters, drains, tributaries of the river would not have been prejudicial to such an extent.

Continuous calibration by CPCB to ensure that the online monitoring system shows the correct values and it must be compared with the actual effluent analysis collected by the Board on regular intervals.

DEFICIENCIES IN SUPERVISORY CONTROL BY EXECUTING BODIES, REGULATORY AUTHORITIES AND STATUTORY BOARDS

150. We have already discussed at some length that one of the main reason for increased pollution of river Ganga and its tributaries is discharge of industrial effluents and sewage, partially treated or untreated at a very high scale. Furthermore, lack of effective regulatory regime is the very basis of increased pollution, particularly, industrial. Its deficiency in collecting appropriate data, enforcement of environmental laws and regular functioning of environmental treatment plants are a matter of concern. We have already noticed serious variations in data collection by local authorities to the data collected by the Joint Inspection Team constituted by the Tribunal. There seems to be a common practice of preparing DPRs without detailed study and analysis of the effluents in the drain, quantum and quality of the sewage as well. The UPPCB due to lack of infrastructure and manpower and other reasons, has not been able to effectively prevent and control industrial pollution in segment B of phase-I. There

are large number of industries which have either not obtained consent of the Board or are operating in violation of the conditions of the consent to operate granted by the Board. These violations are of serious consequences as they result in discharge of high pollutants into the water bodies. In fact, there is notable and substantial variation in the number of the industries operating in this segment. According to the applicant, there are lakhs of industries which are operating in this area, in this Segment. As per the list declared and uploaded on the website by the Directorate of Industries of the State of UP, and according to the UPPCB there are only 1048 seriously or grossly polluting industries. These industries are on the radar of the UPPCB. However, a large numbers of industries are being referred non-water polluting industries and/or dry industries or small scale industries which indulge in dry processes. From records that have been produced during hearing before the Tribunal, certainly do not reflect encouraging state of affairs. The industries have either not installed ETP(s) or even if it is installed, such ETP(s) are not functioning regularly and effectively. The Board is incapacitated to check performance of the plants and discharge of effluents, strictly within the prescribed measures at regular intervals. It hardly requires further elaboration that if all these industries were operating their ETPs or other anti-pollution devices or processes effectively

and their discharged trade effluent were within the prescribed parameters, the content of the effluent in the drain would not have reflected values much in excess of the prescribed parameters. It is established from the above data and statistics that most of the drains are carrying high pollutants in terms of sewage as well as the industrial effluents, in fact, they even carry metals and pesticides. The cumulative effect of all such disappointing state of affairs upon the river and its aquatic life are certainly quite adverse. It is difficult to accept contentions that in the entire segment B of phase-I, there are only 1070 industries which cause pollution. Even the drains which primarily flow through residential sector are also found carrying mixed effluents. Therefore, it could be said that evidently the industries have settled in and around the residential area as well. The UPJN has not been able to show to the Tribunal even a small portion in the entire segment where they have achieved reality of effluents within the prescribed parameters either in relation to industrial effluent or sewage. UPJN is primarily an executing agency for drainage, sewage and establishment of STPs. The parameters like COD, BOD, TSS, Coliform etc. in the sewage drains were found to be extremely inordinate as compared to prescribed norms. STPs which they have established were within the municipal limits.

151. The STPs are found to be inoperative, inefficient, and

incapable of treating the sewage to bring it to the proposed standards of treatment. The drains have proved to be failed because there is considerable overflow from the tapping points into drain, which ultimately meets the river. The STPs are receiving sewage much in excess of their capacity sewage. During the course of hearing, it came to the notice of the Tribunal that the State of UP was not extending full cooperation as contemplated or required for successful attainment of the projects. Findings to that effect were noticed by the Tribunal *vide* its order dated 4th February, 2015, where senior officer had appeared and assured the Tribunal that they would be extending full assistance and requisite help to the other stakeholders. Even the interim directions issued by the Tribunal had not been complied with in their true spirit and substance. Officers appearing on behalf of the UPJN, UPPCB and State of UP could not provide satisfactory answers for non-compliance of the directions as recorded in the order dated 12th October, 2015.

In the order dated 19th October, 2016, the Tribunal had observed that no definite conclusion could be arrived at until quantum and quality of pollution thereof is correctly placed before it Tribunal in relation to segment B of phase-I. Due to an utmost uncertainty in data relating to quantum and quality of pollution, a meeting was held and the committee was required to inform the Tribunal that

how many drains join river Ganga or its tributaries and make clear observations in regard to the quantum and quality of the effluent entering into river Ganga or its tributaries. The data of the same should be available with both UPJN and UPPCB, which is their basic function and in fact, statutory function for the UPPCB. The UPJN was expected to have complete and accurate data in relation to entire drainage, quality and quantum thereof as well as the technology and performance of all the STPs which unfortunately was not provided to the Tribunal much less with accuracy. Similarly, the UPPCB was expected to have accurate data in relation to number of industries, quality of their effluent and quantum thereof. If they had exercised proper supervisory and regulatory control over the industry the industrial effluents could not have led to such high pollution of the water bodies, particularly, the river Ganga or its tributaries.

In the order dated 25th January, 2017, it was noticed that data in relation to 30 drains meeting river Ganga was not submitted and further directions for collection of appropriate data were issued by that order. As already stated above, the order dated 14th February, 2017, was noticed that despite the fact that ₹ 31 crores have already been spent on lying of the sewer line and for construction of STP in the area of Brijghat and Garhmukteswar, the Joint Inspection Team had noticed that the Garh drain was

carrying discharge of 13 MLD and only 3 MLD STP was operational and 6 MLD STP was under construction. As of present, nearly 10 MLD of untreated discharge was directly joining river Ganga. It came to light that no survey had been carried out before or after preparation of DPR by concerned Department and an STP was of the capacity much lower to the discharge in the drain. The Nagar Palika Parishad of Garmukteshwar had not provided sewer connections to the household and thus, even the requisite effluent of 3 MLD was not taken to the STP for treatment.

On 15th February, 2017, the Executive Officer of the Parishad stated that they had financial constraints; therefore, the project could not progress further. This reflects non-coordination, improper planning, and defective execution. We have already noticed that nearly ₹ 31 crores have already been spent on that project without any effective result. The sewage was being discharged on land thus the purpose of laying down pipeline and establishing STP stood largely defeated. Various other deficiencies in the entire network and operationalization of the STPs were also recorded in the order dated 9th March, 2017. In the order dated 9th March, 2017 and in the later order 24th April, 2017, directions were issued to the Joint Inspection Team and the police authorities were directed to provide due assistance to them.

In the order dated 9th March, 2017, it was specifically

recorded that even the designed STPs were incapable of treating coliform which is running in crores against the prescribed parameter of 230 MPN/100 ml. In proceedings before the Tribunal on 7th March, 2017, all the stakeholders were heard and serious doubts were created due to statement made by Project Manager, UPJN who was unable to state as to the exact planning of the UPJN in relation to treatment of sewage for 110 wards where each ward has 50-200 colonies. According to him 38 wards had no sewer line at all. Reference to all this makes it clear that there are large deficiencies in performance of functions by these local authorities and the Boards. We have not pointed out these patent deficiencies for the sake of finding mistakes but primarily to show that one of the reasons stated by the IIT consortium appear to be justified as to lack of supervisory and regulatory control by local authorities and lack of coordination between them which rendered GAP I and GAP II unsuccessful. This would bring us to deliberate on the role of the authorities, particularly, the Pollution Control Board.

152. The SPCBs are required to play a very critical and pivotal role in ensuring effective implementation of various environmental regulations including Water Act, Air Act and Environmental Protection Act. The Boards are the specialized agency created by statutes to deal with the menace of pollution and environmental degradation. The

Parliament, in its foresight way back in 1974, thought it necessary to create such specialized agency to deal the menace of pollution and environmental degradation. In fact, the mere look at these acts would manifestly reveal that legislative intent in formation of such boards is absolutely clear which can be seen from various provisions related to composition of board, powers given to Board and also, penalty to be imposed in case of violations. The legislative intent and foresight of a strong, proactive, technically sound and effective pollution control mechanism could be easily seen in various provisions of the Acts. The paramount important to pollution control and environment protection could be gauged from provisions of 33A of the Water Act and 31A of the Air Act, where Boards have been given powers even to close down any industry or activity in case of pollution event.

Section 16 of, both Water Act and Air Act, postulates the functions of the Central Pollution control board while Section 17 of both Acts prescribe the functions of the SPCBs. The SPCBs are expected to play a multi-faceted role including strategic planning, advisory, problem based research, technology assessment, and appraisal besides, enforcement and compliance, which is primarily, anchored on public awareness and information disclosures. In order to achieve such strong and critical mandate given in the legislations, the SPCBs are required to develop their

capacity in terms of manpower and infrastructure. The role of SPCBs has become more complex and ever widening with the newer regulations being notified particularly under the provisions of Environment (Protection) Act, 1986, with the advancement of our knowledge and understanding of the environmental pollution and degradation. However, with the passage of time the SPCBs have been systematically been reduced to mere enforcement agency rather than as envisaged in the regulations. There are number of reasons for the same for which numerous studies have been carried by CPCB and MoEF&CC and some of them have been referred in *Rajendra Bhandari v. State of Uttarakhand & Ors* (24.08.2016) (OA No. 318/2013).

153. Key observations regarding the operational strategies of the UPPCB are;

a. Pollution control strategy - UPPCB relies on inspection and investigation as the primary strategy for pollution control. This needs to change. There is no transparent, consistent and coherent enforcement protocol or framework and most of the times, the regulatory response is subjective and in firefighting mode.

b. Tools for pollution control - UPPCB relies almost entirely on internal resources (people, laboratories) for pollution control. In order to be an effective

regulator, it needs to reduce its reliance on own resources and supplement this with external resources.

c. Organizational capacity – UPPCB's organizational strengths have not kept pace with its mandate. UPPCB needs to build an organization commensurate with its activities. It needs to strengthen its technical resources. It also needs to strengthen its IT, public interaction, research and technology assessment functions.

d. No up-to-date inventory of polluting sources (industry): The UPPCB could not present any inventory of polluting sources, and rather just relied on the consent data. The inaccuracy of such data was evident from the level of non-compliances observed at various industries and also, identification of several polluting industries at Moradabad during the proceedings. Significantly, data validation among different state government agencies like UPSSIDC, industries department and Electricity authorities is missing.

e. Lack of research and technology appraisal activities. The UPPCB has no specialized cell or group or trained manpower for research, technology appraisal or standard development activities. There is no broad environmental quality

monitoring network which has been scientifically designed. Similarly there was no proper recording and compilation of the available environmental quality data besides analysis and interpretation thereof.

154. There is an urgent need to create an enabling environment at the UPPCB for research and coordination efforts in future focus areas – A dedicated technical excellence cell with the addition of new spheres of activity, the technical skills have not been updated through retraining, etc., leading to a situation where, as of today, UPPCB finds itself technically deficient in fulfilling its mandate under many of the newer laws and rules. At the same time, it is difficult to expect the operational level employees to acquire these skills independently with little or no support from the corporate office. Thus there is a requirement for a dedicated technical excellence cell, which would perform the following activities:

a. Keep abreast of the latest regulations in pollution control and frame the guidelines and procedures for operationalizing them in with the Board.

b. To research on pollution control mechanisms and coordinate with various research bodies like NEERI and other PCBs in performing the functions.

c. Provide training and systems to the operational

staff for better performance of their current duties as well as new duties that may be added over a period of time.

d. Prepare standard operating procedures (SOPs) and also, conduct benchmarking studies for all major types of industries for effective advocacy and use of covenants.

e. Conduct research as envisaged in Section 17 of Water and Air Act respectively, including assessment of pollution status, appraisal of waste treatment technologies, developing pollutant discharge standards etc.

f. Establishing a well-designed environmental monitoring network and dissemination of such information for public information and awareness, adopting innovative analytical interpretation tools.

g. Track development in the State and perform a proactive role towards pollution control and abatement in the State.

h. Thus, we direct the UPPCB to formulate a scheme for inspecting the industrial units and issue appropriate direction and their compliance on regular intervals. The inspection report should be comprehensive and must deal with all aspects and activities of the industry in question. The consent orders passed by the Board must not be of generic

nature and should be unit specific.

155. Another important aspect of UPPCB functioning is absence of a transparent and consistent enforcement mechanism. The Water act and Air act provide for various regulatory responses in terms of directions, prosecution etc. It is necessary that the regulatory response of UPPCB needs to be based on Precautionary Principle and Polluter Pays Principle aiming for the sustainable development. It was revealed during the proceedings that there is no defined enforcement protocol of UPPCB which can help the field level officials to take a transparent, consistent and coherent approach while responding to the issues of pollution and environmental degradation. This has led to the general perception that the environmental regulatory authorities are not performing and are not able to implement the environmental regulations which are at par with developed countries. The UPPCB including its Board, Chairman and Member Secretary are required to provide such uniform regulatory response mechanism for improved enforcement and compliance, which can bring some confidence of the general public in the environmental regulatory agencies and environmental governance in the country. Such enforcement protocols have already been prepared by states like Maharashtra and Goa.

In order to have such a regulatory response towards ensuring compliance, UPPCB will have to firstly, identify

the environmental risks, in terms of pollution load and intensity, associated with any particular industry or activity based on precautionary principle. In other words, the inspections, sampling and verifications need to be at a different level for a polluting industry like tannery, distillery etc than industries in green category. Board needs to develop certain environmental benchmarks in terms of resource consumption, pollution load per unit of product etc for major types of industries so that there can be uniform appraisal of a particular type of industry and also certain success or failure stories can be properly showcased. As a next step, the enforcement of regulations will have to be based on polluter pays principle. The regulatory response need to be based on scale and intensity of pollution, culpability of industry, track record of industry besides assessment of adverse environmental impacts. In order to have such a comprehensive enforcement mechanism, Board will have to undertake serious efforts in terms of developing industry specific documents, preparation of visit reports to cover all aspects of regulations, development of sound environmental monitoring network besides training of manpower. Board needs to adopt new technology and use of IT particularly web based technologies for this purpose.

While recognizing that capacity building and strengthening of SPCBs is fundamental and critical to achieve the desired

level of environmental protection in the country, the Hon'ble Supreme Court, in its interim order dated 14.10.2003 in the matter of Writ Petition No. 657/1995, regarding management of hazardous wastes, has directed all SPCBs to urgently carry out the necessary measures required for strengthening its pollution control mechanism. The capacity of the technical and scientific manpower available with the SPCBs and their operational independence, free from external influence, are always subject matter of concern. In large state like UP, this problem is likely to be serious. Furthermore, with the ever increasing scope of SPCB activities with many new regulations coming into force along with increasing knowledge of environmental pollutants and the increasing stress on the limited natural resources, it would be necessary to develop these SPCBs with an overall objective to be manned by specialized and trained manpower with sufficient degree of operational flexibility so that the enforcement would be effective. Furthermore, it was revealed that the present pay scales of the Board officials are at very low level. It can be simply assessed by the fact that even CPCB Member Secretary has a pay scale of ₹ (37400-67000) + 8900 GP (Sixth Pay Commission), which is equivalent to Director in MOEF&CC. The Regional officers who are the key field level officials who at many a times bestowed with extraordinary powers of even closing

the industry/ activity and even, manning more than even 2 districts, have very junior scale. All these things make them susceptible to external pressures. MoEF&CC has considered these aspects and the High level Committee report of 2014 has recommended a separate Indian Environmental Service, so that a dedicated specialized trained manpower is available. It is high time that such a service is initiated by the government of India.

156. Considering the above discussions, following directions can be issued as regards to UPPCB/CPCB;

a. UPPCB shall form a separate cell for research, development and monitoring activities and all other supporting and advisory roles as envisaged in the Acts within next 2 months to be headed by senior officer of the Board and directly reporting to Member Secretary of the Board. Board shall make sufficient provisions of funds for this cell to carry out the desired functions. However, we leave it to the wisdom of the Board that till the creation of the cell or even otherwise and procurement of requisite infrastructure, it may outsource such activity, in the interest of prevention and control of pollution.

b. UPPCB shall formulate the enforcement protocol as discussed above within next 3 months and place it in public domain.

c. The State Boards are hereby directed to identify an extensive Water Quality Monitoring Network (including groundwater), analyse and collate the data collected and upload it on their respective website.

Board shall also publish a comprehensive report on water quality status of the State on annual basis, which shall be submitted to State government for necessary action.

d. UPPCB shall prepare and submit a comprehensive proposal for capacity building including additional manpower and infrastructure to the State Government within period of 2 months and Sate government shall take a decision such proposal within 3 months thereafter. In order to facilitate development of such proposal by SPCBs, CPCB shall prepare guidelines for requirements of manpower by the Boards, by standardizing the work requirements for visits, inspections, analysis, research activities, complaint redressal, etc. within 4 weeks. Keeping in view the mandate of the SPCB issued in exercise of its powers under Section 17 of the Water Act.

e. Special dedicated monitoring cell should be created in the UPPCB/Uttarakhand PCB and in

fact, in all the Boards which should have an exclusive duty of monitoring the online systems and take appropriate action, wherever the industry is found to be in default without delay.

f. The order granting and/or refusal of consent to operate or establish should be passed only upon the Joint Inspection by the officers of the Board. The inspection report should be complete and comprehensive dealing with all the operational aspects of the plant and technology required or installed for attaining the prescribed parameters.

g. The UP/Uttarakhand Government and in fact, all the State Governments are hereby directed to consider the proposal of the respective Boards for enhancement of infrastructure and manpower for effectively performing its functions. Such proposal should be considered objectively and as far as possible the infrastructure and manpower of the Board should be enhanced to ensure proper implementation and enforcement of the environmental laws.

h. Effective supervisory and regulatory control by the Board is a condition precedent to achieving effective prevention and control of pollution of environment, particularly, the water bodies.

Above directions are necessary for streamlining and ensuring the proper performance of function and duties by the Boards in accordance with the environmental acts.

POLLUTION OF RIVER GANGA AND ITS TRIBUTARIES ATTRIBUTABLE TO INDUSTRIES LOCATED IN SEGMENT-B OF PHASE-1 WITH EMPHASIS ON INDUSTRIAL CLUSTERS JAJMAU, UNNAO AND BANTHAR

157. In the matters pending before the Tribunal, the State of UP and UPPCB had filed a list of industries which are causing pollution of river Ganga and its tributaries. The Tribunal had directed issuance of notice to such industries and were called upon to show cause as to why appropriate directions should not be passed by the Tribunal to prevent and control pollution resulting from such industrial activities. Besides the main case that is *Kishan Kant Singh vs. National River Ganga Basin Authority & Ors.* (supra) there were 285 cases pending before the Tribunal that related to pollution resulting from discharge of industrial effluents into different drains, tributaries and river Ganga itself.

Vide order dated 29th October, 2014, the learned Counsel appearing for the CPCB had submitted the list which was directed to be placed on its website alongwith the criteria for terming the industries as seriously polluting industries

and/or grossly polluting industries. The Tribunal had passed the orders in relation to the industries to whom the notices had been issued. However, some of them are pending herein presently.

The Supreme Court *vide* its order dated 29th October, 2014 referred the issue of industrial pollution of river Ganga and its tributaries to the Tribunal and expressed in no uncertain terms its anguish and serious concern about the increasing pollution of river Ganga over the years. The Hon'ble Supreme Court also observed that lack of monitoring by the statutory bodies and non-implementation of Court orders by the State Governments and the concerned Pollution Control Boards had contributed to the current state of river Ganga. While noticing that the National Green Tribunal has been established for effective and speedy disposal of cases relating to natural resources including environment, the Hon'ble Supreme Court had expressed confidence in the Tribunal and desired effective and expeditious disposal of cases dealing with all the questions relating to pollution of river Ganga by the industries. This order was passed in Writ Petition No.3727/1985. The Supreme Court directed that effective and immediate steps be taken to prevent and control pollution of river Ganga and its tributaries as well as to restore the wholesomeness of the river as it is a lifeline for large number of people living in States located in

the catchment area of the river and its tributaries.

158. On 20th January, 2015, when the matter came up for hearing before the Tribunal, the learned Counsel appearing for the UPPCB had filed details of 15 industries which were not having their own ETP and were, therefore, closed. 43 industries, which did not have Consent to Operate and were not achieving the prescribed norms were also ordered to be closed. 99 other industries were under self-closure. Show cause notice had been issued to 134 industries as they were found to be defaulting or operating without consent. 19 industries out of them had applied for Consent to Operate, which had been granted and 109 industries out of 134 were ordered to be closed. It was also stated that there are nearly 700 tannery industries in and around the city of Kanpur, which are located on the banks of river Ganga. They are one of the major sources of pollution of river Ganga. The CETP that had been established for treating the seriously polluting trade effluents that was being discharged from these industries, was non-functional. It was not performing to its optimum capacity and in any case was incapable of treating the effluent that was found to be coming at the point of intake of the CETP.

In this order, a question arose for consideration before the Tribunal and for submission by the stakeholders that either these 700 industries could be shifted to a well planned industrial sector at some other site or a new CETP

should be constructed or the existing CETP should be upgraded with such additional anti-pollution devices so as to bring the parameters within the prescribed limit. In relation to the CETP operating at industrial cluster at Jajmau, directions were passed and the concerned stakeholders were required to submit a Report, particularly on the issue referred thereto. Direction was also passed with regard to inspection of the entire industrial cluster. It was undisputedly stated that the industrial cluster at Jajmau itself was generating 12.5 MLD effluents which ultimately meets river Ganga as the existing trade effluent capacity of the CETP at Jajmau, Kanpur was only 9 MLD.

The Committee carried a detailed investigation amongst others in regard to the CETP at Jajmau, Kanpur. The samples collected from this CETP were analysed by the CPCB, UPPCB and IIT Kanpur. The analysis reports have been placed in tabular form in the Report submitted by the Committee. It reads as under:

Parameter	36MLD CETP, Jajmau Kanpur								
	Raw Tannery Inlet (36MLD)			Collection Sump (36MLD)			Raw Sewage (36 MLD)		
	NC1			NC2			NC3		
	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB
pH	8.6	9.55	8.90	8.02	8.67	8.21	7.39	7.47	7.52
BOD	1200	1012	1140.00	540	556	420.00	330	186	290.00
COD	3224	2414	3120.00	1146	1213	1440.00	645	479	640.00
TDS	11500	12068	11805.00	5580	5452	5160.00	1130	932	960.00
TSS	2488	2463	1929.00	525	1229	613.00	325	455	380.00
T.Cr	87.21	70	70.320	59.83	54	53.300	1.72	1.35	1.373
Pb	BDL	0.55	0.335	BDL	0.38	0.291	BDL	0.12	0.231
Zn	BDL	0.27	0.282	0.2	0.52	0.520	0.449	0.57	0.549
As	0.0059	0.04	0.00590	BDL	0.02	0.00441	BDL	BDL	0.00282
S	156	42	104.000	--	--	--	--	--	--

It was reported that the tannery waste reaching the CETP

had excessively high concentration of chromium. It was 70–87 mg/l as against prescribed norms of 2.0 mg/l. Such high concentrations in the incoming wastewater was indicative of an overall poor state of primary treatment by tanneries.

As is evident from the above, all the material parameters are much in excess of the prescribed values. It was also noticed that the sewage reaching the CETPs also had high concentration of chromium. This indicates possible discharge of tannery wastewater into the sewage system. The Committee in relation to the effluent from the tannery as well as functioning of the CETP reported as under:

"**Action Taken/Observed status.**

- The increase in Tannery wastewater quantity is due to the increased production capacity, increase in numbers of member units (Originally 175 nos. & presently 400 nos.). The immediate attention is required to restrict the generation of wastewater from tanneries. UPPCB is required to take appropriate action. Further, tanneries in general are required to ensure wastewater metering and minimization measures and till such time it is achieved and augmentation in pumping and associated treatment capacity is made, an appropriate blanket restriction on production may be imposed on all authorized tanneries.
- As a pre-requisite all the tanneries in Jajmau, Kanpur being member of the CETP are required to ensure adequate primary treatment of the wastewater. The primary treatment is first to ensure optimised flow of the wastewater, structural safety of the conveyance system and also to feed pre-treated wastewater to the CETP. Based on monitoring by various enforcement agencies including CPCB it has been noted that the primary treatment including chrome recovery by the member units is generally

poor. This results in receipt of pre-treated wastewater at the CETP with excessively high concentration of chromium and suspended solids. The concentration as noted in the current inspection were total Chromium: 70 – 87 mg/l as against the designed characteristics of 2.0 mg/l. Poor characteristics of primary treated wastewater has adverse impact on overall performance of the CETP.

- The CETP is designed based on treatability of a mixed waste comprising 09 MLD of tannery wastewater and 27 MLD sewage. Both the input components are required to be consistent in terms of designed characteristics. Based on monitoring by various enforcement agencies including CPCB it has been noted that unauthorised discharge of tannery waste in 90 inch trunk sewer has disturbed characteristics of sewage and hence the mixed waste characteristics fed to the CETP thereby, adversely impacting its performance.
- The inbuilt provision of gas collection and utilizing it to generate power, currently lying defunct has to be made operational. This shall improve overall treatment economics by substituting use of conventional power by gas-generated power.
- Up gradation of the existing Kanpur CEPT is needed for complying the prescribed effluent limits. The option for upgrading CEPT to ZLD system through adequate tertiary treatment system shall also be enforced.
- The Committee felt the necessity for augmentation of pumping station and conveyance system for tannery wastewater. This is required to trap the entire untreated wastewater and convey it to CETP/STP for adequate treatment. This shall eliminate currently observed overflow of tannery wastewater from pumping stations.

Action Point/Issue 9.

The Committee shall examine the project with regard to establishment of CETP of 50 MLD and consider the establishment of exclusive industrial effluent treatment plant at Jaimau and whether it will be capable enough to treat all heavy metals travelling to the CETP in light of the result of the analysis report collected in furtherance to the directions passed herein.

Action Taken/Observed status.

- The existing inventory data available with UPPCB, inventory performed in the past by CLRI and ILFS, reviews that discharge quantity has increased may fold due to increase in production capacity of 250 tonnes in 90's to 1000 tonnes per day as of now. It is suggested that DPR under preparation shall include this aspect in detail and proposed the required up gradation in two modules of @ 25 MLD."

Besides the Inspection Report reflecting poor functioning of the CETP at Jajmau, the Tribunal was also informed on 13th April, 2015 on behalf of the UPJN that they are trying their best within available infrastructure but it is not possible to discharge pollution free effluent into river Ganga. It was undisputed and in fact reiterated that the CETP provides for treating trade effluent and sewage at Jajmau but 60% of the effluent coming to the CETP is being discharged directly into river Ganga without treatment.

Submitting its comments to the Report, the UPJN informed that the CETP is designed only for 36 MLD, mixed water containing 75% sewage and 25% effluent of tannery at Jajmau. However, the effluents coming to CETP are highly polluted and are in excess of the capacity of the plant. It is stated that the UPJN has brought to the notice of the SPCB from time to time that inadequate pre-treatment for wastewater is affecting the performance of the CETP. The effluents coming from the tannery sector is much in excess. It was also stated that the cost of operating the

CETP is to be borne by the Kanpur Municipal Corporation and by the tanneries in Jajmau. The arrears or share from UPJN towards operation and maintenance is more than ₹ 9 crores from the tanneries and the Corporation. The UPJN claims to have spent between the years 2014 -2015 about ₹ 13.9 crores in operation and maintenance of the CETP. The capacity of the STP at Jajmau is of 130 MLD, more STPs are under construction. Only 40% of Kanpur area would be covered by the sewage network by 2020.

In relation to CETPs at Unnao and Banthar, with analysis report and functioning of the CETPs, the following report was submitted to the Tribunal by the Committee:

> **"Action Taken/Observed Status**
> The Technical Expert Committee inspected UPSIDC Industrial Area, Site-II and Banthar Industrial area at Unnao. Inspection of Two CETPs operational in Unnao namely (a) Banthar Industrial Pollution Control Company Banthar Unnao and (b) Unnao Tannery Pollution Control Co. Site-2, Unnao was carried out. The Expert Technical Committee also randomly inspected three tanneries located in Unnao namely (a) M/s Ruksh International, B-6/B-7, UPSIDC, LTP, Banthar, Unnao; (b) M/s Lion Global, Unnao and (c) M/s Iqbal leathers, Unnao. Characteristics of samples collected were deposited for analysis to CPCB, Delhi, I.I.T. Kanpur and Central Lab, U.P.P.C.B as directed by NGT, are summarized as under:

Parameter	CETP Unnao								
	M/s Banthar Industrial Pollution Control Company, Banthar, Unnao								
	Inlet of CETP			Sample After Primary Clarifier			Final Outlet of CETP		
	ND11			ND12			ND13		
	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB
pH	7.24	7.58	7.53	7.68	8.28	8.03	7.43	7.81	7.76
BOD	640	1108	550.00	700	1045	600.00	240	528	230.00
COD	2541	1858	2400.00	2753	2092	2720.00	1341	1155	1440.00
TDS	17514	16900	17151.00	18202	18456	18080.00	15420	15764	15468.00

TSS	656	498	643.00	1080	1033	1100.00	880	609	934.00
T.Cr	10.16	10.6	8.742	6.08	11.2	7.598	6.54	9	7.260
S	--	--	--	--	--	--	8	21	12.00
Oil & Grease	--	--	--	--	--	--	3.09	9	14.000

Parameter	CETP UNNAO								
	M/s Unnao Tannery Pollution Control Company (CETP) Site-2, Unnao								
	Inlet of CETP			Sample After Primary Clarifier			Final Outlet of CETP		
	ND14			ND15			ND16		
	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB
pH	7.63	8.55	8.10	7.54	8	7.88	7.43	7.88	7.78
BOD	780	1597	740.00	580	815	580.00	420	784	432.00
COD	3465	4606	3520.00	2188	2158	2640.00	1694	1363	2000.00
TDS	14568	12724	13113.00	15732	14828	14975.00	17586	16738	16189.00
TSS	4340	7020	9002.00	680	494	590.00	580	575	541.00
T.Cr	190.48	166	148.850	6.62	8.1	7.591	6.42	6.2	6.908
S	--	--	--	--	--	--	812	0.2	14.90
Oil & Grease	--	--	--	--	--	--	1.69	10	8.000

Para meter	M/s Ruksh International, Banthar, Unnao, Final Outlet of PETP			M/s Lion Global Pvt. Ltd. , Banthar, Unnao, Final Outlet of PETP			M/s Iqbal leathers Ltd., Unnao, Final Outlet of PETP		
	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB	IIT	CPCB	UPPCB
pH	7.06	7.26	7.49	7.76	8.2	8.11	4.3	4.48	4.49
TSS	1060	796	1219.00	408	323	421.00	2140	552	2146.00
T.Cr	59.09	47.4	34.830	1.36	1.7	1.059	310.74	450	327.00

Note:- All values are in mg/l except pH
BDL:- below Detection Limit

Even the groundwater samples were analyzed from villages like Shekpur and Jana where the wastewater from CETP was being released and used for floriculture and agriculture. The analysis showed metals like Chromium and Arsenic in the samples. TDS was also noticed much higher to the prescribed parameters. The observation in that behalf is as follows:

- "Groundwater quality observed at all the three locations is noted with a high concentration of total dissolved solids (390-1860 mg/l against prescribed norm of 500 mg/l) and a marginally higher concentration of chromium (0.07-0.19 against prescribed norm of 0.05 mg/l); lead 0.18-0.23 against prescribed norm of 0.05 mg/l); lead 0.18-0.23 against prescribed norm of 0.05 mg/l).
- It has been noted that the area is used for

> (food) crop cultivation instead of floriculture in spite of carrying a potential for adverse impact due to discharge of industrial of industrial wastewater. There is a necessity for a detail study to ascertain impact of using treated wastewater on the soil and agriculture. Recommendation of such a study shall be helpful in defining scope of wastewater use in terms of restricting area and crop for which it shall be utilized."

Even the Chromium Recovery Plant was found to be not performing adequately and it was stated that the chromium recovery systems installed in the tannery are not properly designed and installed. Presently, very few tanneries are recovering chromium. The Common Chromium Recovery System (CCRS) at Jajmau was under-utilised. It indicated improper segregation, collection and transportation of spent chrome liquor from tanneries. Submissions were made on behalf of the CPCB, which were made upon analysis of the characteristics of the effluent from Common Chrome Recovery Plant. The inlet Chrome value was 21852 mg/l, while the outlet Chrome value was 14.21 mg/l as opposed to the prescribed value of 2.0 mg/l. It was stated that the plant has a capacity of processing 70 KL/d chrome liquor. It also confirms that the plant has been under-utilized. In the suggestions, it was stated that incomplete infrastructure at the plant for conversion of recovered chrome into marketable product (Flakes), required to be addressed. The member industries and in fact, all units should ensure transportation of spent

chrome liquor to the plant and a monitoring body should be setup for effective working of the plant. It was informed by the UPJN that 30-32 metric tonnes per day sludge is generated by 36 MLD CETP at Kanpur and it is temporarily stored and later taken to sites meant for dumping hazardous waste.

159. After having analysed the status of the plants and industrial clusters at all the three clusters, the Committee made the following recommendations:

> "4.0 RECOMMENDATIONS
>
> - The Committee observed that the actual generation (appx. 26 MLD against the capacity of 09 MLD) of wastewater from tanneries in Jajmau, Cluster, Kanpur in beyond the designed capacity of 9 MLD tannery wastewater in the 36 MLD CETP at Jajmau Kanpur. Till such time additional treatment provision is provided, there is an immediate need to (i) first restrict the number of tanneries contributing their wastewater. In order to restrict their numbers and capacity of operations, a reference shall be made to list of tanneries initially identified during commissioning of the CETP. (ii) Considering characteristics of combined tannery wastewater carrying high concentration of chromium and other objectionable pollutants, required additional pre-treatment provision to accept shock loading at the CETP be made available for tannery wastewater. (iii) All the tanneries are required to provide a tamper proof sealed electro-mechanical flow meters at the outlet of their Primary Treatment plants UPPCB shall ensure that the wastewater discharge is in strict conformity of notified standards for the consented capacity of hide processing; (iv) O & M cost sharing shall be based on load based contribution by the member units in place of volume.
> - Impact of using treated wastewater from CETP on crops and soil fertility is required to be studied.
> - In order to expedite up-gradation of sewage

treatment infrastructure at Kanpur with special reference to the upcoming 210 MLD STP at Bhingawan, Kanpur & reported difficulty in land acquisition, the Committee was of the view that in place of Polishing Pond requiring excessive land, possibility may be explored for post treatment of treated sewage through other existing high rate anaerobic system, thus minimising the land requirement and expedite project execution. Feasibility report may be prepared by UP Jal Nigam.

- The Committee felt the necessity to explore possibility for augmenting capacity of pumping, conveyance system and treatment for tannery wastewater. This is required to integrate untreated wastewater and convey it to CETP for adequate treatment. This shall eliminate currently observed overflow of tannery wastewater from pumping stations. It is suggested that the entire collection network and pumping stations have to be redesigned to cater for increased flow of 50 MLD (as reported by CLR).
- The Committee took up the issue with Kanpur District Administration for providing sewerage system in Jajmau area. It was noted that UP Jal Nigam has already submitted a separate project proposed under NGRBA Activities.
- UPPCB shall place immediate steps to ensure that online effluent monitoring system in all GPIS, CETP & MSTPs are installed & made operated by 30.06.2015 as directed by CPCB.
- UPPCB & local authorities are required to ensure environmental sound management & disposal of flashings. (Process waste from tanneries).
- Immediate action to close down all illegal operators/activities of Jajmau, Kanpur.
- Strict Vigilance enforcement & compliance by industries to be enforced by the UPPCB.
- To prevent any possibility of further Ground Water River pollution, indiscriminate dumped Hazardous solid wastage need to be lifted & sect. to TSDF (Treatment storage and disposal facility).
- The UPPCB should strengthen its enforcement and monitoring mechanism to ensure that Hazardous Solid Waste generated from the industries, CETP, shall be properly stored, disposed off as per provision of Hazardous Waste (Handling & Management)

Rules and not dumped in the city or along the River/Road.

- Strict action needs to be taken against the defaulting units such as operation without consent orders/authorization of hazardous waste.
- Industrial activity and associated operation in the region needs to be monitored very closely for ensuring better compliance with the prescribed pollution Control Standard. Local administration under the chairmanship of DM can monitor the implementation of action plan on quarterly basis and also take necessary corrective measures.
- The irrigation channel carrying treated wastewater from all the three treatment plants needs to be strengthened urgently and the work of modification and lining of the earthen portion be taken up by Nagar Nigam keeping in view the planned sewage treatment capacity. Capacity of the command area irrigated through treated effluent channel be ascertained on the basis that alternate watering should be with other sources of water, and if found insufficient, the channel length/command area should be increased. Nagar Nigam should also oversee and regulate the controlled use within the command area. It was noted that unutilized sewage taken from the irrigation channel anal applied on agricultural land also reached River Ganga in and around village Shekhpur.
- All possible measures are required to be taken for expediting repair of collapsed structure of trunk sewer so as to optimize its utilization and eliminate the possibility of discharge of untreated sewage into River Ganga.
- The Ganga Pollution Control Unit (UP. Jal Nigam) is required to prioritize regular cleaning/ maintenance of the Conveyance Network, optimize individual plant performance so as to avoid discharge of untreated wastewater in to the River Ganga.
- The capacities of pretreatment system designed in individual tanneries are based on the consent capacities given by pollution control board. Whereas tanneries are processing more than the consent capacity and discharging wastewater at larger quantities, due to increase in wastewater discharge quantity pretreatment system is not

effective in removing the suspended solids. Therefore, it is suggested to modify the pretreatment to the installed capacity of the individual tannery. The pretreatment system to be provided with proper screens, flow measuring devices, collection tank, pumping system and dewatering system. It is also suggested prior to construction of pretreatment system approval may be obtained from the competent authority. If required, dosing system is also to be provided for removal of suspended solids and chromium to meet standards as per Environmental (protection) rules 1986. No tannery is to be allowed to process more than the specified capacity.

- Most of the tanneries are adoption SDBs for dewatering of sludge but the area of SDBs are grossly inadequate. Therefore, it is recommended to install mechanical dewatering system for dewatering the sludge.
- The Build, Own & Operate Option/Developing Co-operative Society for management of new/proposed CETP in place of UP Jal Nigam shall be worked out.
- A monitoring body by Special Purpose Vehicle (SPV) may be constituted with the overall responsibility of collection of chrome liquor, transportation and recovery of chromium, returning the recovered chromium to the respective tanneries."

160. *Vide* its order dated 27th January, 2016, the Tribunal had directed that the State of UP and UPPCB to publically advertise that the industrial clusters could be shifted from the present site. The notices were issued and the stakeholders including the Industries Association were heard on this question. The status of these complexes was also discussed by the Tribunal in its order dated 18th November, 2016, which reads as follows:

"There are three industrial clusters primarily housing tannery industries. One in Jajmau, Kanpur where there are nearly 400 tannery industries. Second at Unnao where there are

> 15 tannery units and third is at Banthar where there are 42 tannery industries.
> The Learned Counsel appearing for the Uttar Pradesh Pollution Control Board and Central Pollution Control Board submit that the CETPs are located at Banthar and Unnao which treat the waste generated by the tannery units in respective industrial areas.
> The Learned Counsel appearing for the State of Uttar Pradesh submits that at Unnao the 15 tannery units are operational. All the 15 tannery industries have their own Chromium Recovery Plant and their outlet is connected to a CETP which is expected to treat the trade effluent in relation to all the parameters generated by such industries. The Learned Counsel appearing for the CETP submits that mostly CETP is designed to treat trade effluent to achieve the levels of prescribed standards. According to him, the treated effluent is discharged into Loni drain which ultimately joins River Ganga. As far as the tannery industries at Banthar are concerned, there are 42 industries out of which, according to the Learned Counsel appearing for the CETP, 25 industrial units are operational and remaining units for one reason and other have not started their operation and/or are under construction or otherwise closed down and all the industries are stated to have their own Chromium Recovery Plant and effluent is then treated in the CETP and finally discharged into the City Jail drain finally going to River Ganga."

But even at Jajmau and Banthar recovery of chromium is not effective and complete. The analysis report for both the drains, i.e., Loni drain and City Jail drain show that Chromium was present in the effluent that was analyzed. In the case of City Jail drain, it even exceeds the prescribed parameters.

161. *Vide* its order dated 25th January, 2017, the Tribunal had even issued notices to the industries, particularly, petro-chemical, distillery and other major industries which are

polluting the 86 drains which were joining river Ganga and its tributaries. In this order, the stakeholders were also directed to submit their report in relation to the end of pipeline treatment as opposed to decentralised treatment plants being set up all over the cities. In the order dated 17th April, 2017, the Tribunal had also issued various directions to the stakeholders for compliance. It was vehemently stated and deliberated at length that ZLD is not the desired solution as it would generate very large quantity of salt which will be very difficult to store and handle. Even if 70% of the generated salt, as stated, is converted to sodium salt which are capable of being sold, even then it will be difficult to create a market for sale of such huge quantity of sodium salts. This still would leave the remnant 30% to be stored which will require huge land and storage capacity. In view of this and even otherwise, it will not be practical and economically viable.

MoWR, however, had suggested that ZLD in CETP should be made effective and there should be three-pipeline system, one for 'chromium recovery', other for 'trade effluent' leading to CETP and third with regard to 'domestic and other effluents'. Shifting of the industrial complexes was also subject matter of deliberation before the Tribunal. The UPPCB had taken a specific stand which in fact was submitted by some of the stakeholders that there has to be a separate Chromium Recovery Plant and CETP capable of

treating the quality of the effluent that is being generated in that area. Views expressed by the various stakeholders and experts invited by the Tribunal were also taken into consideration.

162. When the matter was taken up on 11th April, 2017, the Tribunal had specifically noticed that in furtherance to the order dated 30th March, 2017, Senior Officers from the concerned Ministry, State of UP and other stakeholders including SPCB, CPCB were present. The stand of each stakeholder had been deliberated in the chamber meeting and its minutes were recorded and confirmed. The said minutes read as follows:

> 1. "The Additional Chief Secretary, (Environment & Forest) has stated that Uttar Pradesh Government has taken a policy decision for making all possible efforts to clean and rejuvenate River Ganga.
> 2. As far as Segment-B is concerned, the Government is quite clear that all the sources which pollute River Ganga should be treated on the basis of definite data and information.
> 3. The Government of Uttar Pradesh has, in principle, taken up decision to shift the tannery industries from Jajmau and the place to which they are to be shifted is under effective consideration. It would be identified shortly. However, the Government is also open to the idea that appropriate anti-pollution devices including Chromium Recovery Plant and Common Effluent Treatment Plant may be provided at the existing site and if the outlet provides the effluent as per the declared parameters then the water could be recycled.
> 4. The Executing Agency would be the Uttar Pradesh Jal Nigam, except for the projects which are taken on Hybrid

Annuity Mode.

5. The State of Uttar Pradesh would have no objection in providing the Sanitary Landfill Site beyond 500 meters from the flood plain of the River. There should be complete restriction on any kind of waste being dumped into the River.
6. The State of Uttar Pradesh will provide complete and correct with regard to the following, on the next date of hearing i.e. 17th April, 2017:-
   i. What should be the minimum environmental flow of River Ganga in Segment-B.
   ii. Whether there is excessive extraction of groundwater in this section and/or whether the water being diverted into the various Ganga Canals should be regulated so as to help maintenance of minimum flow of the River.
7. It is undisputable that two major problems are causing pollution, excessive extraction of water on the one hand while on the other high pollutants are being put into the River. Unless both are controlled, it will be difficult to restore the River to its original pristine.
8. The State of Uttar Pradesh has preference for cleaning River Ganga.
9. The Special Secretary on behalf of MoEF&CC stated that the Ministry would give all help and assistance to the State Government for the purposes of ensuring the treatment of the effluent, being discharged by Tannery industries into River Ganga.
10. The Solid Waste Management Rule, 2016 make it clear, and in fact it is a clear stand of MoEF&CC that the waste, in any form, cannot be permitted to be dumped in any form in River Ganga and there will not be any Sanitary Landfill site within the flood plain.
11. As far as the minimum environmental flow of the River as well as the excessive extraction of water intake, the Ministry would submit its comments by the next date of hearing. It can be better answered along with the Ministry of Water Resources.
12. The online monitoring system should be enforced.

13. Both the conditions i.e. ZLD as well as online monitoring system are pending consideration before NGT and MoEF&CC will comply with its order.
14. The Chairman, CPCB stated that it will be beneficial to stop/prohibit any kind of waste being dumped into the River and Sanitary Landfill site to be located beyond the 500 meters from flood plain.
15. Jajmau poses a serious pollution issue and the present CETP is as good as non-exiting, keeping in view the load of more than 25-30 MLD of trade effluent, whereas it is for treating 9 MLD of trade effluent mixed with 27 MLD of domestic sewage. It also does not have the capacity to treat other pollutants, except BOD and COD. It needs to be replaced by new CETP which is of the requisite capacity and capable of treating all effluents, besides sewage.
16. Dilution based treatment is the possible solution, though CPCB seeks to enforce standards and standards are technology neutral.
17. The Central Pollution Control Board would implement the parameters at the end of the pipe, which should be meeting the prescribed standards. However, establishment of individual ETP and proper enforcement could be a good solution, but implementation thereof would be a serious question. Separate Common Chromium Recovery Plant would be necessary.
18. 86 drains have been identified and most of them carry not only sewage, but even trade effluent. It is a mixed discharge which contains variety of elements including heavy metal and therefore, end of the pipeline would be proper treatment. But site selection of STP would require proper study of the longitudinal profile of drains.
19. The Executive Director (NMCG), on behalf of the Ministry of Water Resources, stated that the Ministry would be willing to render all help and assistance, but the object of cleaning of River Ganga rather than concentrating on cleaning of cities is the first & preferred option.

20. The Ministry will finance, in terms of its scheme, for domestic sewage and industrial effluent treatment separately.
21. As per the scheme of NMCG, the first priority is cleaning River Ganga, but it would also spend through other major schemes relatable to cleaning of cities etc.
22. In terms of the Notification and as per the stand of the Ministry, Uttar Pradesh Jal Nigam is the Executing Authority for the work falling in Segment-B.
23. As far as Jajmau Tannery Cluster is concerned, if the State chooses to shift the industries to a different site, it will be its choice. However, the existing industrial clusters at Jajmau and Unnao requires establishment of an entirely new CETP with a separate Chromium Recovery Plant and separate pipelines.
24. The Technology of the CETP would be ZLD based which would only generate salt and sludge.
25. After being cleaned, part of salt will be usable and hence saleable and rest will have to be dumped.
26. The sludge deposit site has to be created which must meet scientific standards.
27. In relation to e-flow of the River, the Ministry of Water Resources had taken holistic study of various reports submitted by the expert agencies, the final view is still required to be taken. The recommendations vary from 20% to 30% depending upon the geographical location of the River and particularly it should be site specific. However, we direct the Ministry to take a stand which may be a tentative view and inform the Tribunal on the next date of hearing. There should be complete prohibition of any kind of waste being dumped in the River and on flood plain. There should be prohibition also on construction of Sanitary Landfill Site on 500 meter or any other reasonable distance of the high flood line, with reference to once in 25 years flood cycle.
28. All of them agree to 'Polluter Pays Principle' application for control of industrial pollution.

> The concerned stakeholders shall positively provide the information required as above, to the Tribunal by 17th April, 2017, during the hearing of the case on a day-to-day basis. The State of Uttar Pradesh is at liberty to file before the Tribunal, list of its priority project(s), if any, but no expenditure would be incurred on any project without leave of the Tribunal."

163. From the above order-cum-minutes, it is evident that all the stakeholders in principle agreed to cleaning of river Ganga and its tributaries on priority to cleaning of cities which itself is a major project. Uncertainty in execution of such project was writ large as was evident from the records that there are a large number of unauthorized and unplanned colonies which had no sewer lines and no mechanism for collection, transportation and disposal of the sewage generated in such colonies which were highly populated. Furthermore, the areas, which were within the planned development, were still not provided with proper sewer lines. In view of this, providing decentralized STPs is a long-term solution, which under no circumstances, can be executed in the near future. Cleaning of river Ganga and its tributaries being the prime object, such solutions have to be applied, which are capable of achieving this object atleast in the coming years. The State of UP, however, showed its reluctance in shifting the industries from Jajmau. Other suggestions afore-referred were found to be acceptable to all the concerned stakeholders and they

were required to be implemented. The entire emphasis has to be on cleaning of 86 drains and ensuring that from these drains no pollutants join river Ganga or its tributaries. This solution would ensure that the pollutants do not enter river Ganga and its tributaries falling in Segment-B, thus, cleaning and rejuvenating river Ganga in all respects.

Since Jajmau industrial cluster is one of the major contributors of pollution of river Ganga, it would be appropriate to examine in detail the working of this cluster, existing systems and the pollutants being generated from those cluster industrial clusters.

1. Jajmau cluster mainly accommodated tannery industries. The Jajmau cluster is located on the right bank of river Ganga on North Eastern border of Kanpur city. As per the information given by CPCB and UPPCB, there are 400 tanneries in this cluster. According to them, most of these tanneries are chrome based with varying scales of operations.
2. The tannery industry is known to be a highly polluting industry especially through industrial effluents which are high in organic and inorganic matters, highly toxic content accompanied by propensities for high oxygen demand and potential toxic metal salt residue. These industries are also associated with environmental concerns mainly

from issues like decomposition of protein content of solid waste, presence of Hydrogen Sulphide, Ammonia and complex Volatile Organic Compounds. An important aspect of this industry is that a significant part of the chemicals used in the leather processing are not actually used or consumed in the process but are released in the environment in the form of waste.

3. The tannery operations involve conversion of raw hides or screened leather, stable material that can be used for manufacturing of large number of products. The tannery industry operations can be broadly classified into three stages namely- pre-tanning, tanning and post-tanning processes. The pre-tanning is employed mainly for removal of impurities from the raw materials.

4. The impurities consists of mainly hair, flesh etc. which can cause degradation of protein material. The pre-tanning process involves use of salt lime, sulphide etc. as process chemicals. The pre-tanning process may include stages like curing, soaking, de-hairing, fleshing, deliming etc.

5. The tanning process is aimed at converting the air collagen fiber of the hides into a stable product which is no longer susceptible to bio-degradation or rotting. The tanning process can be of different type

like chrome tanning, vegetable tanning, mixed vegetable tanning and mixed chrome tanning. However, the chrome tanning is predominantly used due to its operational simplicity, lesser cost and sustained product quality.

6. The post tanning processes include coloration and several other operations that enhance the product quality in terms of appearance, softness and reliability of leather.

7. It is now necessary to understand the configuration of the tannery industry at Jajmau. According to the CPCB, there are 400 tannery industries in Jajmau. The UPPCB has granted Consent to Operate to all these 400 industries with a condition to treat their industrial effluent as per the standards. UPPCB further submits that out of 400 industries, 272 units are in operation and of the balance 128 units, 85 have been closed by the UPPCB for non-compliance and the remaining 43 industries are self-closed. The UPPCB is unable to furnish record of how many industries have their own Chrome Recovery Plant (CRP) and how many have the membership of the Common Chrome Recovery Plant (CCRP).

8. However, all the parties admit to a fact that all these industries are in operation in small and

medium scale industry category as per the definition of the Industry Department. The tannery industries association on 24.11.2016 submitted that out of 400 industries, 211 use chrome tanning process and remaining 189 are rather using vegetable or split tanning process. They further submit that out of 211 chrome tanning units, 141 units have their own Chrome Recovery Plant and 61 industries are member of Common Chrome Recovery Plant (CCRP). The details of 9 chrome tanning units are not known. The tannery industry association further submits that all the tannery units at Jajmau have a Primary Effluent Treatment Plant within their premises and all the chrome tanning units either have their own Chrome Recovery Plant or are the member of the CCRP.

9. According to CPCB, drains originating from Jajmau are characterized by high concentrations of total Chromium. The CETP discharge is in irrigation canals. CPCB submits that the main issues related to Jajmau are:

   a. The tannery industries in Jajmau are located in thickly populated residential areas and many units are also part of the residence as units operate on job work basis.

   b. Though there are 400 listed tannery

industries, it is highly possible that there are many more small scale units which are not registered and operating without unauthorization.

c. Though, there is a limit prescribed in consent for the number of hides to be tanned, there is no effective mechanism to verify such compliance limit. However, based on thumb rule related to chrome waste generated per hide from tanning, authorities have estimated than much more hides than the consented numbers are being tanned in the Jajmau area.

d. The existing Common Chrome Recovery Plant of 72000 ltr/day capacity is operated at a maximum 25% capacity due to non-availability of adequate chrome liquor from the member industries, which is transported to the plant by tankers by the Nagar Nigam. Though UPPCB has all necessary information on spent chrome liquor sent by respective tannery yet no action has been taken by it.

e. The chrome recovery plant is operated by Kanpur Nagar Nigam while the CEPT is operated by UPJN. There is no coordination between these two units or the agencies. Significantly, both these plants are located

adjoining to each other.

f. The CETP at Jajmau has a capacity to treat 9MLD of tannery effluent and 27 MLD of domestic effluent. However, there is much more flow i.e. about 43.55 MLD reaching the Sump, from which untreated effluent is pumped to CETP.

g. The industries at Jajmau are discharging much more than 9 MLD industrial effluents, mainly containing Chromium. These industries are located in thickly populated residential area, thereby causing mixing of industrial effluent with domestic sewage which is nearly 35 MLD. This mixed waste is collected through four major conveyer drains in a common Sump, from where the mixed waste is pumped to CETP operated under Kanpur Nagar Nigam for treatment. As the capacity of CETP is much less, the excess of mixed waste overflows from this Sump and meets river Ganga through drains.

h. There is no enforcement of consent conditions by UPPCB which requires all industries to send their chrome liquor to the Chrome Recovery Plant and pay for the treatment.

i. Industries are finding it easy to dispose their

entire waste including the chrome liquor in the common drain which conveys both domestic as well as industrial waste.

j. No analysis of river sediments or embankments is available and CPCB has now taken some samples to verify the critical pollutant concentrations.

k. The fate of pollutants once it reaches the rivers is an area where research is required. The rivers with its natural flow and velocity will have self-cleansing capacity as far as BOD or organic load is concerned, but in the present case, with low or practically no flow, this phenomenon is hardly relevant in the present stretch. The fate of metals in the river is another area, which is largely unexplored. The diffusion, dispersion, sedimentation and leaching are the natural processes, but how much metals are further dispersed in downstream water environment, and how much either enters the biological cycle by bioaccumulation or converted as deposits due to sedimentation, is not known or assessed.

10. The CPCB in its Report dated 24th August, 2016 has elaborately explained the present scenario of the tannery effluent being generated at Jajmau,

Kanpur. The existing CETP of 36 MLD was constructed and commissioned in 1994 for about 175 Tanneries, which were existing at that point of time. This CETP is based on UASB technology with an inflow capacity of 36 MLD with tannery effluent to sewage (T:S) blending ratio of 1:3 i.e. 9 MLD tannery effluent and 27 MLD sewage. For collection of wastewater from tanneries located in the Jajmau area, 12 kilometres long conveyance system was constructed. The conveyance system is meant for the tannery wastewater conveyance through 4 pumping stations from where waste is pumped to the 36 MLD CETP. The tannery wastewater and the domestic sewage are blended in a mixing tank in the ratio of 1:3 and ultimately pumped into UASB reactors. The treated effluent is finally utilised for irrigation after mixing with treated sewage of two STPs (of the capacity of 130 MLD and 5 MLD) located in the same premises. The CPCB further informed that they have actually measured the tannery wastewater flows at 4 pumping stations in March and September, 2016 and observed that the total discharge is in the range of 68 MLD to 72 MLD on the grab sampling. CPCB further informed that based on the composite sample in March, the daily wastewater generation from Jajmau is about

44 MLD based on the composite monitoring in April-May, 2016. CPCB further informed that the Common Chrome Recovery Plant installed with the capacity of 70 kl per day is underutilized and chrome liquor coming to the plant is very low. According to CPCB, this indicates improper segregation, collection and transportation of spent chrome liquor from tanneries to the Common Chrome Recovery System (CCRS) for recovery and reuse of chromium. CPCB further elaborately presented the performance data of the CETP which indicates that the industrial inlet has a very high chrome content of about 77 mg per litre which is affecting the performance of CETP resulting in the outlet of more than 7 mg per litre Chromium, besides, other non-compliance in terms of BOD, Total Dissolved Solids, Suspended Solids and Ammoniacal Nitrogen. CPCB further informed that even after dilution with the treated sewage, the problems related to Chromium, TDS, Oil and Ammonical Nitrogen are persisting and this treated effluent if used for irrigation may pose serious environmental problems.

As stated in the report dated 24th August, 2016, the Committee had collected samples from the CEPTs/STPs, analysed them and submitted their

report and opinion to the Tribunal. It found that the samples collected from the CIDCOL Haridwar, Jajmau, Kanpur, Banthar, Unnao and UPSIDC Site-II in Unnao are non-compliant and violative of the prescribed parameters. The report noticed high concentration of TSS, Total Coliform. It was pointed out that the high concentration of Total Coliform at the inlet adversely affects the biological treatment system due to its toxic nature. Amongst metals, Cadmium, Cobalt, Copper, Iron, Manganese, Nickel, Lead and Zinc were found. To be precise, it was found that these CETPs/STPs were non-functioning or were functioning in violation to the prescribed standards. Large quantity of trade effluents and sewage were being bypassed and directly discharged into river Ganga and its tributaries.

11. On specific query, CPCB informed that the river dredging is not commonly practiced in India, which is generally used for navigational purposes or raising the embankments of rivers. CPCB further submits that there is a need to collect information regarding suitability and effectiveness of dredging versus scrapping of riverbeds, which may depend upon the characteristics of the sediments. In coastal areas, benthic and sediments have

tendency of accumulating pollutants due to currents and tides, but in riverine stretches, the actual accumulation pattern may be different. It would, therefore, be necessary to study whether the riverine banks and the sediment in the main river stream shows characteristics of accumulation of pollutants similar to benthic in coastal waters. This aspect of the fate of pollutants released into the river water stream is important, as floodplains and banks are extensively used for agriculture and have a significant health consideration, due to bioaccumulation of pollutants.

12. It is also informed by the CPCB that there are reports indicating a broad diversity of aquatic species in river Ganga, and in 1970 there were 70 fish species which were predominantly native species. However, as per some published research papers, there are about 53 species in the river and water quality sensitive fish varieties have disappeared, whereas the commercial species are now predominant species.

13. The Tannery Industries Association submits that the mismanagement and non-compliance of the waste treatment at Jajmau cannot be solely attributed to the tannery industries. The learned Counsel submitted that the conveyer belt

(conveyance system) which is laid down to collect the industrial effluent from tanneries is broken and damaged at several locations which allows ingress of sewage and industrial effluent from other industries in the area. He submits that there are about 42 to 50 industries in the vicinity, which are using Chromium and discharging waste which is containing Chromium. He further submits that because of such increase in other wastes, the Sumps at 4 pumping stations are over flowing and discharging the waste directly or indirectly in river Ganga. It is further submitted that total industrial effluent from the tannery is only about 12 MLD as against 46 MLD projected by CPCB. The Association further submits that they are fully coordinating with the Jal Nigam to operate the CETP efficiently and consistently in order to ameliorate the problems of pollution.

14. It is the case of the Industry Association, that the ZLD which has been proposed by the MoWR cannot be a long term and sustainable solution, for the reason that the proposal is financially not feasible due to very high capital investment and recurring cost. Instead, the Association is of the opinion that the upgradation of the existing CETP coupled with appropriate waste collection system is the most

feasible option. They further submit that in this regard, they had submitted a detailed project report twice, and both these reports have been recently rejected by NMCG without hearing them or assigning any justified reasons for such rejection. The Association also submits that it is possible to lay down a 3 pipeline collection system to collect sewage, effluent containing chrome, and other effluents separately and they are ready to bear the cost of such pipe line to the tune of 30 per cent.

15. The Industries Association further submitted that ZLD has not been prescribed in the standards notified under the Environmental Protection Rules, 1986 and, therefore, the MoWR under a subsidiary notification cannot impose such standards over-looking the standards prescribed under the Rules. They also submit that the online monitoring system for the tannery industries is also not technically and economically feasible, for the simple reason that most of the effluent is in the batch process and, therefore, there is no continuous flow. Further, there are standards prescribed for several parameters like pH, TDS and Chrome. It is submitted that as on today, about 120 industries have installed only the flow meters and not the analysers for the above mentioned polluting

parameters. It is further submitted that there is no ZLD industry in Jajmau Industrial Cluster.

16. Most of the CETPs in the country have been developed under the CETP scheme of MoEF&CC, which envisages an active participation of the Industries Association. In fact, in most of the cases, the CETP have been built by the Industries Association with the financial aid/ subsidy from Central and State Governments. Further, the operation of the CETP is also managed by the Industries Association or an operator selected by them. In some industrial areas, the Industries Association have even taken the responsibility of collection and disposal of the waste as per the prescribed standards. This situation and scenario was discussed in the proceedings on 21st November, 2016 and the tannery association was specifically asked about their willingness to implement the up-gradation of the CETP, operation of CETP as well as to undertake proper collection and disposal in order to remove any chances of lack of coordination or undefined responsibilities. The learned Counsel for the Tannery Association on instructions from his client expressed their inability to operate the existing CETP. He also expressed his inability to undertake the up-gradation of the

collection treatment and disposal system, as per the CETP scheme. The Learned Counsel submitted that UPJN which is a specialized body of UP Government is technically equipped and mandated to undertake such works and they are ready to cooperate with them.

17. The NMCG which is now entrusted with the responsibility of Mission Clean Ganga has also evaluated the pollution problems arising out of the tannery cluster at Jajmau, Kanpur in order to abate water pollution of river Ganga. Secretary of Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India *vide* its letter dated 21st March, 2016 has submitted the executive summary of the Report prepared by NMCG for this purpose. It is seen from this Report that NMCG had appointed Tamil Nadu Water Investment Company (TWIC) to prepare a detailed project report for 20 MLD capacity with Zero Liquid Discharge (ZLD) based tannery effluent Management System and resource recovery from the tannery cluster at Jajmau, Kanpur. The system broadly comprises of separate collection of chrome liquor and process wastewater, treatment for meeting usable quality criteria and its distribution back to the Member Tanneries, besides salt

recovery based on State of the Art Technology. It is further submitted that this system has been thoroughly corroborated by the Indian Institute of Technology, Kanpur.

18. The proposed ZLD project envisaged by NMCG includes collection and a conveyance piping system for raw effluent and separate piping for collection of spent chrome liquor. It also includes Common Chromium Recovery Plant and reused chrome. The treatment of raw effluent from the Tanneries is followed by use of reverse osmosis and Multiple Effect Evaporator in addition to the captive power plant. The proposed ZLD-CETP aims to recover water upto 96% which will be reused in the Member Tanning units and redistributed back to the Member units through separate dedicated piping network. NMCG has considered various information as available from CPCB and UPPCB and has come to a reasonable conclusion that a 20 MLD capacity CETP will be necessary to manage the wastewater from 400 Tanning Industries. It is also expected that out of 420 tonnes of salt generated at a CETP about 70%, i.e., 320 tonnes per day will be recovered and reused. The remaining salt, i.e., which would be a mixed waste salt about 120 tonnes per day will be stored at

CETP for 5 years as it is expected that with the proposed R&D activities this remaining salt will also be reused and recycled in the near future. Similarly, the sludge (lime sludge) generated in the CETP will be sent to the Cement Plant for co-processing, subject to the condition that the Chrome segregation is effective and the lime sludge is reasonably free from chrome contents. The expected capital cost of this ZLD-CETP (20 MLD) will be about ₹ 856 crores and the cost of its operation and maintenance will be about ₹ 314 per kl. This O&M cost will be substantially reduced upto ₹ 163 per kl after considering the recovery of water, salt and power generated from the Captive Power Plant. According to NMCG, this proposal of ZLD-based CETP at Jajmau, Kanpur will be a long-term sustainable solution though the same is comparatively costlier. The NMCG feels that with the improved environment and stringent compliance, the industries will be able to operate their plant to the desired capacity which will make their industrial operations economical and sustainable.

19. The Executive Director of National Mission for Clean Ganga (NMCG) submits that the DPR for the ZLD technology based CETP for the Jajmau tannery

cluster has been prepared by the Expert Agency. He further submitted that as per the information available from the State Authorities there are 400 tannery units. He further conceded that NMCG itself has not verified the number of industries or physically investigated the present status of effluent collection, treatment and disposal. NMCG has relied on the data given by the State Agency and also the report submitted by the consultants. The Executive Director, NMCG further submitted that subsequent to the proposal for this ZLD/CETP, further discussions have been held with CLRI Madras which has recently come up with a new modified environment friendly tanning process, which is called as Water-Less Tanning. The Executive Director, NMCG further submits that as per the primary estimation of CLRI, there will be minimum 40% reduction in use of water for the tannery process and equivalent reduction in the salt used. It is further submitted that the salt which is generated after the ZLD process will mainly comprise of Sulphates and Chlorides and if proper segregation of these salt could be done then there are several opportunities to commercially reuse these salts.

20. However, Executive Director, NMCG fairly

submitted that the appropriate technology for segregation of Sulphates and Chloride salt from the salt recovered in the ZLD process has not been identified so far. Besides that the commercial aspect of salt recovery, particularly, market availability of these salt has not been studied so far. It is an admitted fact that even today the existing CETP generate significant quantity of salt which also contain substantial concentration of Chromium (Cr) due to ingress of chrome containing tannery effluent into the CETP. The environmental implication of the huge quantity of such salts stored in the CETP premises, particularly, ground water contamination, has not been stated so far. In fact, it would be necessary to study the characteristics of such accumulated sludge to verify the concentration of chromium viz-à-vis the stipulated criteria identification of such sludge as hazardous waste.

21. CPCB further informed that the Ministry of Environment and Forest had launched the Charter on "Corporate Responsibility for Environmental Protection" (for short, 'CREP') in 2003 as a covenant to look beyond the compliance of regulatory norms for industrial pollution control. The action points under the CREP for Tannery

Sector were formulated under this programme and they are as under:

ACTION POINTS UNDER CREP FOR TANNERY SECTOR

Chrome Recovery

- *All the chrome-tanning units in the country will have the Chrome Recovery Plant either on individual basis or on collective basis in the form of Common Chrome Recovery Plant and use the recovered chrome in the tanning process.*
- *Common Chrome Recovery Plant is to be installed and commissioned at Kanpur , for which the Feasibility Report has already been prepared.*
- *Recovered Chromium is to be utilized in tanning process*

Waste Minimization Measures

- *Waste minimization circles will be formed in all the clusters of tanneries in the country to implement waste minimization measures and for adoption of clean technologies.*
- *Efforts should be taken to implement the waste minimization measures in all the tanneries in the country and gradually made obligatory with time to the tannery units.*

Reduction of Water Consumption in Tannery Units

- *All the tanneries should install water meters and flow meters to measure actual consumption and wastewater discharge.*
- *Water consumption rates will be brought down to 28 m 3 /tonne of hides by taking waste minimization measures.*

Compliance of standards

All CETPs and ETPs should take the following measures:

- *Employ qualified and well trained staff for O & M of the ETPs/CETPs.*
- *Installation of automatic monitoring instruments.*
- *Interlocking of manufacturing processes with ETP operation*
- *Separate Energy meters for ETPs/CETPs by December 2003.*
- *Open anaerobic lagoons should be converted into closed systems with gas recovery*
- *For health & safety of worker in the industry & ETP/ CETP the guidelines developed by CPCB should be implemented.*
- *All major tannery units should take-up environmental auditing on annual basis.*

- *Major tannery units & CETPs should attempt to obtain ISO-14000 certification.*
- *Tannery units &CETP management should take-up modification/up-gradation of the CETPs/ETPs wherever necessary*

Management of Total Dissolved Solids (TDS)
All tannery units to adopt the following

- Manual/mechanical desalting.
- Use of cleaner technology for less use of salt.
- Refrigerated transportation of hides
- High Rate Transpiration system for effluent treatment
- Treated wastewater will be mixed with the sewage & the treated effluent be used on land for irrigation.

Solid Waste Management
All the tannery units to adopt the following:

- *i. Utilization of Process sludge for by-product recovery.*
- *ii. Resource Recovery from process sludge and ETP sludge in the form of Biogas.*
- *iii. Chromium recovery from tanned leather shavings.*
- *iv. Safe disposal of hazardous sludge and non-hazardous solid wastes.*

Salts from Solar Evaporation
All the tannery units to adopt the following:

- *Reuse of recovered salt.*
- *Quality improvement of recovered salts for reuse*
- *Safe land disposal*
- *Sea disposal*

Use of Boron *bearing compounds will be dispensed with. By: December 2003*
Ground water quality monitoring *to be strengthened.*
Sulphur recovery *from sulphide bearing effluents to be explored.*
The implementation of recommendations of the Task Force on leather tannery units constituted by the Ministry of Environment & Forests, Govt. of India in a phased manner

164. Upon proper analysis of the reports, data and functioning of the industrial clusters as submitted by various stakeholders and more particularly the regulatory bodies, it is clear that the industrial cluster at Jajmau requires immediate action and steps to ensure prevention of further

pollution of river Ganga. There are only two alternatives by which contamination of river Ganga from the industrial clusters particularly, the tannery cluster at Jajmau can be controlled and prevented without losing any further time. One of such options is that the entire industrial cluster at Jajmau should be shifted to another area which is developed and fully equipped to treat the effluents generated by such industries. In this regard, it was stated that the land is available and the Government could take effective steps for shifting the industrial cluster but it is reluctant to do so for obvious reasons. Once the industrial cluster is shifted in its entirety, there would be no requirement for establishment of an STPs/CETPs, Chromium Recovery Plant and/or up-gradation of the existing plants. The other alternative is the two pipeline system to be provided. One pipeline will be dedicated pipeline for bringing the Chromium from the industries to the Chromium Recovery Plant. The Chromium Recovery Plant would recover the Chromium and sell the same for being reused by the Tannery Industries itself. Such recovered Chromium has an open market for sale. The other pipeline, in fact which is the existing conveyor belt, should be completely dredged, cleaned and other trade effluents along with the sewage could bring the effluents collected from industrial-cum-residential complex to the CETP which requires complete up-gradation and/or

construction of a new STP at the existing site. The discharge from the CETP should be either recycled for use by the Tannery Industries for agriculture and horticulture purposes and only the remnant which normally should not exceed 25% of the total discharge of the treated effluents from the CETP should be released into river Ganga. This option has to be time bound which the responsibility and obligation of the industries should be clearly defined. The industrial cluster should share the expenses for construction/up-gradation of CETPs/STPs/ Chromium Recovery Plant and for laying down the pipelines. The CETPs/STPs/Chromium Recovery Plant should be collectively run by the UPJN and they should be responsible in all respects for smooth and effective performance of the plants. The drainage system bringing the sewage to these CETPs/STPs at Jajmau should be cleaned, dredged and kept free of any accumulation of waste and sludge to ensure free flow of the sewage effluents to the CETPs/STPs as discussed above at some length.

165. The reply filed by the Jajmau Kanpur Tannery Industry Association states that the industrial cluster should not be shifted to another site but steps for prevention and control of pollution at the existing site should be taken by up-grading the CETPs. They claimed that they are not seriously polluting industries and, therefore, they should

not be shifted. It will cause heavy financial loss and displacement of labour if the industry is directed to be shifted.

It is averred that the pumping stations at Jajmau have become outdated and are not working properly. The population has increased and there is no proper maintenance of drainage and sewer lines, even the pipelines are broken at different places. It is submitted that the tanners are law abiding citizens who have taken initiatives suggested for up-gradation and expansion of the CETP. This was even suggested by them to the State Government but no effective steps have been taken so far.

166. According to Industrial Association, the order of the Hon'ble Supreme Court in relation to shifting of tannery industries in Calcutta in the case of *MC Mehta Vs. Union of India and ors* (supra) would not apply to the present situation as in the Calcutta case, space for installation of appropriate CETP and other anti-pollution devices was not available. While in the present case, enough space is available at the industrial cluster to treat the effluents. Industries have also raised serious objections with regard to enforcement of ZLD and online monitoring system at Jajmau. In fact, the Association had filed specific objections in regard to ZLD before the CPCB. The CPCB considered those objections and offered comments. The objections primarily related to economic viability of ZLD,

desired audit of salt balance, ZLD system not being installed anywhere in the world and there would be excessive energy consumption and carbon footprinting. There is no solution for use or disposal of quantity of salt recovered. The CPCB had expressed the view that the final effluent discharge from the Jajmau CETP does not conform to the prescribed standards. The final effluent discharge from Banthar, Unnao CETP also did not conform to the prescribed standards. There was no compliance to the directions issued by the CPCB and UPPCB. The Members had not complied with the installation of Continuous Emission Monitoring System. The Principal Committee had also suggested in its meeting dated 2nd January, 2015 that the Joint Monitoring System would be applicable to the industries working in clusters like Jajmau and connected to CETPs. Both the installation of online monitoring system and ZLD remained the question of debate. The UPPCB and UPJN had also taken the stand that it is necessary to dilute tannery effluent of Jajmau by 10 times of the treated sewage and the CETPs/STPs should be made functional to ensure discharge of effluents within the prescribed limits.

167. The State of UP prior to the stand recorded in the minutes of April 2017 had earlier taken the stand that the industrial cluster could be shifted to another part of land located at some distance from Kanpur. However, in the

submission made by the Advocate General, it was stated that shifting is neither possible nor feasible and it will give rise to social problems. However, all with regard to other issues, the State Government was in line with the measures suggested by the stakeholders for prevention and control of pollution of river Ganga. In relation to industrial clusters at Unnao and Banthar, the precise suggestions are upgrading of the existing CETPs, greater regulatory and supervisory control by the authorities and proper maintenance of the conveyor belt/drains, bringing the effluents to the CETPs /STPs. The industries have raised no serious objections with regard to up-gradation and improvement of the existing anti-pollution devices and measures to ensure that there is no pollution of river Ganga. The industries along with other stakeholders have suggested time bound programme and upgradation of the plants and willingness to fully comply with the prescribed standards of discharge of effluents. They make no exception that the pollution of river Ganga and its tributaries should be controlled and they would not shirk from their responsibility in that behalf. It is also suggested that the industries would make their contribution and discharge their liabilities in relation to carrying on of the proposed activity and up-gradation of plants for better control and prevention of pollution of river Ganga.

168. Once the jurisdiction of the Tribunal has been invoked in a

case involving substantial question relating to environment, the Tribunal is obliged to apply the three principles described in Section 20 of the NGT Act, 2010 while deciding the case under the Act. Sustainable development is the guiding principle but it has an inbuilt element of Precautionary Principle. Industrial or any other development should progress but with due care for Precautionary Principle.

169. A development in absence of precaution would fall beyond the known parameters of sustainable development. Industries have a Right to carry on their business in terms of Article 19(1)(g) of the Constitution of India which is subject to restriction imposed by law. Article 21 of the Constitution which guarantees Right to decent and clean environment as a fundamental right is free of any such limitation. The Constitutional obligation upon the State and the citizens to protect the environment and ecology, and the rivers clearly implies that Right to carry on business should be subjected to reasonable restrictions, which would be in the large public and environmental interest. The environment thus, must take precedent over the restricted Right to carry on business. An industry cannot be permitted to contend that it has a Right to carry on business and by necessary implications right to pollute. The Constitution imposes an obligation that it must protect the environment while carrying on any industrial

activity to ensure that it causes no pollution. It necessarily must comply with all the environmental laws in force. The Right to carry on business is subject to obtaining Consent to Operate from the concerned Board to discharge its effluents within the prescribed limits, while ensuring that it has taken all precautionary and preventive measures thereto. The provisions of NGT Act, 2010 enumerate the application of Principle of Strict Liability. In other words, the onus is upon the industry to prove that it is not causing any pollution and it has taken all precautionary and preventive measures on that behalf. The application of Strict Liability by the Statute itself places the duties and obligation of person carrying on an activity, which may result in pollution at a much higher pedestal. Such pedestal is not a social concept but is a constitutional and statutory obligation. In case of default in discharge of such duties/obligations, the business or industry can be subjected to the order of closure and the liability to pay for such pollution is inseparable and based on Polluter Pays Principle. Within this framework of law, we have to examine the present case. In fact, it is undisputable and unquestionable that these industries are causing severe pollution of river Ganga and its tributaries. Industrial development cannot be taken as cause of deprivation of either Right to business or Right to clean environment.

170. Large population of the country is dependent upon river

Ganga and its tributaries for its livelihood and drinking water. The industries which are carrying on its business have to take all precautions and preventions to ensure that they cause no pollution. They should operate with the consent of the Board and release trade effluents which are strictly within the prescribed limits. The violations are admitted. Partial failure of the Regulatory Regime by the Statutory Authority and Boards is undisputed.

The pollution by tannery industries, particularly, in this segment has been a matter of serious concern not only for the stakeholders but even for the judiciary. As already noticed, the public interest litigation was filed by M.C. Mehta (supra) to prevent discharge of trade effluent by these industries into river Ganga. At this stage, there were only 70 tanneries which increase to 80 in 1988, out of which in terms of the order of the Supreme Court dated 22nd September, 1987 titled *'M.C. Mehta vs. Union of India'* 1987 4 SCC 463, the Supreme Court noticed that no effective and preventive steps have been taken by the authorities and the tanneries at Jajmau, Kanpur cannot be allowed to continue to carry on industrial activity unless they take steps to set up functional Primary Effluent Treatment Plant. The pollution caused by them was affecting the life, public health and ecology which has priority over unemployment and loss of revenue. The Supreme Court of India resultantly, directed that 29

tanneries specified in the order itself, which had failed to install anti-pollution devices and were causing pollution should not be allowed to continue to carry on industrial activity and were ordered to be shut down.

Despite the above order of the Supreme Court of India, as of present, there has been a tremendous increase in the tannery units which is stated to be 402 and the extent of discharge of industrial effluent has increased manifolds. The industrial effluent carries pollutants much beyond the prescribed limits and the units have failed to install functional Primary Effluent Treatment Plant. This status continued and even by a very recent order dated 22nd February, 2017, the Supreme Court of India in the case of '*Paryavaran Sanrakshan Samiti vs. Union of India*' (supra) while transferring the cases to this Tribunal directed that the industries which have not installed anti-pollution device, i.e., Primary Effluent Treatment Plant and are not connected to CETPs, should not be permitted to carry on their industrial activities.

171. Significantly, the Tribunal has to take notice of the order passed by the High Court of Allahabad in the Public Interest Litigation No. 4003 of 2006 *Re Ganga Pollution* dated 26th March, 2010 wherein it had directed shifting of tannery industries to the land which is to be acquired under the scheme named as 'Banthar (Unnao Extension)'. The UPSIDC had even published advertisement for

registration of the applicants to which there was poor response.

The Court was not impressed with the submission raised on behalf of the Government that the acquisition should be on self-finance basis. The Court held that shifting of tannery industries is not an acquisition for a company so as to compel the tanneries to bear entire compensation. It further passed certain directions in relation to the manner and methodology for such shifting. The said directions obviously remain un implemented in their entirety till date. The State had even contended at a subsequent stage before the High Court that compliance of the directions may not be possible. Such submission came to be rejected.

172. In any case, increase in industrial units and their income on the one hand and increase in the pollution of river Ganga and its tributaries on the other also remains unchallenged. Industries have not fairly shared their responsibility in terms of finances and enforcement of prescribed standards during this period. The data and report show flagrant violation of the prescribed norms. Thus, the liability to pay on the basis of Polluter Pays Principle does not admit any argument to the contrary. All the stakeholders including the industries must discharge their constitutional, statutory, social and moral obligations in accordance with the law. Thus, the Tribunal has to find solution that would be in consonance with the three above

stated principles. The mechanism so devised by the Tribunal may provide the opportunity to the industries to carry on their industrial activity but subject to strict compliance of the prescribed standards and Consent to Operate orders. If they fail to do so, the only alternative would be to shut down the industries at the existing site and they shall be ordered to be shifted to another appropriate site, which is fully developed and has the capacity to treat the effluents generated by such tannery industries. In no event, they should be permitted to cause any pollution of environment, water bodies or for that matter the groundwater. The mechanism would include construction of new STPs/CETPs and/or up-gradation of existing CETPs/STPs, setting up of the pipeline, construction of other anti pollution devices and installation of all other incidental requirements thereto, in a time bound manner. The industry should fully co-operate and discharge its responsibility in all respects including financial liability.

173. Therefore, we must state with clarity the outline of the project that must be carried out at Jajmau, Unnao and Banthar:

1. The CETP which is stated to be operational at Jajmau presently has the capacity of treating 9 MLD of tannery effluent and 27 MLD of sewage. It is based on UASB technology followed by aerobic

post-treatment managed by UPJN. This CETP is incapable of treating metals, particularly, it cannot recover chromium. It receives 9 MLD of trade effluent mixed with 27 MLD of domestic sewage while around 60% of it is directly discharged into river Ganga. It is deficient in a number of ways and does not meet the prescribed parameters, much less the proposed parameters.

This CETP requires upgradation and setting up of other anti-pollution devices which we shall state in some elaboration hereinafter.

2. The existing Chromium Recovery Plant was again found to be deficient in various respects. Firstly, the tanneries from the Jajamau complex were not collecting and sending chromium contained effluent to the plant. Secondly, the Chromium Recovery Plant was not designed and installed appropriately. The Chromium Recovery Plant which is undisputedly under-utilized, cannot be operated and maintained properly and efficiently. It indicated improper segregation, collection and transportation of spent chrome liquor from the tanneries. Nearly 30 to 32 metric tonnes per day sludge is generated and is temporarily stored at CETP at Kanpur site. Thus, it is directed that the Chromium Recovery Plant shall be upgraded to

ensure effective and proper supervision of the plant. The operating agency/public authority concerned shall ensure that the Chromium Recovery Plant operates and is maintained efficiently and does not at any stage release the effluent that would contain chromium in excess of the prescribed parameters. In fact, the content of the chromium in the discharged effluent should be much below the prescribed limit, which can be safely taken care of by dilution process.

All the tannery industries at Jajmau and even at Banthar and Unnao shall be duty bound to ensure transportation of the spent chrome liquor from their premises to the plant through tankers, which are being operated by the authorised agencies as of today. The tankers used for appropriate transportation of the spent chrome liquor shall be fitted with GPS to maintain due record of transportation of the effluent.

The public authority concerned, that is, the UPJN shall issue duly endorsed booklets containing three counterfoils which will be titled as 'Industry'. Upon signature of the concerned officials, one copy shall be retained by the plant while the other by the transporter and the third copy would be retained by the local authorities, i.e., officials of

the UPJN/the Association identified for operation and maintenance of the plant. This would be signed by the industry at the time of collection and by the officials of the plant at the time of receiving the spent chrome liquor.

The chromium recovered from each unit shall be processed and recovered at the Common Chromium Recovery Plant. Recovered chromium shall be provided to the industry at a no profit no loss basis. The remnant recovered chromium shall be sold in the open market and funds so received shall be utilised for efficient operation and maintenance of the plant.

It shall be ensured that the remnant effluent discharged from the plant is appropriately subjected to dilution by treated sewage, before it meets river Ganga or any of its tributaries.

The sludge generated from the plant shall be stored and transported regularly to the fully developed sites presently at Kanpur maintained by Ramkay. It shall be ensured that the sludge and other hazardous waste collected from the plant should be maintained strictly in accordance with the Hazardous Waste Management Rules, 2016.

3. Compliance of these directions shall be paramount duty of the industries, the Association and the

public authority responsible for operating and maintaining the plant and the agency appointed for transportation of the spent chrome liquor. In default, each or all of them would be liable to pay environmental compensation. The environmental compensation for such breach and default would be ₹ 50,000/- for each default on the part of the agency responsible for transportation and the Association and Public Authority responsible for operation and maintenance of the plant. Besides the above, in case of offences relating to discharge of chrome by an industry, which is processing more than 30 and less than 100 hides per day, they would be liable to pay environmental compensation of ₹ 25,000/- per breach; industry entitled to process more than 100 hides per day, would be liable to pay environmental compensation of ₹ 50,000/- per breach and the industry processing 100 and above hides per day, ₹ 1,00,000/- per breach. This environmental compensation shall be payable instantaneously, on default found either by the concerned public authority i.e. UPJN and/or UPPCB and/or any Member of the Committee constituted by the Tribunal under this judgement.

4. All the industries shall operate their units strictly

and limited to the hides that have been sanctioned in the order of consent to operate.

5. It is commonly and without exception agreed that as of present there is a dedicated pipeline network in existence that takes the industrial effluent to the existing CETP at Jajmau. It is also agreed that there is a dedicated sewage network in operation that takes the sewage of the industrial clusters as well as surrounding areas to the STPs located at Jajmau itself.

It is on record that the CETP suffers from technical deficiencies and as of present is non-performing. As already stated, the CETP is even discharging 60% of the effluent directly into river Ganga which is completely untreated. Thus, we direct that the CETP at Jajmau shall be upgraded in terms of the capacity and quality. The CETP should have physio-chemical treatment before primary treatment, biological treatment and tertiary treatment (R.O. System). All these three treatments should be installed to upgrade the CETP at the earliest. The treated effluents being discharged from the CETP should be subjected to dilution by the treated sewage received from the STPs in Jajmau itself. Such diluted effluent discharged from the CETP should be recycled,

reused for industrial units at Jajmau, agriculture or horticulture activity in that area or nearby areas and for cooling purpose of the power plants located in close vicinity. The remnant treated effluent should be released into the river but not in excess of 25% of the total discharge.

6. The tannery industries should be encouraged to adopt the methodology for processing of hides as per the Central Leather Research Institute, Chennai. The pinpoints are as follows:

   - *Alternative methods of preservation of hides/ skins nd processing of green hides.*
   - *Desalting of hides and skins and collection of salt for disposal or reuse.*
   - *Use of enzymes in soaking process.*
   - *Soaking in drums instead of pits*
   - *Green fleshings of hides.*
   - *Cleaner liming options.*
   - *Ammonia-free deliming process.*
   - *Alternative pickling & chrome tanning process.*
   - *High exhaust tanning process.*
   - *Pickle less Chrome tanning process*
   - *Pickle-Basification Free Chrome Tanning.*
   - *Salt Free Chrome Tanning.*
   - *Direct Chrome Liquor Recycling (DCLR).*
   - *Chrome Recovery and Reuse.*
   - *Cleaner technologies in post tanning and finishing.*

7. All the 402 industries and/or such other numbers which are operational, would be permitted to operate strictly in compliance with the conditions of the Consent to Operate order. Any industry which violates the prescribed parameters, conditions of the Consent to Operate and the directions

contained herein, shall be liable to be shut down by CPCB/UPPCB.

8. The industries would be liable to pay the determined share, by the competent authority, of the expenditure to be incurred on laying down of pipelines and construction/up-gradation of the CETP/ Chromium Recovery Plant on the basis of Polluter Pays Principle. The CETP and the Chromium Recovery Plant shall be operated and maintained by the Association of the Industries under the strict supervision and under the effective control of the UPJN. The UPJN and the Association of Industries would be collectively responsible and liable to be proceeded against, in accordance with law, in the event of default and violations.

9. It is again commonly agreed and undisputed that as of now two STPs of the capacity of 130 MLD and 5 MLD, respectively, are operating in Jajmau. Another STP of the capacity of 43 MLD is under construction. It has already been noticed that the two operational STPs are not working satisfactorily and the parameters are much beyond the prescribed limits. It is in crores as far as coliform is concerned and BOD is also very high. Thus, we direct that the two existing STPs of 130 MLD and 5 MLD respectively shall be subjected to inspection

by the Joint Inspection Team within 4 weeks from today and the recommendations made by the Joint Inspection Team consisting of representatives from MoEF&CC, NMCG, CPCB, UPPCB, UPJN and Professor in the required specialty from IIT Roorkee. They shall make due recommendations for proper operation and maintenance of the plant and to ensure that these violating values are brought within the prescribed norms. The recommendations made shall be implemented by UPJN and NMCG without any further delay or default. This must be executed with utmost priority and expeditiousness.

As far as the STP of 43 MLD under construction is concerned, we direct that the said STP shall be constructed and completed to ensure that it meets the prescribed values, particularly, in relation to BOD, Faecal coliform and all other parameters. It should achieve value of BOD at 10 mg/l and 230 MPN/100 ml of coliform, as directed by CPCB and MoEF&CC.

The discharge from the STP should firstly be used for dilution of the trade effluent from the CETP and the remnant should be reused for agriculture, horticulture and industrial cooling of power plants etc., not in excess of 25% of the total discharge that should be released into river Ganga.

10. The CETPs at Unnao and Banthar, Kanpur are stated to be in operation. Unnao CETP is being operated with the activated sludge process technology. The analysis report shows quality of treated effluents at the outlet exceeding notified standards. It shows high concentration, particularly, of TSS, total coliform and chromium, which adversely affects the biological treatment system, it being toxic. The CETP at Banthar was found not complying. It was violative of the prescribed parameters and was found not efficiently working and causing adverse impacts. Both these CETPs need to be upgraded in terms of capacity and quality of treatment. We direct upgradation of these CETPs on the basis of the reports submitted to the Tribunal and which should be reconfirmed while submitting the final project report to the Tribunal for implementation.

    Both these CETPs shall also be subjected to inspection by the Joint Inspection Team within 4 weeks from the date of passing of this judgement. Their recommendations should be implemented with utmost priority and expeditiousness.

11. The conveyor belt/drains carrying the effluents from the industrial clusters should be dredged and cleaned. Immediate steps should be taken in

that direction by the concerned authorities primarily by UPJN and Kanpur Nagar Nigam collectively.

12. The industries at Unnao and Banthar shall be liable to pay and share the financial responsibility for properly preparing the pipeline/conveyor belt, construction/ upgradation of the CETPs, as per the share determined by the competent authority on the basis of Polluter Pays Principle.

13. A direction is issued to the State of UP, UPJN, UP Nagar Nigam and UPSIDC with due consultation with Director NMCG and CPCB to submit a complete project report in furtherance to these directions giving time bound programme for completion of the project in terms of these directions within a period of six weeks from today. The report shall be submitted within six weeks and the work in furtherance to such project report and in consonance with this judgement should start within four months from the date of pronouncement of this judgement and the projects completed and made operational in all respects without exception within two weeks from the date of pronouncement of this judgement.

14. In the event, the above direction is not carried out in its true spirit and substance and report placed

before the Tribunal within the stipulated time, then all the tannery industries at Jajmau, Unnao and Banthar shall be directed to be shut down and would be shifted to a new industrial site which is fully developed having provisions for CETP and Chromium Recovery Plant.

Keeping in view the directions of the Supreme Court and the judgement of the Allahabad High Court as referred above, we direct that the State of UP alongwith the Association of the Industries, who shall submit the project action plan as afore directed within 6 weeks from the date of passing of this judgement, failing which, it shall take steps for shifting of the tannery industrial complex from Jajmau to the identified site at 'Banthar (Unnao Extension)' or any other land identified by the State within that period.

15. Having passed generic directions in relation to the tannery industries located at Jajmau, Banthar and Unnao, we also need to deal with the three drains, namely, Sheetlabazar Drain, Budhiyaghat Drain and Wazidpur Drain as discussed in para 92 at page no. 217 of the judgement above and other specific matters peculiar to the tannery industries located at Jajmau. Thus, in addition to the above, we pass the following directions in

relation to industrial cluster at Jajmau:

I. All the tannery industries shall abide by all the directions afore-stated.

II. The two dedicated pipelines for carrying sewage and trade effluent shall be cleaned, silt and sludge removed and shall be maintained in future directly so that there is no obstruction to the flow of the effluent/sewage and there is no overflow coming from the interception/points, where pumps have been constructed to the above three drains. Once the pipelines operate efficiently and the CETP and STPs operate to their optimum capacity as afore directed, the three above-stated drains would carry no effluent or sewage and they would be restored to their original status of being storm water/natural drains.

III. It will be ensured that the sewage from Jajmau industrial complex as well as surrounding areas is carried through the dedicated pipeline to either of the STPs located at Jajmau itself. Similarly, the trade effluent is carried to the CETP at Jajmau. The entire network of sewer line and drain should be kept free of

obstruction, sludge or silt.

IV. Due record shall be maintained for collection, transportation and treatment of the spent chrome liquor at Jajmau.

V. Each tannery industry shall maintain a tank of an appropriate size in their premises in which the spent chrome liquor is stored, till it is transported as directed. It should be ensured that the tank does not have any leachate affecting groundwater in that area.

VI. In any of the above events, if the unit is found to be defaulting and/or discharging chromium contained effluent into drain or conveyor belt or in any form and causing pollution, the unit shall be liable to be closed and shutdown with immediate effect.

VII. Resultantly, the three drains would be converted and maintained as natural storm water drains and they shall be cleaned, silt and sludge removed without any further delay.

VIII. All the drains would be fixed with 'screen traps' at the end of the pipeline to ensure that no waste of any type enters the river.

IX. All the concerned stakeholders including the public authorities would ensure that no trade effluent/sewage or municipal sludge waste is permitted to be discharged or dumped in any of these three drains and they should maintain their natural character.

16. The administrative regime/body shall be primarily of the association of industry itself, supervised by UPJN and the UPPCB.

17. The charges for collection and transportation of the remnant chromium effluent or the entire spent chrome liquor shall be fixed by the above mentioned administrative regulatory body, which will be payable every month in advance but such payment will not absolve the responsibility of the unit for actual transportation of the effluent to the Chromium Recovery Plant and the same should be applicable to CETP as well.

18. It is directed that where the effluent discharge standards have been fixed, keeping in view the dilution ratio of 1:10, then it must be ensured that the recipient water body carries that capacity. In the event it falls short of 10 times dilution then the standards of discharge of effluent should be accordingly revised and fixed by the Board on case-

to-case basis, while granting consent to the industries.

FINANCIAL REQUIREMENT AND DIMENSIONS OF THE PROJECT

174. The project of cleaning and rejuvenation of segment B of phase I of river Ganga and its tributaries as stated in this judgement is not likely to incur any financial blockage or impediment. The Tribunal had already held that there exists a triangular responsibility for providing decent and clean environment specifically in relation to prevention and control of pollution of river Ganga and its rejuvenation. This responsibility and obligation co-exists with the exercise of Right to decent and clean environment. It is not an exclusive responsibility of the Central Government but needs to be shared collectively by the State Government and the class of Industries or persons responsible for generating pollution. All these three stakeholders, i.e., Central Government and State Government and its instrumentalities, the industries are responsible for causing of such pollution and even the public at large which generates heavy quantity of sewage, adds to the excessive pollution of river Ganga and its tributaries. The financial liability is expected to be shared in the defined proportion by these stakeholders.

175. The Prime Minister of the Country in 2015 declared river Ganga and its cleaning and rejuvenation as a National

Project. The allocation was coupled with providing of financial budget of ₹ 20,000 crores for a period of 5 years i.e. 2015-2020. This amount had to be spread over for a period of 5 years. For the financial year 2015-16, ₹ 2750 crores had been allocated which includes ₹ 100 crores for Ghat work. There could not have been a greater financial commitment for the cause of environment and bringing back the pristine nature of the holy river Ganga. The funds committed for cleaning of river Ganga since 2011-12 to 2016-17 as declared by National Mission for Clean Ganga are stated to be as follows:

National Mission for Clean Ganga Funds allocated and spent so far on cleaning of Gang since inception till 15.09.2016 Rs. In crore

FY	BE	RE	Actual Expenditure by Govt. of India
2011-12	500.00	216.61	192.58
2012-13	512.50	193.50	191.52
2013-14	355.00	309.00	303.95
2014-15	2,137.00	2,053.00	326.00
2015-16	2,750.00	1,650.00	1,632.00
2016-17	2,500.00	-	315.00
Total	8,754.50	4,422.11	2,961.05

If one examines the above figures, the budgeted estimate for 2013-14 to 2015-16 was ₹ 5242 crores and the revised estimate for the same period was stated to be ₹ 4,012 crores. Even the revised estimates have not been actually spent and considerable amount remains unspent for each financial year as well as on the whole. The Government of

India has formulated the schemes under NMCG and the comprehensive approach to rejuvenate the river Ganga by inclusion of tributaries under an umbrella, which was the basic programme of Namami Gange as approved by the Cabinet on 13th May, 2015. The programme envisages 100% Central Government funding, however, the expenditure shown for the year 2015-16 (till July, 2015) was only ₹ 85.34 crores in relation to cleaning of river Ganga for the year 2014-15 expenditure, stated to be ₹ 326 crores. Besides this, the Government has also established a Clean Ganga Fund for harnessing the enthusiasm of those who are concerned about the rejuvenation of river Ganga. The total contribution received till 15th July, 2015 is ₹ 64.57 crores which includes funds received from Indian residents, Non-resident Indians, corporate both public and private sectors including PSUs (as stated on the floor of Rajya Sabha on 3rd August, 2015).

176. The NMCG had also submitted a note before the Tribunal on 26th July, 2016 on the guidelines of mode of funding of Hybrid Annuity Mode and PPP base under Namami Gange Scheme. It was stated that the policy decision has been taken on 6th January, 2016, inter alia to introduce Hybrid Annuity based PP funding model for the projects under this scheme. The Annuity Mode funding aims to reform the Wastewater Management Sector in the Country to ensure performance, efficiency, viability and sustainability.

In terms of this mode out of all the funding, a part of the capital invested, i.e., 40% will be paid by the MoEF&CC through construction linked milestones and the balance from annuity over contract operation upto 25%. The Executive Director, NMCG submitted that this was taken in view of the lesson learned from the implementation of Ganga Action Plan-I and Ganga Action Plan-II. In the proposed Hybrid Annuity Mode, 40% capital cost will be given to the contractor/operator on completion of STP and balance 60% of the capital cost will be paid on annuity mode for a period of 20 to 50 years, along with operation and maintenance cost based on satisfactory performance. The State Agencies will have an important role in DPR tendering work and execution of the project, though the final approval to the project will be given by NMCG as per the notified scheme. The local bodies and agencies are the partner agencies in the entire planning and execution of the project and NMCG as on today envisage handholding with these agencies for a period of 15 to 20 years. Thereafter, the State Agencies will be able to take over these projects. The above financial data clearly demonstrate that funding for the project is nowhere scarce, on the contrary more than ample funds are available for execution of the work under the project outlined in this judgement. While NMCG should be primarily responsible for cleaning and rejuvenating river Ganga and its

tributaries as per this judgement and must sanction and get work executed as enunciated in this judgement.

177. The prime object of this judgement is to ensure cleaning and rejuvenation of river Ganga and its tributaries and not cleaning the cities *per se.* While NMCG would grant priority only to the projects covered, under this judgement in Segment- B of phase I through State Governments, the State Governments would simultaneously take up the decentralised projects within the city to further clean sewage, drains and ensure free flow of sewage and effluents. We have already noticed that in terms of the notification issued by the Government, the primary responsibility of NMCG is to clean river Ganga and its tributaries. It is incidental to various other functions of NMCG to deal with the drains of the city, by providing centralised or decentralised STPs/CETPs and improving sewage system, etc. Thus in discharge of its fundamental functions, the NMCG should meet its financial responsibility for completing the mega project of cleaning of river Ganga without default and delay.

178. While the Central Government and the State Government have to discharge their responsibility and financial commitments, the industries causing pollution are equally liable for their share of financial responsibility for the defined portion on the basis of 'Polluter Pays Principle'. On facts of the present case, there is no escape from such

liability qua the tannery and other industries. What supports adopting of such an approach is that, for all this period, the industries have failed to perform their obligation of ensuring discharging of trade effluent from their premises strictly in accordance with the prescribed norms. Other major failure is lack of proper regulatory, monitoring and supervisory control by the authorities vested with the power under the different environmental laws. There is hardly any compliance of the law as well as the conditions of the Consent to Operate order. The cumulative effect of this is constantly increasing pollution of river Ganga and its tributaries. The industries have failed to establish ETPs and install/construct Chromium Recovery Plants and discharging effluent within the prescribed parameters. Of course, an array of reasons have been advanced on behalf of various stakeholders for such non-performance which are unacceptable by the Tribunal. Non-fulfillment and non-performance of obligations was evidently for earning economic benefits at the cost of environment.

There is unequivocal responsibility upon the industry, now atleast, to pay for pollution that they have caused over the years and even presently causing. The industry must contribute in the cost that would be incurred for installation of CETPs/STPs, providing of sewer line network and for installation of required anti-pollution

devices for prevention and control of pollution of river Ganga and its tributaries. The Central Government and the State Government constitutionally, statutorily and in terms of the Notification issued by NMCG are duty bound to clean and rejuvenate river Ganga and its tributaries. The State Government and its instrumentalities are to provide Public health and sanitation; hospitals and dispensaries (Entry 6 List II). Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power in terms of Entry 17 of List-II which is subject to Entry 56 of List-I. Entry 56 List-I provides for Regulation and development of Inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by the Parliament by law to be expedient in the public interest. Furthermore, in view of the Right to decent and clean environment being a fundamental right, the stakeholders and the industries are liable to bear the cost for effective exercise of this right. The industry has to contribute on the basis of 'Polluter Pays Principle' and in fact even the public at large is expected to contribute for the huge quantity of sewage and other domestic effluent that is put into river Ganga and its tributaries.

179. Having determined the financial liability of the respective stakeholders, now, we may examine the availability of funds for execution of the projects contemplated under this

judgement. In this regard, it would suffice to refer to the order of the Tribunal dated 7th July, 2017 which reads as under:

> "Today is the 5th hearing before this Tribunal when the Central Government, State Government, Uttar Pradesh Jal Nigam and all concerned departments had been directed to furnish the expenditure incurred upon cleaning of river Ganga particularly in Segment-B of Phase-I. The figures that have been furnished even on this 5th day of hearing suffer from patent inaccuracy and deficiencies.
>
> Be that as it may, the Tribunal has to proceed further with the matter rather than keep on adjourning the case just for providing of this information, which we notice with great regret.
>
> The officers are present and they have furnished some statements of expenditure to the Tribunal in relation to State of Uttar Pradesh and by the Central Government on the expenditure incurred for the entire stretch of river Ganga. According to the statement furnished, duly signed by the Ministry of Water Resources, the total expenditure prior to constitution of National Mission for Clean Ganga in Gap-I and Gap-II and even thereafter is stated to be as follows:
>
> 1. Actual amount released by Government of India is ₹ 6788.78 crores.
> 2. The amount actually released for expenditure is ₹4864.48. Thus leading to the unspent balance as on 30th June, 2017 is ₹ 1924.30 crores.
>
> According to Ministry of Environment, Forest and Climate Change, there is a little variation in the amount released and spend under Gap-I. According to them the original sanction for Gap-I

was ₹ 256.26 crores which upon revision increased to ₹ 462.04 crores. Out of this only a sum of ₹ 451.70 crores was released out of which ₹ 433.30 crores was spent, leaving balance of ₹ 28.74 crores.

Besides the above amount, the State of Uttar Pradesh has as on March, 2017 spent a sum of ₹ 1827.07 crores in the State of Uttar Pradesh for cleaning of River Ganga and its tributaries. This includes a sum of ₹ 164.69 actually spent on standalone projects of State of Uttar Pradesh, while the remnant of ₹ 1662.38 crores is State contribution towards the Central schemes. Unutilised amount of both these accounts is ₹ 171.09 crores. The amount spent by the State of Uttar Pradesh is primarily through Uttar Pradesh Jal Nigam. There might be certain more amounts spent by the State of Uttar Pradesh directly through local authorities etc. in relation to cleaning of river Ganga. On the basis of above statements which have been reaffirmed before the Tribunal by the stakeholders, as of today ₹ 2095.39 crores is un-utilised amount available with the Centre and the State, for rejuvenation and cleaning of river Ganga and its tributaries. It is commonly conceded before us that these amounts do not lapse as they are already earmarked particularly for expenditure which is a continuing expenditure. It may be noticed here that only in the year 2015-16, the Uttar Pradesh Jal Nigam has spent ₹ 95.96 crores on Segment-B of Phase-I alone, obviously without any improvement in the water quality of river Ganga. In the year 2016-17 they have already ₹ 83.83 crores.

The above financial statement clearly shows that more than enough funds are available for execution of the projects. There are considerable unutilised funds as of

today, besides the huge funds that have been made available under the national project as declared by the Hon'ble Prime Minister wherein ₹ 20,000/- crores have been allocated for the five years commencing from 2015-2020. Even after spending ₹ 7304.64 crores upto March, 2017, by the Central Government, State Government and local authorities of the State of UP, the status of river Ganga has not improved in terms of quality or otherwise and it continues to be a serious environmental issue. The NMCG is the Nodal Agency for overseeing the execution of the project and to provide requisite funds for completion of the projects in appropriate, effective and expeditious manner.

DISCUSSION ON: WAY AHEAD-A NEW PERSPECTIVE

180. Having deliberated upon different aspects of pollution in relation to river Ganga, its tributaries and cleaning and rejuvenation of river Ganga, we may now advert to the discussion on a crucial aspect of this judgement, which relates to the necessity for adopting a new perspective of planning and execution of the projects for better prevention and control of pollution and rejuvenation of river Ganga and its tributaries as directed under various heads of this judgement. In the considered view of this Tribunal, it was found essential to avoid the conventional approach that had been adopted by the stakeholders so far for variety of reasons. The results of the projects

undertaken *vide* different schemes did not provide desired results, on the contrary, there has been tremendous increase in the pollution levels adversely effecting the water quality of the river Ganga and its tributaries. For instance, the discharge flow of river Ganga from sewage is 2683.6 MLD and from the industrial effluent it is 285.9 MLD in 2009. While as per the report of the CPCB in the year 2012 it was reported to be 6966.3 MLD from sewage and 501 MLD from industrial effluent. Out of which in segment B the total wastewater meeting river Ganga through drains is 2775 MLD and correspondingly the BOD load being 229.61 TPD. Besides this, 225 MLD of wastewater is generated by the industries. The experiences of the past where different schemes were formulated, heavy expenditure (₹ 2961.05 Crores) was incurred, however, the results produced were not only unsatisfactory but counterproductive to the extent that there had been serious increase in the levels of the pollution of the rivers. This compelled the Tribunal for not adopting existing practices for planning and execution of the projects and to look for a new beginning or way ahead with new perspective, which is technically feasible, economically viable, and practically executable with tested modern technology, appropriate technical inputs from the stakeholders, expert institutions as to performance and planning, free from fundamental errors. All this was

initiated through stakeholders, special constituted high-powered committees, experts from different institutions including IITs and finally through the stakeholders consultative process in adjudication by holding chamber meetings. Once these basic parameters were satisfied, a draft action plan had been put before the stakeholders and all concerned parties including industries for better execution and acceptance. The stakeholders and all concerned gave their inputs and significant issues of the action plan and project which were unanimously accepted, by the representatives from MoEF&CC, MoWR, NMCG, CPCB, UPPCB, UPJN, UPPJN, Kanpur Nagar Nigam and the State of UP and the Tribunal further proceeded to examine the merit or otherwise of the proposals and suggestions. After a critical examination of various aspects in this behalf, the Tribunal which itself has an expert panel, reserved the matter for pronouncement. The judgement contains all essential features and a complete project which needs to be executed for achieving common object of cleaning and rejuvenation of river Ganga and its tributaries in a time bound manner. The judgement caters to all the necessary ingredients required for data collection, planning and execution of the project of such magnitude. The Tribunal has taken due care to frame the judgement to be inclusive of most of the projects that have already been planned by the stakeholders or are under partial

execution. Such approach would help not only in saving the public funds but would ensure proper utilization thereof. It remains undisputed before the Tribunal that no part of river Ganga and its tributaries is free of pollution as of today. This by itself is a sufficient indicator that the stakeholders must adopt an innovative approach quite different to the orthodoxical and uncertain approach. There has to be proper planning, better execution, higher accountability and ensuring objective performance of the project. Unless these factors are inbuilt in the project, its success would always be doubtful and that is the precise reason that the Tribunal has dealt with each drain separately which confluences river Ganga and pollutes it, with certain definite solutions. It must be ensured that sewage/effluent from each drain is recycled and only remnant is permitted to join river Ganga and its tributaries when it is well within the prescribed parameters.

181. In order to avoid repetition and to bring out the reasons with greater precision, we would mention the following points that would substantiate the adoption of a new approach or perspective that the Tribunal had adopted:

a. Undisputedly and as discussed in detail in the judgement above, it is established on record that GAP I and GAP II has failed to yield the required results and on the contrary there has been tremendous increase in the industrial and sewage

pollution load in river Ganga and its tributaries.

b. Lack of collection of appropriate and definite data by the local authorities and the stakeholders which creates a sustainable question as to the very preparation of the DPRs.

c. Quantum and qualitative analysis in relation to the various drains was not only lacking but was absent.

d. Performance of most of the STPs or CEPTs was found to be poor and they could not even treat the basic pollutants and metals. It is a known fact and for years in the past that TC and FC are the highest pollutants of river Ganga and its tributaries. None of the plants are capable of treating these pollutants and no other mechanism had been provided to remove this highest contaminating pollutant. The industrial effluent which were acidic and contain metals could not be removed from the effluent, before the same is permitted to join river Ganga and its tributaries. The Hon'ble Supreme Court of India in the case of *Paryavaran Suraksha Samiti & Anr. v. Union of India & Ors.*, WP(C) No. 375 of 2012, pronounced on 22nd February, 2017, enunciated on the setting up of functional CETP and PETPs in order to continue with industrial activities and upheld that no industry which requires Consent to Operate from the concerned

Pollution Control Board shall be permitted to function unless it has a functional ETP which is capable to meet the prescribed norms.

e. Lack of coordination and cooperation between various Central and State Agencies caused hindrances in achieving the object of cleaning river Ganga and its tributaries. There was no clear demarcation of responsibilities and performance between various stakeholders which resulted in conflict not only in decision or policymaking but even in the execution.

f. Lack of supervisory and regulatory regime, particularly in relation to providing pollution treatment at source.

g. The segment approach was found to be more appropriate as to treatment of pollutants with reference to 'hot spot' approach. The segment approach was not only approved by the stakeholders but even by the High Powered Committee consisting of various senior officers from the Ministries, experts from the IITs and even by the special experts that are invited by the Tribunal at the request of MoWR.

h. River basin approach was supported by all the stakeholders. This approach needs to be adopted to ensure the wholesomeness of the river by taking

appropriate control and mitigation measures in respect of the identified sources of pollution.

i. Waste volume reduction and waste strength reduction were well accepted principles of wastewater treatment, design and planning have been incorporated in the new approach. Reliance has been placed upon the efficacy, economy and consistency of waste management methodologies.

j. End of the pipeline treatment, which is a more practical and scientifically implementable approach, has been adopted in preference to decentralized treatment plants all over the city. The geography of the drains, the drainage hydrological aspects, quantum and quality of the pollutants and load of the effluent in the drains has been formed as the very basis for arriving at appropriate decisions.

The end of pipeline treatment has not been adopted as a rule. Wherever the situation has demanded, decentralized construction of CETP/STP or laying of pipeline has been permitted. It is primarily for the reason that the internal drainage system of the city is not available much less with exactitude. There are large number of unauthorized and illegal colonies and jhuggi clusters, which have no drainage system and it, would require much longer duration to implement regular drainage, sewer line

projects of such areas. Furthermore, there are even planned and developed areas, which do not have sewer line or drainage systems. Thus, it may not be incorrect to observe that the projects confined to cleaning the cities internally within the municipal limits are no solution to the problem of severe pollution at hand.

k. The failure on the part of the industries to perform their obligations of discharging only those effluents, which are within prescribed parameters. Thus, the liabilities of the industries to bear consequences of their default and causing damage to the environment must follow practical approach including most of the works planned or under execution by different stakeholders but taking due care of public funds as well as environment.

l. The objectives taken by the State Government and its instrumentalities with regard to the planning, execution, maintenance and performance of the project, not being in consonance with the federal structure by the other stakeholders and inconsistency in policy decisions.

FINAL DIRECTIONS AND ORDER OF THE TRIBUNAL

182 Such substantial environmental issues relating to massive pollution of river Ganga and its tributaries are incapable of being resolved by issuance of directions, which are routine

or quotidian in their scope and implementation. Problems of extraordinary dimensions of industrial and sewage pollution would necessarily require stringent and path-breaking directions. Problems of such magnitude need to be resolved by recourse to extraordinary measures and actions. The historical background of this case demonstrably exhibit fundamental errors in planning, adoption of technology and implementation of the projects. Deficiencies in the regulatory and supervisory regimes are writ large from the record of the case. Thus, the directions for compliance that are required to be passed by the Tribunal should serve the purpose of established environmental principles of Sustainable Development and Precautionary Principle. Violators must realize the consequences of their consistent defaults. Causing of continuous pollution must visit them with liability to pay for the pollution caused in the past years and presently. The fundamental object of these directions is to achieve the goal of prevention and control of pollution of river Ganga and its tributaries on the one hand and its cleaning and rejuvenation on the other. The remedial directions and solutions provided herein, would enforce the Principle of Sustainable Development as the industries would be encouraged to carry on their industrial activities but with a clear caution that they would face coercive orders including closure of industry, if required. The government

and public authorities must perform their functions and complete the project in a time bound manner as that is their constitutional, statutory and public law obligation.

In light of the constitutional mandate and the statutory scheme contemplated under Section 20 of the National Green Tribunal Act, 2010, we may examine legal aspect of the environmental issues arising in the present case. Right to decent and clean environment is an integral part of Article 21 of the Constitution of India. By law, the industry is mandated to adhere to the prescribed standards for discharge of trade effluents. The State in discharge of its constitutional obligation is to ensure prevention of contamination of rivers. Protection and improvement of environment is the golden principle underlining the various judgements of the Hon'ble Supreme Court of India. In the case of '*Ashok Kumar Thakur v. Union of India', (2008) 6 SCC 1*, the Hon'ble Supreme Court of India repelled the plea of the State that lack of availability of finances could be a defence for not taking effective steps for providing clean environment. It is to be noted that financial constraint cannot be a ground to deny fundamental rights and the provision for the schemes and the utilisation of the funds are also relevant factors. It appears that better coordination between the funds provider and the utiliser is necessary.

The constitutional duty upon the citizens is to protect and

improve the nature, environment including forests, rivers, wildlife and to have compassion for living creatures. No industry much less the State or its instrumentality can be permitted to indulge in pollution of natural resources particularly the river for economic benefits. It is a settled principle of law that the Polluter Pays Principle and Precautionary Principle have to be read into the Principle of Sustainable Development. Normally, they are applied collectively. Restrictions imposed are inbuilt fact of sustainable developments and that itself serves the cause of Intergenerational Equity. To protect and improve the environment has a direct nexus to the quality of human life, thus, all environmental principles must come to the aid of the Courts and Tribunals for furthering the cause of Sustainable Development. In the case of *'Vellore Citizens Welfare Forum vs. Union of India' 1996 5 SCC* 647 held with approval:

> "The concept of development to say that the traditional concept that development and ecology are opposed to each other is no longer acceptable. Sustainable Development is the answer i.e., development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. It is intended to improve the quality of human life, while living within the carrying capacity of the supporting ecosystems. The 'Precautionary' Principle and 'Polluter Pays' Principles were, therefore, said to be the essential features of the Principle of Sustainable Development."

The Sustainable Development means that the richness of the earth's bio-diversity would be conserved for future generations by greatly slowing or if possible halting extinctions, habitat and ecosystem destruction, and also by not risking significant alterations of the global environment. The trend of law is that a delicate balance has to be struck between the ecological impact and development. The other principle that has been ingrained and of which the Courts and Tribunals have taken note of is that if a project is beneficial in the larger public interest, inconvenience to smaller number of people is to be accepted, as having interest or interest of a class of persons is smaller to the public interest and must yield to the larger public interest for effective and efficient environmental management, transparent accountable and participatory administration and approach is necessary.

Under our legal system, environmental jurisprudence includes the Public Trust Doctrine and the State is a trustee of all the natural resources. The aesthetic use and the pristine glory of the natural resources, the environment and the ecosystems of our country cannot be permitted to be eroded for private, commercial or any other use unless the courts find it necessary, in good faith, for the public good and in public interest to encroach upon the said resources. Professor Joseph L. Sax in his classic article, "*The Public Trust Doctrine in Natural Resources Law:*

Effective Judicial Intervention" (1970), indicates that the public trust doctrine, of all concepts known to law, constitutes the best practical and philosophical premise and the legal tools for protecting public rights and for protecting and managing resources, ecological values or objects held in trust.

The Polluter Pays Principle is universally accepted as a sound principle and is applied for determining the question of liability of the polluter for causing pollution as well as the cost of the remedial measures. The liability of the polluter is absolute for the harm done to the environment, which extends not only to compensate the victims of pollution but is also aimed to meet the cost of restoring environment and also to remove the sludge and other pollutants as held by the Hon'ble Supreme Court of India in the case of '*Indian Council for Enviro-Legal Action and Ors. vs. Union of India* and Ors.'1996 SCC (3) 212.

The industries that have caused pollution spread over such a long time must be held liable and, therefore, directed to ensure cost of precautionary and restorative measures. The State *ex-facie* has not been able to protect the natural resources despite its duty to do so. The Principle of Intergenerational Equity, Precautionary Principle and the Sustainable Development applied to the facts of the present case demands application of balanced approach and issuance of appropriate directions.

Thus, the directions are widespread and would deal with various aspects while ensuring that no pollutants are permitted to enter river Ganga and its tributaries from any of the drains falling in Segment 'B' of Phase I, that is Haridwar to Unnao, Kanpur. Once the projects in terms of this judgement are completed, preventive, precautionary and remedial steps, as directed, are taken, stretch of 500 kilometres of river Ganga besides its tributaries shall be cleaned and rejuvenated. The stretch of 450 kilometres in the State of Uttarakhand is covered by the judgement of this Tribunal dated 10th December, 2015 in Original Application No. 10 of 2015, while the 500 kilometres stretch falling in Segment-B, Haridwar to Unnao, UP is covered by the present judgement. As already noticed, the total length of river Ganga is 2525 kilometres and total discharge flow is 11374.28 MLD. The discharge flow in Segment A of Phase I is 216.99 MLD and discharge flow in Segment B of Phase I is 2775.19 MLD. In other words, 2992.18 MLD discharge flow of river Ganga in Phase I (Segment A and B) would be remedied by implementation of this judgement. It can be stated that projects completed under this judgement would clean the entire stretch of river Ganga and its tributaries falling in Segment A and B of Phase-I, i.e., Gaumukh to Unnao, UP. This would reduce pollution load by 27% of the entire stretch of river Ganga from Gaumukh to Bay of Bengal that would be the

impact of compliance of cleaning and rejuvenating of river Ganga and its tributaries. Besides cleaning and rejuvenation of river Yamuna in terms of the judgement of the Tribunal dated 13th January, 2015, which is under implementation. It is the constituent of the pollution that gains greater relevancy as opposed to the quantum of the discharge. The discharge in Segment B of Phase I is highly contaminated. The industrial or sewage discharge in this Segment, besides containing metals, pesticides and being acidic also carries effluents, sewage, i.e., highly violative of the prescribed norms, therefore, effluent in each drain must be treated before it meets river Ganga and its tributaries. The Central Government, the State Government and local authorities of the State of UP have spent approximately a sum of Rs. 7304.64 crores upto March 2017 without any effective improvement in the water quality of river Ganga or its tributaries. It is after due deliberations and advice of the experts that the Tribunal has preferred by and large end of pipeline treatment in the peculiar facts and circumstances of the case. The projects directed under the judgement not only bring within its ambit the proposed projects of the stakeholders and the Government with some variations but has even evolved scheme of the projects which is environmentally sound, technically acceptable, economically viable and practical to be implemented. The

directions to be issued by the Tribunal can be divided into two different but interlinked segments, first would relate to directions which are generic in their character and implementation, while the other would be project or plant centric. Hence, the following directions and order:-

GENERAL DIRECTIONS:

182.1 The general directions contained under this head shall apply *mutatis mutandis* to the directions specified under the respective heads of the judgement (supra). In order to provide clarity and for better understanding, we have referred to most of the directions in the operative part of this judgement, to that extent, the directions stated in the body of the judgement and the operative part, may be overlapping or repetitive. Thus, it is necessary that the directions must be read and given effect to conjunctively.

1. We hold and direct that ZLD (Zero Liquid Discharge) and online monitoring system would not be applied by any of the official respondents in the present application to the industrial units across the board. The directions in that behalf shall be on case to case basis particularly with reference to the load of effluent being discharged, quality of effluents, the anti-pollution devices that have been installed or directed to be installed and the resultant pollution caused by such industrial units and

the environmental risk associated with such pollution. This should have reference to the financial viability as well.

2. The State Government, its instrumentalities, Departments and concerned public authorities shall ensure that all the 86 drains specified in the judgement as well as other major drains and sewerage line connecting thereto shall be dredged, cleaned of sludge and waste removed therefrom within a period of six weeks from the date of pronouncement of the judgement.

Similarly, the sludge from the plants i.e. Chromium Recovery Plant and CETP etc. should also be properly collected and transported to the identified site.

The sludge containing the hazardous waste and the waste which even may contain hazardous waste should be collected on regular basis transported and dealt with, to a duly identified site in accordance with Hazardous Waste Management Rules, 2016.

Presently, there is Ramky Hazardous Waste Treatment plant located in Kanpur and it has a area of 18 acres of land out of which 5 acres is being used for dumping of waste/hazardous waste and 13 acres is kept for green belt.

Additional land of 6.88 acres has also been purchased. The landfill site has been approved and consent granted by the UPPCB. The site has also been inspected by CPCB and has been found to be operated and maintained appropriately. Thus, we direct that the site in question should be expanded beyond 5 acres should be constructed, maintained and operated strictly in accordance with rules afore-stated. Around the site, green belt should be maintained.

3. All the directions contained in this judgement and more, particularly, in this part shall be carried out and implemented within the time frame specified under those directions. Wherever the directions relate to submissions of plan of the project/DPR the same shall be submitted to the Tribunal within six weeks from the date of the pronouncement of this judgement. The works identified and directed in this judgement must commence within four months of the order of the Tribunal and construction of STP/CETP or installation of any other anti-pollution devices, laying of pipeline should be completed positively within two years from the date of pronouncement of this

judgement. Every authority, i.e., State Government, NMCG and all other departments of the Government and local authorities shall ensure compliance of this direction without delay and default. In the event any extension of time is required, they shall file an application before the Tribunal for that purpose well in advance.

4. That the Tribunal is of the considered view and hold that the dilution (by way of mixing with sewage) process of CETP should be preferred to the ZLD technology for tannery cluster in the present case. The ZLD technology would generate huge quantity of salt which is required to be treated to convert it into a marketable product. Its storage has already been discussed as a serious issue. There is uncertainty in economic as well as technical field. Opposed to this, the dilution process by sewage would provide a consistent source for reuse and recycle of the treated sewage effluent for agriculture, horticulture, industries and for cooling and other purposes. Thus, it would provide not only a useable benefit but would also have a direct impact on reduction in extraction of groundwater. This, however, we do not state as

a rule but as an approach to the present case, in view of the peculiar facts and circumstances and projects on record and reasons afore recorded.

5. Any Government Agency, Public Authority, Industry or person who violates any of the directions contained in this judgement and more particularly in relation to storage, transportation of spent chrome liquor, dumping of any kind of waste in river Ganga and its tributaries or on the banks of the same and discharges effluents from outlet, including the STP/CETP in violation to the prescribed norms or is found to be discharging spent chrome liquor or any effluent containing chrome or otherwise, shall be liable to pay environmental compensation of Rs. 50,000/- for each breach or default. Besides above, where offence is related to chrome, in case of industry which is processing 30 or less hides per day, they would be liable to pay environmental compensation of Rs. 25,000/- per breach; industry entitled to process more than 30 but less than 100 hides per day, would be liable to pay environmental compensation of Rs. 50,000/- per breach and the industry processing more than 100 hides per day, Rs. 1,00,000/- per breach. The environmental

compensation shall be recovered by the UPPCB on the basis of the violations detected by the Board, any of the inspecting agency or the inspection teams appointed by this Tribunal. In the event of default of payment of the environmental compensation, the industry shall be ordered to be closed.

6. We hereby constitute the following committees to perform the functions directed hereinafter and for reporting the progress to the Tribunal:

(I). Supervisory Committee: following will be the Chairman and Members of this Committee:

A. Secretary, Ministry of Water Resources, Chairman
B. Additional Secretary, MoEF&CC
C. Additional Secretary, Urban Development, State of Uttar Pradesh
D. Chief Secretary, State of Uttar Pradesh
E. Chairman of the Central Pollution Control Board
F. Professor A.K. Gosain, IIT Delhi
G. Professor Vinod Tare, IIT Kanpur
H. Concerned Executive Director of NMCG shall be the Nodal Officer.
I. Dr. A. B. Akolkar, presently Member Secretary, CPCB

This Committee shall oversee and supervise proper and effective implementation of all the projects under this judgement and will ensure providing of funds expeditiously and finally submit the implementation-cum-progress report to the Tribunal every three months. This

Committee shall hold its first meeting within two weeks from the date of pronouncement of this judgement to examine the outline of the action plan. Meeting shall be held alongwith the Members of the Implementation Committee. The Committee will hold its subsequent meetings on regular intervals.

(II).Implementation Committee: following will be the Chairman and Members of this Committee:

A. Secretary, Environment, State of UP, Chairman
B. Secretary, Urban Development, State of UP
C. Concerned Executive Director of NMCG
D. Mr. Sundeep, Director (T-II), NMCG
E. Dr. A. B. Akolkar, presently Member Secretary, CPCB
F. Member Secretary, UPPCB
G. Managing Director, UP Jal Nigam
H. Sr. Most Officer of Kanpur Nagar Nigam
I. Concerned Professors or his Nominees from IIT Roorkee
J. Concerned Director of NMCG shall be the Nodal Officer.
K. Chief Engineer, Department of Irrigation, State of UP

This Committee shall submit to the Tribunal action plan reports for giving details of the projects, the manner and methodology in which those projects should be implemented, including the technology but strictly in consonance with this judgement for commencement and

completion of the projects at site and their effective execution.

7. Till the demarcation of the floodplains and identification of permissible and non-permissible activities by the State Government of this judgement, we direct that 100 meters from the edge of the river would be treated as no development/construction zone in Segment-B of Phase-I (Haridwar to Unnao, Kanpur).

8. There shall be a complete prohibition on disposing of MSW, E-waste or bio-medical waste on the floodplain or into river Ganga or its tributaries falling in Segment B of Phase-I.

9. On the cumulative analysis of the submissions made and as an interim measure, we direct that while diverting the water from Haridwar to the Ganga canal or even otherwise, the minimum E-flow in the main stem does not fall below 20% of the average monthly lean season flow, which will be referable to the status of the river at Haridwar pre-diversion. Also, the extent of diversion of water of river shall be adequately reduced and/or adjusted, in the event the flow falls below 20%. We have already noticed that the water of river canal is being wasted indiscriminately which ultimately joins various

drains in Segment-B which as already directed should be prevented.

10. From the above discussion, on advantages and disadvantages of the ZLD, it is evident that ZLD cannot be adopted across the board. It must have rationality as its sole criteria, should be unit centric and industries specific. The Sugar or Distillery Industries may be of a huge capacity say discharging 100 KL per day. They could be a Sugar Industry or Distillery Unit with 10 KLD discharge and thus a very small-scale unit. To apply the same yardstick to all would not be feasible and result oriented. They should be assessed on their own performance and function, however, ensuring in all the situations that the effluents permitted to be discharged on land/drain, etc. should be strictly adhering to the prescribed norms.

11. Keeping in view the directions of the Supreme Court and the judgement of the Allahabad High Court as referred above, we direct that the State of UP, Implementation Committee under this judgement including the representatives of the Industries Association shall submit the project action plan as afore-directed within six weeks from the date of passing of this judgement,

failing which, the State Government shall be duty bound to close the tannery industry and shift the same from the present location of tannery industrial complex at Jajmau to the identified site at Banthar, Unnao Extension or any other developed site or identified site to be developed in accordance with the Rules by the State, after the expiry of the said period of six weeks.

A direction is issued to the State of UP, UPJN, Kanpur Nagar Nigam and UPSIDC with due consultation with Director NMCG and CPCB to submit a complete project report in furtherance to these directions giving time bound programme for completion of the project in terms of these directions within a period of six weeks from today. The report shall be submitted within six weeks and the work in furtherance to such project report and in consonance with this judgement should start within four months from the date of pronouncement of this judgement and the projects completed and made operational in all respects without exception within two years from the date of pronouncement of this judgement.

12. There shall be no dumping or landfill sites for

any kind of waste irrespective of any technology for waste processing, within 500 meters from the edge of the river Ganga and/or its tributaries.

13. All the action plans under various directions of the Tribunal should be submitted by the Implementation Committee including representative of Industries Association, in relation to different industrial clusters, local authorities and bodies and the State Government, within a period of six weeks from the date of pronouncement of this judgement. The action plan should deal with all sources of pollution of river Ganga, i.e., sewage, industries effluent, municipal solid waste, hazardous waste, bio-medical waste, diversion of water, extraction of groundwater and all other relevant fields.

14. It will be appropriate that while carrying out precautionary dredging of the river, no instream mechanical mining is permitted and even the mining on the flood plain should be semi-mechanical and preferably more manual. Such mining should be permitted only after a detailed and comprehensive assessment of the annual replenishment of sand and gravel in the river

bed and ensuring that the longitudinal and lateral connectivity of the river is not disturbed and that only quantity less or equal to the annual replenishment is permitted to be removed from the river bed or its banks. This is absolutely essential for the health of the river, maintaining of aquifers, ground water flow and protecting the flood plains.

15. All the industrial units falling on the basin/catchment area of river Ganga and its tributaries should not be permitted to indiscriminately extract ground water. Extraction of groundwater should be subject to the CGWA granting permission for such extraction, and that too, only after ensuring that such permission is granted after rigorous water use assessment by the industry, water reuse and recycling methodologies adopted by the industry and also subject to the rain water harvesting measures adopted by the industry and monitored by the CGWA.

The flow meters must be installed prior to the grant of such permissions. Every industry should be directed to pay for extraction of such water, that too, subject to the conditions stated in the order permitting such extraction.

16. The State Government, its instrumentalities, Departments and concerned public authorities shall ensure that there are no encroachments, unauthorized illegal constructions on the banks/flood plain of the major drains, river Ganga and its tributaries. Preferably, these areas should be utilized for creation of a Green Belt and biodiversity park, etc. (natural fringes of effluent and sewage).

17. As directed, all the projects under this judgement shall be finalized by NMCG and wherever necessary contribution shall be invited from the State Government. Primarily it would be the responsibility of MoWR and NMCG to finalize these projects out of funds available, as these projects relates to the cleaning of river Ganga. The finances shall be provided in terms of this Notification. The industry shall contribute finances not exceeding 25% of the total cost in relation to the construction, up gradation of STP, CETP and providing common infrastructure in terms of this judgement. Till the works on the projects in accordance with the judgement are commenced, the NMCG and/or any other funding Ministry would not incur any expenditure on any projects in the States of Uttarakhand and Uttar

Pradesh relating to cleaning and rejuvenation of river Ganga and its tributaries falling in Segment A and B of Phase-I, i.e., Gaumukh to Unnao, Kanpur.

18. All the stakeholders through the committees constituted under these directions shall submit periodical progress reports in relation to the projects under this judgement to the Tribunal. The compliance report should be submitted every three months.

19. The CPCB and the respective SPCBs, particularly, concerned with river Ganga shall issue consent orders which must contain stipulations/conditions with regard to reuse of the treated sewage for industrial and other purposes. This condition should also be incorporated by an amendment in the orders already issued by the Boards to the industries, however, they may be provided time frame for compliance of this direction. The Board can implement this direction in stages, giving preferences first in the urban areas and later in rural areas.

20. All the existing STPs as well as the STPs to be designed and constructed should satisfy the existing standards. The new STPs should be

designed and constructed in a manner in which they should be able to achieve more stringent norms, if prescribed in future.

21. The STPs should not be constructed close to the riverbed, preferably there should be a distance of 500 meter plus from the edge of the river.

22. The Association running the CETP shall be responsible for proper O&M of the CETP. Every industry located in that area whose effluents are being sent to the CETP shall be member of the CETP association and would be liable to pay such monthly amount as may be determined by the State of UP in consultation with the Association of the CETP.

23. The charges for collection and transportation of spent chrome liquor from each unit shall be determined and notified by the concerned authority that is UPJN and the State of UP within four weeks from the date of pronouncement of the judgement. The monthly charges payable in advance would be determined with reference to number of hides, the unit is entitled to process as per consent order and it will be fixed charges.

24. It is brought to the notice of the Tribunal that chromium sulphate dumps have been created in open in the area of Jajmau and other locations

like Rakhi Mandi and Khanpur village. This is a hazardous waste, therefore, we direct that this entire chromium sulphate dumps shall be remediated by UPPCB, UPJN and Kanpur Nagar Nigam within four weeks. This shall be disposed appropriately and in accordance with the Rules of 2016 at the site being maintained by the State of UP and being run by Ramkay Plant or at a secured landfill site identified by the State Government.

25. The sewer line carrying sewage and effluent of Jajmau which is presently 70% non-functional should be cleaned, dredged and silt waste removed from the drain within four weeks from the date of pronouncement of the judgement. The said sewer line leading to Jajmau and all connected drains should be cleaned.

26. We direct the CGWA to carry out the study and notify the areas in Segment-B of Phase-1 which are Over exploited, Critical, Semi-critical and Safe zone. There shall be complete prohibition on extraction of groundwater in the critical areas. Further, in relation to other two areas, the CGWA shall also publicize the fundamental conditions subject to which the extraction of groundwater would be permitted and the extent thereof and, if

necessary, would require people to fix the flow meters who are using the bore well or tube-well for extraction of the groundwater.

27. As directed in our order dated 11th April, 2017, for each default, the defaulter would be liable to pay Environmental Compensation of ₹ 50,000/- per default for such dumping and/or throwing the waste of any kind into the river.

28. It is commonly and without exception agreed that as of present there is a dedicated pipeline network in existence that takes the industrial effluent to the existing CETP at Jajmau. It is also agreed that there is a dedicated sewerage network in operation that takes the sewage of the industrial clusters as well as surrounding areas to the STPs located at Jajmau itself.

It is on record that the CETP suffers from technical deficiencies and as of present is non-performing. As already stated, the CETP is even discharging 60% of the effluent directly into river Ganga which is completely untreated. Thus, we direct that the CETP at Jajmau shall be upgraded in terms of the capacity and quality. The CETP should have physio-chemical treatment before primary treatment, biological treatment and tertiary treatment (R.O. System). All these three

stages of treatment should be installed to upgrade the CETP at the earliest. The treated effluents being discharged from the CETP should be subjected to further dilution by the treated sewage received from the STPs in Jajmau itself. Such diluted effluent discharged from the CETP should be recycled, reused for industrial units at Jajmau, agriculture or horticulture activity in that area or nearby areas and for cooling purpose of the power plants located in close vicinity. The remnant treated effluent should be released into the river but not in excess of 25% of the total discharge.

29. The tannery industries should be encouraged to adopt the methodology for processing of hides as per the Central Leather Research Institute, Chennai. The pinpoints are as follows:

- *Alternative methods of preservation of hides/ skins and processing of green hides.*
- *Desalting of hides and skins and collection of salt for disposal or reuse.*
- *Use of enzymes in soaking process.*
- *Soaking in drums instead of pits*
- *Green fleshings of hides.*
- *Cleaner liming options.*
- *Ammonia-free deliming process.*
- *Alternative pickling & chrome tanning process.*
- *High exhaust tanning process.*
- *Pickle less Chrome tanning process*
- *Pickle-Basification Free Chrome Tanning.*
- *Salt Free Chrome Tanning.*
- *Direct Chrome Liquor Recycling (DCLR).*
- *Chrome Recovery and Reuse.*
- *Cleaner technologies in post tanning and finishing.*

30. We order and direct that the State Government, its instrumentalities, Departments and concerned public authorities shall ensure, wherever possible, adjacent to and on the floodplain of river Ganga and its tributaries, it shall create the Green Belt by plantation of the endemic species and protect the Green Belt areas from any encroachment and illegal and/or unauthorised construction.

31. It will be appropriate that while carrying out precautionary dredging of the river, no instream mechanical mining is permitted and even the mining on the floodplain should be semi-mechanical and preferably more manual. Such mining should be permitted only after a detailed and comprehensive assessment of the annual replenishment of sand and gravel in the river bed and ensuring that the longitudinal and lateral connectivity of the river is not disturbed and only that quantity which less or equal to the annual replenishment is permitted to be removed from the riverbed or its banks. This is absolutely essential for the health of the river, maintaining of aquifers, groundwater flow and protecting the floodplains.

32. The State Government, its instrumentalities/ Departments and concerned Public Authorities should incentivise farmers to adopt agricultural/irrigation technologies for more efficient use of surface and groundwater including adoption of drip irrigation wherever feasible besides promoting crop diversification to promote less water intensive crops in the Ganga river basin. Technologies developed by Research Institutions to promote water use efficiency in irrigation even in the existing crops like sugarcane and paddy, which are high water consuming crops, grown in river basin should be encouraged through demonstration, extension, incentivization and adoption of new technologies.

33. The State Government, its instrumentalities, Departments and concerned public authorities shall formulate guidelines and notify the same by putting it in the public domain in relation to strictly regulating the activities, religious or otherwise, which could be permitted on the Ghats and or near the floodplains of river Ganga and its tributaries in accordance with law. The prime object of these guidelines should be to prevent and control pollution of river Ganga and its tributaries.

34. The State of UP, UPPCB, UPJN and the body/association running and maintaining the CETP/CRP shall ensure proper regulatory and supervisory regime to be implemented, enforced and in default shut down the respective erring units.

35. Wherever the industry is discharging its effluents, particularly, in case of Distillery and Sugar Mills, by method of composting, in such event, the compost material should meet the prescribed standards for such purpose as per the Notification issued by the Ministry. If the industry is found to be in default, it shall be treated a statutory violation and action should be taken accordingly by the State Board.

36. The State Boards are hereby directed to identify the Water Quality Monitoring Network (including groundwater), scientifically based and analysis the data collected and upload it on their respective website.

37. Similarly, the Online Monitoring System or Continuous Emission Monitoring System should also be applied on case-to-case basis with reference to the facts and circumstances of the given unit. They must be feasible, for instance, if there is a tannery unit which has consent for

processing of say 10 hides a day, it cannot be expected to become ZLD or to install Online Monitoring System or Continuous Emission Monitoring System would be opposed to any accepted principles of technology and safeguards of economic advancement. They would be compelled to operate and discharge their effluents only and strictly as per the prescribed norms in default. They would be liable to be shutdown.

38. No industry should be permitted to start its operation in the catchment area of the drain till the time it either becomes a ZLD unit or recycles its entire treated discharge for agriculture, horticulture and its own industrial purposes. The recycling or use of same water for agriculture, horticulture purposes should be permitted only when the effluent is within the parameters which are permissible for discharge on land etc. The UPPCB and CPCB shall enforce this direction.

39. Any STP/CETP discharging effluent in violation of the prescribed norms and/or in the event the plant is not operating effectively in accordance with the prescribed norms, shall also be liable to pay environmental compensation of Rs. 50,000/-

per breach. This shall be the responsibility of the person in-charge and responsible for running of the plant.

40. The six drains, namely, Ranighat Drain, Police Line Drain, Jail Drain, Adil Nagar-2 Drain, Behind Shanidev Mandir Drain and Neem Nallah and such other drains which are not carrying any effluent or sewage as a result of interception or otherwise and are dry may be fixed with screen traps at the end of drain to ensure that no municipal or other waste enters the river through these drains. It should be ensured that these drains do not carry any trade effluent or sewage.

41. All the industries which have an effluent generation of 100 KLD or above per day and are located in the catchment area of river Ganga and its tributaries would be subjected to an inspection by the Joint Inspection Team of UPPCB and CPCB, if not already inspected. Appropriate directions for compliance to ensure prevention and control of pollution of discharge of trade effluent directly as per prescribed parameters shall be issued within six weeks from today.

42. As UPJN, Kanpur Nagar Nigam and the Jal Sansthan are the authorities responsible for constructing, operating and maintaining the plants, sewer line etc. Thus, we direct that all these public authorities must be provided with additional infrastructure, manpower and training. All these authorities must act and execute the work in coordination and cooperation with the State Government, NMCG and the Central Government.

43. We also grant liberty and in fact, it shall be desirable for every local authority to recover environmental conservation charges from the public at large or in any case a class of persons responsible for generating higher sewage. Appropriate decisions in this regard shall be taken by the local authorities in accordance with law and should be duly publicized within the municipal limits of the authority.

SPECIFIC DIRECTIONS RELATING TO A PROJECT, PLANT AND DRAIN AND THE 86 DRAINS JOINING RIVER GANGA AND ITS TRIBUTARIES.

DIRECTIONS WITH REGARD TO ENVIRONMENTAL FLOW:

182.2 Thus, we have to pass specific directions in regard to environmental flow of the river, extraction of groundwater and the diversion of water of river Ganga into canals, etc.

1. On the cumulative analysis of the submissions made and as an interim measure, we direct that while diverting the water from Haridwar to the Ganga canal or even otherwise, the minimum E-flow in the main stem does not fall below 20% of the average monthly lean season flow, which will be referable to the status of the river at Haridwar pre-diversion. Also, the extent of diversion of water of river shall be adequately reduced and/or adjusted, in the event the flow falls below 20%. We have already noticed that the water of river canal is being wasted indiscriminately which ultimately joins various drains in Segment-B which as already directed should be prevented.

2. We direct the CGWA, Irrigation Department of State of UP, UPPCB to carry out study as to the requirement for minimum environmental flow of river Ganga, that is essential to maintain the health of the river, its aquatic life and biodiversity. This Committee should submit the report to the Tribunal within six months from the date of passing of this judgement.

3. We direct that no person shall be permitted to extract groundwater for industrial and commercial purposes unless it has obtained

permission from CGWA. The CGWA should also regulate extraction of groundwater for agriculture and other purposes as per State policy. The permission shall be granted subject to such terms and conditions as may be necessary for the purpose of preventing and controlling the pollution on the one hand and ensuring maintenance of depletion in the groundwater projects as well as ensuring measures for recharging of the groundwater levels.

4. We direct the CGWA to carry out the study and notify the areas in Segment-B of Phase-1 which are Overexploited, Critical, Semi-critical and Safe zone. There shall be complete prohibition on extraction of groundwater in the critical areas. Further, in relation to other two areas, the CGWA shall also publicize the fundamental conditions subject to which the extraction of groundwater would be permitted and the extent thereof and if necessary would require people to fix the flow meters who are using the borewell or tube-well for extraction of the groundwater.

DEMARCATION OF FLOOD PLAINS AND CONNECTED DIRECTONS

182.3 We pass the following directions for compliance:

i) We direct and constitute a Special Committee

consisting of representatives from MoWR, Senior Officer from Department of Irrigation, State of Uttar Pradesh, Revenue Department of Uttar Pradesh and Central Water Commission which shall identify and demarcate the floodplains of river Ganga in Segment B of Phase-I on one in twenty five years cycle.

ii) Till the said identification and demarcation of floodplain is completed, we direct that 100 meters from the edge of the river would be designated as no development/construction zone in Segment B of Phase-I i.e. Haridwar to Unnao, Kanpur.

iii) The Special Committee would also identify no development/construction zone, regulatory zone and the activities that can be/cannot be carried on in the regulatory zone of the floodplain.

iv) There shall be a complete prohibition on disposing of MSW, E-waste or bio-medical waste on the floodplain or in river Ganga or its tributaries falling in Segment B of Phase-I.

v) As directed in our order dated 11th April, 2017, for each default, the defaulter would be liable to pay Environmental Compensation of Rs. 50,000/- per default for such dumping and/or throwing the

waste of any kind into the river.

vi) All the concerned authorities including the UPPCB, UPJN and State of UP shall be responsible for carrying out these directions as well as the directions contained in our order dated 11th April, 2017 (supra).

vii) There shall be no dumping or landfill sites for any kind of waste irrespective of any technology for waste processing, within 500 meters from the edge of the river Ganga and/or its tributaries.

DIRECTIONS WITH REGARD TO ZERO LIQUID DISCHARGE, CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) AND ONLINE MONITORING SYSTEM

182.4 1. From the above discussion, on advantages and dis-advantages of the ZLD, it is evident that ZLD cannot be adopted across the board. It must have rationality as its sole criteria, should be unit centric and industries specific. The Sugar or Distillery Industries may be of a huge capacity say discharging 100 KL per day. They could be a Sugar Industry or Distillery Unit with 10 KLD discharge and thus a very small-scale unit. To apply same yardstick to all would not be feasible and result oriented. They should be assessed on their own performance and function, however, ensuring in all the situations that the effluents

permitted to be discharged on land/drain, etc. should be strictly adhering to the prescribed norms.

2. The Board in its advisory capacity may be able to suggest or guide as to the appropriate technology, which may be feasible for the industries for attaining the prescribed norms. To impose ZLD on such industries would neither be fair nor just. In fact, it will not be in consonance with the requirement of law under relevant Acts.

3. An industry should be permitted to operate, subject to grant of Consent to Operate, by the concerned Board. The CPCB has the competency under law to issue directions under Section 18 of the Water Act. The purpose of empowering Boards with certain powers is to restrict and control pollution. It is not expected from the Boards to stop the natural growth or restrict industries from operating but compliance to the environmental laws is fundamental to exercise of their powers.

4. The Board must take into consideration of the aspects including technology, financial viability, limitations of the unit, process adopted by the

industries but in all events ensuring that the discharge of effluents from the unit has to be strictly in compliance with the prescribed standards.

5. No industries, big or small can be permitted to pollute the groundwater, drains, water bodies and environment.

6. The ZLD directives cannot be applied across the board. On the one hand, it would be violative of the rights of the parties while on the other it may not be in consonance with the provisions of the relevant environmental acts.

7. ZLD should be applied on case to case basis. The concerned boards should exercise its technical know-how to issue appropriate directions in that behalf. The ultimate purpose is prevention and control of pollution and not an internal management of the plant. Effluent discharge must be strictly within the prescribed norms and the Board in appropriate cases could issue directions with regard to recycle, reuse of the treated effluent appropriately. The ZLD as inferred from the notification dated 7th October, 2016 is incapable of being enforced across the

Board without reference to the member industries and other relevant aspects afore-stated.

8. Similarly, the Online Monitoring System or Continuous Emission Monitoring System should also be applied on case-to-case basis with reference to the facts and circumstances of the given unit. They must be feasible, for instance, if there is a tannery unit which has consent for processing of say 10 hides a day, it cannot be expected to become ZLD or to install Online Monitoring System or Continuous Emission Monitoring System would be opposed to any accepted principles of technology and safeguards of economic advancement. They would be compelled to operate and discharge their effluents only and strictly as per the prescribed norms in default, they would be liable to be shutdown.

9. Another consequential issue that arises in this context is that there has to be a specialised, technically sound and dedicated mechanism with every board including CPCB which monitors entire input of Online Monitoring System or Continuous Emission Monitoring System. This

monitoring should include not only collection of data but to ensure that actions taken in default and operational deficiencies in the units are rectified within the prescribed time, failing which the unit should be ordered to be closed. The concept of self-regulation would achieve its object, only when there is an effective supervisory control.

10. There have been serious and noticeable drawbacks, deficiencies, and omissions in regulatory regimes else, the current state of industrial clusters, drains, tributaries of the river would not have been prejudicial to such an extent. Therefore, CPCB or UPPCB should ensure continuous calibration so that the online monitoring system shows the correct values and it must be compared with the actual effluent analysis collected by the Board on regular intervals.

DIRECTIONS WITH REGARD TO UPPCB/CPCB

182.5 i) UPPCB shall form a separate cell for research, development and monitoring activities and all other supporting and advisory roles as envisaged in the Acts within next 2 months which is to be headed by senior officer of the Board and directly

reporting to Member Secretary of the Board. Board shall make sufficient provisions of funds for this cell to carry out the desired functions. However, we leave it to the wisdom of the Board that till the creation of the cell or even otherwise and procurement of requisite infrastructure, it may outsource such activity, in the interest of prevention and control of pollution.

ii) UPPCB shall formulate the enforcement protocol as discussed above within next 3 months and place it in public domain.

iii) The State Boards are hereby directed to identify an extensive Water Quality Monitoring Network (including groundwater), analyse and collate the data collected and upload it on their respective website.

iv) Board shall also publish a comprehensive report on water quality status of the State on annual basis, which shall be submitted to State government for necessary action.

v) UPPCB shall prepare and submit a comprehensive proposal for capacity building including additional manpower and infrastructure to the State Government within period of 2 months and Sate

government shall take a decision such proposal within 3 months thereafter. In order to facilitate development of such proposal by SPCBs, CPCB shall prepare guidelines for requirements of manpower by the Boards, by standardizing the work requirements for visits, inspections, analysis, research activities, complaint redressal, etc. within 4 weeks. Keeping in view the mandate of the SPCB issued in exercise of its powers under Section 17 of the Water Act.

vi) Special dedicated monitoring cell should be created in the UPPCB/Uttarakhand PCB and in fact, in all the Boards which should have an exclusive duty of monitoring the online systems and take appropriate action, wherever the industry is found to be in default without delay.

vii) The order granting and/or refusal of consent to operate or establish should be passed only upon the Joint Inspection by the officers of the Board. The inspection report should be complete and comprehensive dealing with all the operational aspects of the plant and technology required or installed for attaining the prescribed parameters.

viii) The UP/Uttarakhand Government and in fact, all

the State Governments are hereby directed to consider the proposal of the respective Boards for enhancement of infrastructure and manpower for effectively performing its functions. Such proposal should be considered objectively and as far as possible the infrastructure and manpower of the Board should be enhanced to ensure proper implementation and enforcement of the environmental laws.

ix) Effective supervisory and regulatory control by the Board is a condition precedent to achieving effective prevention and control of pollution of environment, particularly, the water bodies.

x) Above directions are necessary for streamlining and ensuring the proper performance of function and duties by the Boards in accordance with the Environmental Acts.

DIRECTIONS WITH REGARD TO JAJMAU, UNNAO AND BANTHAR

182.6 We must state with clarity the outline of the project that must be carried out at Jajmau, Unnao and Banthar:

1. The CETP which is stated to be operational at Jajmau presently has the capacity of treating 7 MLD of tannery effluent and 27 MLD of sewage. It is based on UASB technology followed by aerobic post-treatment which is managed by UPJN. This CETP is incapable of

treating metals, particularly, it cannot recover chromium. It receives 9 MLD of trade effluent mixed with 27 MLD of domestic sewage while around 60% of it is directly discharged into river Ganga. It is deficient in a number of ways and does not meet the prescribed parameters, much less the proposed parameters.

This CETP requires upgradation and setting up of other anti-pollution devices which we shall state in some elaboration hereinafter.

2. The existing Chromium Recovery Plant was again found to be deficient in various respects. Firstly, the tanneries from the Jajamau complex were not collecting and sending chromium contained effluent to the plant. Secondly, the Chromium Recovery Plant was not designed and installed appropriately. The Chromium Recovery Plant which is undisputedly under-utilized is also not being operated and maintained properly and efficiently. It indicated improper segregation, collection and transportation of spent chrome liquor from the tanneries. Nearly 30 to 32 ML per day sludge is generated and is temporarily stored at CETP at Kanpur site. Thus, it is directed that the Chromium Recovery Plant shall be upgraded to ensure effective and proper supervision of the

plant. The operating agency/public authority concerned shall ensure that the Chromium Recovery Plant operates and is maintained efficiently and does not at any stage release the effluent that would contain chromium in excess of the prescribed parameters. In fact, the content of the chromium in the discharged effluent should be much below the prescribed limit, which can be safely taken care of by dilution process.

All the tannery industries at Jajmau and even at Banthar and Unnao shall be duty bound to ensure transportation of the spent chrome liquor from their premises to the plant through tankers, which are being operated by the authorised agencies as of today. The tankers used for appropriate transportation of the spent chrome liquor shall be fitted with GPS to maintain due record of transportation of the effluent.

The public authority concerned, that is, the UPJN shall issue duly endorsed booklets containing three counterfoils which will be titled as 'Industry'. Upon signature of the concerned officials, one copy shall be retained by the plant while the other by the transporter and the third copy would be retained by the local authorities, i.e., officials of the UPJN/the Association identified for operation and maintenance

of the plant. This would be signed by the industry at the time of collection and by the officials of the plant at the time of receiving the spent chrome liquor.

The chromium recovered from each unit shall be processed and recovered at the Common Chromium Recovery Plant. Recovered chromium shall be provided to the industry at a no profit no loss basis. The remnant recovered chromium shall be sold in the open market and funds so received shall be utilised for efficient operation and maintenance of the plant.

It shall be ensured that the remnant effluent discharged from the plant is appropriately subjected to dilution by treated sewage, before it meets river Ganga or any of its tributaries.

The sludge generated from the plant shall be stored and transported regularly to the fully developed sites presently at Kanpur maintained by Ramkay. It shall be ensured that the sludge and other hazardous waste collected from the plant should be maintained strictly in accordance with the Hazardous Waste Management Rules, 2016.

3. Compliance of these directions shall be paramount duty of the industries, the Association and the public authority responsible for operating and maintaining the plant and the agency appointed for transportation of the spent chrome liquor. In default, each or all of

them would be liable to pay environmental compensation. The environmental compensation for such breach and default would be ₹ 50,000/- for each default on the part of the agency responsible for transportation and the Association and Public Authority responsible for operation and maintenance of the plant. Besides the above, in case of offences relating to discharge of chrome by an industry, which is processing more than 30 and less than 100 hides per day, they would be liable to pay environmental compensation of ₹ 25,000/- per breach; industry entitled to process more than 100 hides per day, would be liable to pay environmental compensation of ₹ 50,000/- per breach and the industry processing 100 and above hides per day, ₹ 1,00,000/- per breach. This environmental compensation shall be payable instantaneously, on default found either by the concerned public authority i.e. UPJN and/or UPPCB and/or any Member of the Committee constituted by the Tribunal under this judgement.

4. All the industries shall operate their units strictly and limited to the hides that have been sanctioned in the order of consent to operate.
5. It is commonly and without exception agreed that as of present there is a dedicated pipeline network in existence that takes the industrial effluent to the

existing CETP at Jajmau. It is also agreed that there is a dedicated sewage network in operation that takes the sewage of the industrial clusters as well as surrounding areas to the STPs located at Jajmau itself.

It is on record that the CETP suffers from technical deficiencies and as of present is non-performing. As already stated, the CETP is even discharging 60% of the effluent directly into river Ganga which is completely untreated. Thus, we direct that the CETP at Jajmau shall be upgraded in terms of the capacity and quality. The CETP should have physio-chemical treatment before primary treatment, biological treatment and tertiary treatment (R.O. System). All these three treatments should be installed to upgrade the CETP at the earliest. The treated effluents being discharged from the CETP should be subjected to dilution by the treated sewage received from the STPs in Jajmau itself. Such diluted effluent discharged from the CETP should be recycled, reused for industrial units at Jajmau, agriculture or horticulture activity in that area or nearby areas and for cooling purpose of the power plants located in close vicinity. The remnant treated effluent should be released into the river but not in excess of 25% of the total discharge.

6. The tannery industries should be encouraged to adopt the methodology for processing of hides as per the Central Leather Research Institute, Chennai. The pinpoints are as follows:

    - *Alternative methods of preservation of hides/ skins nd processing of green hides.*
    - *Desalting of hides and skins and collection of salt for disposal or reuse.*
    - *Use of enzymes in soaking process.*
    - *Soaking in drums instead of pits*
    - *Green fleshing of hides.*
    - *Cleaner liming options.*
    - *Ammonia-free deliming process.*
    - *Alternative pickling & chrome tanning process.*
    - *High exhaust tanning process.*
    - *Pickle less Chrome tanning process*
    - *Pickle-Basification Free Chrome Tanning.*
    - *Salt Free Chrome Tanning.*
    - *Direct Chrome Liquor Recycling (DCLR).*
    - *Chrome Recovery and Reuse.*
    - *Cleaner technologies in post tanning and finishing.*

7. All the 402 industries and/or such other numbers which are operational, would be permitted to operate strictly in compliance with the conditions of the Consent to Operate order. Any industry which violates the prescribed parameters, conditions of the Consent to Operate and the directions contained herein, shall be liable to be shut down by CPCB/UPPCB.

8. The industries would be liable to pay the determined share, by the competent authority, of the expenditure to be incurred on laying down of pipelines and construction/up-gradation of the CETP/ Chromium

Recovery Plant on the basis of Polluter Pays Principle. The CETP and the Chromium Recovery Plant shall be operated and maintained by the Association of the Industries under the strict supervision and under the effective control of the UPJN. The UPJN and the Association of Industries would be collectively responsible and liable to be proceeded against, in accordance with law, in the event of default and violations.

9. It is again commonly agreed and undisputed that as of now two STPs of the capacity of 130 MLD and 5 MLD, respectively, are operating in Jajmau. Another STP of the capacity of 43 MLD is under construction. It has already been noticed that the two operational STPs are not working satisfactorily and the parameters are much beyond the prescribed limits. It is in crores as far as coliform is concerned and BOD is also very high. Thus, we direct that the two existing STPs of 130 MLD and 5 MLD respectively shall be subjected to inspection by the Joint Inspection Team within 4 weeks from today and the recommendations made by the Joint Inspection Team consisting of representatives from MoEF&CC, NMCG, CPCB, UPPCB, UPJN and Professor in the required speciality from IIT Roorkee. They shall make due recommendations for proper operation and

maintenance of the plant and to ensure that these violating values are brought within the prescribed norms. The recommendations made shall be implemented by UPJN and NMCG without any further delay or default. This must be executed with utmost priority and expeditiousness.

As far as the STP of 43 MLD under construction is concerned, we direct that the said STP shall be constructed and completed to ensure that it meets the prescribed values, particularly, in relation to BOD, faecal coliform and all other parameters. It should be designed to achieve suggested values of BOD at 10 mg/l and 230 MPN/100 ml of Faecal Coliform, as directed by CPCB and MoEF&CC, but in any case must achieve the presently prescribed norms.

The discharge from the STP should firstly be used for dilution of the trade effluent from the CETP and the remnant should be reused for agriculture, horticulture and industrial cooling of power plants etc., not in excess of 25% of the total discharge that should be released into river Ganga.

10. The CETPs at Unnao and Banthar, Kanpur are stated to be in operation. Unnao CETP is being operated with the activated sludge process technology. The analysis report shows quality of

treated effluents at the outlet exceeding notified standards. It shows high concentration, particularly, of TSS, total coliform and chromium, which adversely affects the biological treatment system, it being toxic. The CETP at Banthar was found not complying. It was violative of the prescribed parameters and was found not efficiently working and causing adverse impacts. Both these CETPs need to be upgraded in terms of capacity and quality of treatment. We direct upgradation of these CETPs on the basis of the reports submitted to the Tribunal and which should be reconfirmed while submitting the final project report to the Tribunal for implementation.

11. Both these CETPs shall also be subjected to inspection by the Joint Inspection Team within 4 weeks from the date of passing of this judgement. Their recommendations should be implemented with utmost priority and expeditiousness.

12. The conveyor drains carrying the effluents from the industrial clusters should be dredged and cleaned. Immediate steps should be taken in that direction by the concerned authorities primarily by UPJN and Kanpur Nagar Nigam collectively.

13. The industries at Unnao and Banthar shall be liable to pay and share the financial responsibility for properly preparing the pipeline/conveyor belt,

construction/ upgradation of the CETPs, as per the share determined by the competent authority on the basis of Polluter Pays Principle.

14. A direction is issued to the State of UP, UPJN, UP Nagar Nigam and UPSIDC with due consultation with Director NMCG and CPCB to submit a complete project report in furtherance to these directions giving time bound programme for completion of the project in terms of these directions within a period of six weeks from today. The report shall be submitted within six weeks and the work in furtherance to such project report and in consonance with this Judgement should start within four months from the date of pronouncement of this judgement and the projects completed and made operational in all respects without exception within two years from the date of pronouncement of this judgement.

15. In the event, the above direction is not carried out in its true spirit and substance and report placed before the Tribunal within the stipulated time, then the tannery industries at Jajmau shall be directed to be shut down and would be shifted to a new industrial site which is fully developed or to be developed having provisions for CETP and Common Chromium Recovery Plant.

Keeping in view the directions of the Supreme Court

and the judgement of the Allahabad High Court as referred above, we direct that the State of UP alongwith the Association of the Industries, who shall submit the project action plan as afore directed within 6 weeks from the date of passing of this judgement, failing which, it shall take steps for shifting of the tannery industrial complex from Jajmau to the identified site at 'Banthar (Unnao Extension)' or any other land identified by the State within that period.

16. Having passed generic directions in relation to the tannery industries located at Jajmau, Banthar and Unnao, we also need to deal with the three drains, namely, Sheetlabazar Drain, Budhiyaghat Drain and Wazidpur Drain as discussed in para 92 at page no. 217 of the judgement above and other specific matters peculiar to the tannery industries located at Jajmau. Thus, in addition to the above, we pass the following directions in relation to industrial cluster at Jajmau:

a. All the tannery industries shall abide by all the directions afore-stated.

b. The two dedicated pipelines for carrying sewage and trade effluent shall be cleaned, silt and sludge removed and shall be maintained in future directly so that there is no obstruction to the flow

of the effluent/sewage and there is no overflow coming from the interception/points, where pumps have been constructed to the above three drains. Once the pipelines operate efficiently and the CETP and STPs operate to their optimum capacity as afore directed, the three above-stated drains would carry no effluent or sewage and they would be restored to their original status of being storm water/natural drains.

c. It will be ensured that the sewage from Jajmau industrial complex as well as surrounding areas is carried through the dedicated pipeline to either of the STPs located at Jajmau itself. Similarly, the trade effluent is carried to the CETP at Jajmau. The entire network of sewer line and drain should be kept free of obstruction, sludge or silt.

d. Due record shall be maintained for collection, transportation and treatment of the spent chrome liquor at Jajmau.

e. Each tannery industry shall maintain a tank of an appropriate size in their premises in which the spent chrome liquor is stored, till it is transported as directed. It should be ensured that the tank does not have any seepage affecting the groundwater in that area.

f. In any of the above events, if the unit is found to be defaulting and/or discharging chromium contained effluent into drain or conveyor belt or in any form and causing pollution, the unit shall be liable to be closed and shutdown with immediate effect.

g. Resultantly, the three drains would be converted and maintained as natural storm water drains and they shall be cleaned, silt and sludge removed without any further delay.

h. All the drains would be fixed with 'screen traps' at the end of the drain before it joins the river, to ensure that no waste of any kind enters the river.

i. All the concerned stakeholders including the public authorities would ensure that no trade effluent/sewage or municipal sludge waste is permitted to be discharged or dumped in any of these three drains and they should maintain their natural character.

17. The administrative regime/body shall be primarily of the association of industry itself, supervised by UPJN and the UPPCB.

18. The charges for collection and transportation of the remnant chromium effluent or the entire spent chrome liquor shall be fixed by the above mentioned administrative regulatory body, which

will be payable every month in advance but such payment will not absolve the responsibility of the unit for actual transportation of the effluent to the Chromium Recovery Plant and the same should be applicable to CETP as well.

19. It is directed that where the effluent discharge standards have been fixed, keeping in view the dilution ratio of 1:10, then it must be ensured that the recipient water body carries that capacity. In the event it falls short of 10 times dilution then the standards of discharge of effluent should be accordingly revised and fixed by the Board on case to case basis, while granting consent to the industries.

182.7 **DIRECTIONS WITH REGARD TO INDIVIDUAL DRAINS JOINING RIVER GANGA OR ITS TRIBUTARIES.**

GARH DRAIN

i. The 3 MLD STP Plant at Brijghat should be made operative without any further delay.

ii. The 6 MLD STP Plant that is under construction at Garh drain to treat the sewage from Garhmukteshwar should be completed without any further delay. Though, we have provided the load discharge under this drain as well as quality analysed but we direct the concerned executing agencies to ensure that the capacity and design of the plant is duly confirmed

before any further construction of the plant and it should be ensured that the plant brings the proposed standards of faecal coliform of 230 MPN/100 ml and BOD 10mg/l, but in any case should conform to the existing standards.

iii. No discharge shall be permitted in the Jhorh at Brijghat, henceforth. The remaining work of sewer line should be completed and each household should be connected to the sewer line without any further delay. This should be taken up by the executing agency as a project of top priority and all the concerned authorities and respondents are directed to deal with the matter accordingly

iv. The treated discharge from STP even if chlorinated should be used for agriculture and horticulture as far as possible. The sewer line is to be connected to the STP through pumping station which are still to be constructed. However, the sewer drain should be connected even during the interregnum by providing adhoc pumping arrangements or any other appropriate measures.

v. All the stakeholders including MoWR, MoEF&CC, CPCB, State of UP, UPPCB, UP Jal Nigam entirely agreed with these directions.

ANUPSHAHR STP DRAIN I & II

i. We direct that two different STPs shall be

constructed, one of 1.5 MLD while other of 2 MLD capacity.

ii. The work of 1.5 MLD STP has already been started for drain I, completion thereof should be expedited. The STP should be so constructed that it should satisfy, preferably, the proposed standards of faecal coliform of 230 MPN/100 ml and BOD 10mg/l, but in any case should conform to the existing standards.

iii. The executing agency shall duly confirm before the commencement of the work, the discharge in the respective drains and quality thereof. These drains need not be intercepted and independent STPs should be constructed to provide regular source of power. Also, solar energy should be utilized.

iv. The STPs should not be constructed close to the riverbed. Ideally there should be a distance of more than 500 meter from the edge of the river.

HATHIKHANA NALLAH, BARGADIYAGHAT NALLAH AND CANTT. NALLAH

i. The effluents from Cantt. Nallah and Bargadiyaghat Nallah shall be brought to Hathikhana Nallah at the point where presently MPS is proposed and the STP of 17 MLD capacity will be constructed.

ii. This STP should have the capacity to treat and bring the values of the general parameters to the prescribed norms.

iii. If any development is sanctioned by the Government or any local authority between the point of establishment of STP and the river bank in that event that developing agency shall ensure that STP/CETP is required to be constructed by such developing agency. In the event if it is a colony being built up by Government or any of its agencies then it shall not do so without constructing any STP/CETP and only the discharge from that STP/CETP that would be permitted to join the Hathikhana Nallah. The 17 MLD STP shall take due care of the future demands and therefore constructed with utmost expeditiousness and with proper technology.

PERMIYA NALA, RANIGHAT DRAIN, SESAMAU, TEFCO NALA, PARMATH GHAT, MUIR DRAIN, POLICE LINE DRAIN, JAIL DRAIN, GOLAGHAT NALA, BHAGWATDAS/GUPTARGHAT NALA, SATTI CHAURAHA, DABKA NALA-3 AND AIR FORCE DRAIN

i. The Nawabganj drain should be intercepted and its effluents taken to the main sewer line which goes to Jajmau STP.

ii. The STP of 43 MLD at Jajmau under construction should be completed with utmost expeditiousness. All these STPs should be upgraded and should be of an appropriate capacity so that they can treat the entire effluents left from these 5 drains and Permiya Nallah and sent to appropriate STP at Jajmau.

iii. It is informed that there is sufficient land available at

Jajmau for construction of STP and since the existing STPs are already there, it will be more convenient to install another STP at the same site.

iv. The Local authorities, Nigam and State of UP are hereby directed to ensure that the 70% non-functional factor of the sewer line taking the sewage effluents of Jajmau should be cleaned forthwith and the flow of the drain should be 100% as opposed to 30%. This direction is necessary because if there is no proper conveyance capacity of the sewer line, the entire sewage and effluent collected would overflow or leak from the point of interception or tapping, defeating the entire project which had already been sanctioned by NMCG in 2016.

v. The STP at Jajmau should be able to treat all the effluents including BOD, COD, TSS, Coliform and the CETP should be able to treat the industrial pollutants so as to achieve the prescribed norms.

vi. The treated water from the STP shall be recycled for use in industrial and agriculture purposes and it is only the remnant that would be subjected to discharge in river Ganga. The escape channel of Ganga canal should be strengthened and it should be ensured that there is no leakage to the Permiya drain and no unintended discharge.

vii. A new STP of 3.5 MLD by interception and diversion

of Nawabganj drain with sewer line along Permiya drain which has already been approved by NMCG is permitted to be executed.

viii. The pumping station of Nawabganj drain should be upgraded, cleaning and capacity enhancement to be carried out so that the entire effluent could reach the Jajmau without any obstruction.

RANIGHAT NALLAH, SISAMAU NALLAH AND TEFCO NALLAH:

i. We direct that all these three drains shall be fully and completely tapped wherever necessary through pumps. The discharge shall be put into the sewer line leading to Jajmau STP.

ii. All the pumps shall be provided with alternative sources of energy, i.e., solar or DG sets to ensure uninterrupted functioning of the pumps. This would ensure that there is no overflow or backflow from the pumps or point of interceptions.

iii. It should be ensured under all circumstances that no overflow of effluents or sewage enters the drains beyond the point of tapping.

PARMATH DRAIN:

i. We direct that the existing tapping point shall be strengthened and upgraded.

ii. It should be ensured that there is no overflow. The drain should not be sealed at the point of confluence.

MUIR MILL NALLAH:

i. We direct that the drain should be completely tapped so as to not permit overflow from the tapping point.

ii. The tapping point should be upgraded and strengthened appropriately subject to compliance of other general directions issued in this judgement.

GOLAGHAT NALLAH:

i. We direct that this drain be tapped fully and completely and the effluent be taken to Parmath pumping station or any other nearest pumping station to finally put the effluent into sewer line leading to Jajmau.

BHAGWAT DAS GHAT DRAIN/GUFTAR GHAT NALLA, SATTICHAURA GHAT DRAIN AND DABKA NALLA DRAIN-3:

i. It is directed that besides tapping the three drains taking the effluent to the pumping station at Guftar Ghat drain, finally to Jajmau the three drains should be sealed towards the river at their end. In fact, this order was passed by the Tribunal on 20th April, 2017 which is reiterated.

ii. The waste deposited in the drains beyond the point of tapping should be mechanically lifted and appropriately dumped at regular intervals.

HEMRAJ DRAIN

i. We direct that the STP of 24 MLD under construction at Bijnor should be completed expeditiously but it

must ensure that the technology provided in the STP should have appropriate capacity to be able to treat all the effluents including coliform and other pollutants indicated in the Judgement.

ii. We direct that along with STP, soaking tank should be constructed with proper filtration system.

CHHOIYA DRAIN (RIVER GANGA)

i. The drain should be de-silted immediately and the colour content should be removed so as to ensure that in future the drain is not polluted and does not cause colour mixing. One time cleaning of the drain on all the parameters should be prescribed.

ii. The Tribunal is of the considered view that it will be more appropriate to construct or provide the three rural areas in the catchment area of the drain with oxidation ponds. The effluent from these oxidation ponds should be taken to the STP that is proposed to be constructed at some distance from the point where Chhoiya drain meets river Ganga. The three major industries afore-noticed should be directed to become ZLD either by incineration process or by recycling 100% treated effluent. They should strictly comply with the prescribed standards for treatment of the trade effluent of these industries. The remnant from both these sources should be taken to STP treated where it should be treated. The treated effluents

should be recycled and not in excess of 25% should be discharged into the river Ganga.

iii. The drains should be dredged, de-silted and cleaned and all the effluents and colour even in the soil on the bed of the drain should be removed to ensure that there is no pollution generated in future. Furthermore, the land/area falling prior to the STP and the municipal limits in future would not be permitted to discharge any sewage or effluents into this drain. In the area which is stated to be approximately 5 km if any development, industrial and/or residential, is permitted then such development will not be permitted unless such development project has CETP/STP of required capacity capable of treating the effluent generating as a result of the development and it will only be the treated effluent that would be permitted to be discharged in the main Chhoiya drain. Every effort should be made to restore the drain to its original nature of being a canal.

BAGAD RIVER (DRAIN)

i. The Bagad river (drain) inclusive of Mahua, should be cleaned, dredged and maintained as a river or storm water drain.

ii. All the 12 industries located in the catchment area of this drain, which are highly polluting should be put

under strict surveillance by the UPPCB as well as the Joint Inspection Team.

iii. The Joint Inspection Team has already been directed to inspect these industries to conform with appropriate conditions for permitting and operating all these functions.

iv. These industries have been directed to comply with the conditions of the consent order and directions issued by the Joint Inspection Team under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and Environmental (Protection) Act, 1986.

v. In the event of these industries not complying with such directions, they shall be liable to be closed without any further notice.

vi. The Joint Inspection Team and the UPPCB shall submit compliance report in relation to these industries before the Tribunal upon regular intervals.

PHULDERA DRAIN

i. The Joint Inspection Team and UPPCB shall maintain strict vigil over the functioning of these industries and submit appropriate representation before the Tribunal.

BHAIROGHAT/TOKAGHAT DRAIN AND DEENAPUR DRAIN

i. An STP of 30 MLD is to be constructed at Dhinapur

at the proposed site.

ii. The area bereft of habitation shall not undergo any development unless and until the developer or the concerned agency, whether governmental or otherwise install/construct its own STP so that no further effluents are added to the drain after the point where the STP is being constructed and at the confluence point.

iii. The water from STP should be recycled and reutilized for agricultural purposes.

iv. The proposed CETP at Farukhabad should be constructed without any further delay but before clearance of the project, the concerned stakeholders shall ensure that the load quality of the effluent arriving at the CETP is completely analysed with reference to the capacity and technology of the CETP.

SHEETLABAZAR DRAIN, BUDHIYA GHAT DRAIN AND WAZIDPUR NALLAH

i. The two dedicated pipelines for carrying sewage and trade effluent shall be cleaned, silt and sludge removed and shall be maintained in future directly so that there is no obstruction to the flow of the effluent/sewage and there is no overflow coming from the interception/points where pumps have been constructed to the above three drains. Once the pipelines operate efficiently and the CETP and STPs

operate to their optimum capacity as afore directed, the three above-stated drains would carry no effluent or sewage and they would be restored to their original status of storm water/natural drains.

ii. It will be ensured that the sewage from Jajmau industrial complex as well as surrounding areas is carried through the dedicated pipeline to either of the STPs located at Jajmau itself. Similarly, the trade effluent is carried to the CETP at Jajmau. The entire network of sewer line and drain should be kept free of obstruction, sludge or silt.

iii. Due record shall be maintained for collection, transportation and treatment of the spent chrome liquor at Jajmau.

iv. Each tannery industry shall maintain a tank of an appropriate size in their premises in which the spent chrome liquor is stored, till it is transported as directed. It should be ensured that the tank does not have any seepage affecting groundwater in that area.

v. In any of the above events, if the unit is found to be defaulting and/or discharging chromium contained effluent into drain or conveyor belt or in any form and causing pollution, the unit shall be liable to be closed and shutdown with immediate effect.

vi. Resultantly, the three drains would be converted and maintained as natural storm water drains and they

shall be cleaned, silt and sludge removed without any further delay.

vii. All the drains would be fixed with 'screen traps' at the end of the drain before it joins the river, to ensure that no waste of any kind enters the river.

viii. All the concerned stakeholders including the public authorities would ensure that no trade effluent/sewage or municipal sludge waste is permitted to be discharged or dumped in any of these three drains and they should maintain their natural character.

ix. All the tannery industries shall abide by all the directions.

CITY JAIL DRAIN

i. The existing CETP of 4.5 MLD should be upgraded in terms of capacity, design and quality so as to specify the prescribed parameters. The entire effluent from these industries, containing high pollutant load should be diverted to the CETP and treated to bring the effluents within the prescribed norms.

ii. There should be constructed, a chromium recovery plant prior to the CETP where the entire chromium should be recovered, recycled and resold for use to the tannery industries or in the market at large. There is no dispute that chromium has enough market, particularly in that area.

iii. The STP as proposed of 12.5 MLD should be constructed and the entire sewage from that area particularly Magarwara and other places should be brought to the STP and treated. The treated sewage water should be recycled in industries such as industrial, agriculture, horticulture and other purposes in that area.

iv. The Regulatory Regime and Supervisory control of UPPCB and other concerned authorities including the association of CETP has failed to bring the desired results, the industries should be asked to bring their parameters within the prescribed limit as well as to ensure that chromium is sent to the chromium recovery plant prior to this being mixed with the sewage. In fact, the industrial effluent and the sewage are proposed to be dealt with separately which all the stakeholders, particularly the executing agency should enforce without default.

v. Both CETP and STP should operate to their optimum capacity and effectively to prevent pollution of river Ganga.

vi. All the industries of any kind which are water polluting industries located in this area within the catchment area of this drain shall pay 25% of the total cost of up-gradation of CETP and construction of STP as afore-stated.

vii. The Association running the CETP shall be responsible for proper O&M of the CETP. Every industry located in that area whose effluents are being sent to the CETP shall be member of the CETP association and would be liable to pay such monthly amount as may be determined by the State of UP in consultation with the Association of the CETP.

viii. The CETP and all the industries located in the catchment area of this drain should be subjected to proper supervisory control by the UPPCB.

ix. There shall be a separate chromium recovery plant before the CETP, the chromium so recovered shall be recycled and utilized for tannery purpose and/or sold in the open market. The industries which are not complying with the prescribed parameters and/or do not become members of the CETP shall be ordered to be shut down by the UPPCB.

x. If any development by a government agency or a private stakeholder is undertaken at any point of time in future, the said development would not be permitted to be carried out unless and until the said development be it industrial or residential has first installed a STP/CETP as the case may be from that CETP/STP only treated effluent strictly as per prescribed norm should be recycled, reused for agriculture, horticulture purposes and the remnant of

the treated discharge should alone be permitted to be put into the drain/river.

LONI DRAIN:

i. The existing CETP of 2.15 MLD run by Unnao Tannery Association shall be upgraded in terms of capacity, design and quality so as to specify the prescribed parameters upon due study.

ii. The tributaries of Loni drain that carry sewage would be intercepted and taken by gravity or by pumping to Jail drain where STP of 12 MLD and the STP capacity of 12.5 MLD should be confirmed or constructed while taking into consideration the inflow after interception of tributaries of Loni drain.

iii. Industrial effluents of Loni drain should be treated by the upgraded CETP.

iv. All the industries, slaughter houses and tannery industries should become members of the CETP at Unnao to upgrade CETP. It shall be operated effectively and it will be ensured that it brings the trade effluent parameters within the prescribed limits. All the industries located in the catchment area of Loni drain shall contribute 25% cost of the up-gradation of the CETP and would also pay monthly O&M charges to the CETP association as may be determined by State of UP in consultation with UPPCB and the Unnao association.

v. The interception of the drain should take place at the end of the Housing Board drain where it meets Loni drain.

vi. There shall be a separate chromium recovery plant before the CETP, the chromium so recovered shall be recycled and utilized for tannery purpose and/or sold in the open market. The industries which are not complying with the prescribed parameters and/or do not become members of the CETP shall be ordered to be shut down by the UPPCB.

NOHRA DRAIN

i. An STP of 5 MLD should be constructed at the outskirts of Sheohara town and the entire sewage should be treated before it is put into Nohra drain.

ii. There shall be installed filter system at the end of the drain nearly 200 meters away from the river to ensure that no waste of any kind enters the river by putting screens or otherwise.

iii. The distillery and sugar industries located in the catchment area of this drain should be required to put up their own ETP and install all necessary anti-pollution devices. They should be strictly adhered to ensure that the drains effluents are within the prescribed parameters. In fact, they are directed to recycle, reuse their treated water. The industries should be inspected by the joint inspection team of

the UPPCB and appropriate conditions in the Consent to Operate should be imposed upon them. In the event of default or discharging effluents beyond the prescribed limit, they should be ordered to be closed down.

RAMPUR DRAIN:

i. We specifically direct the State of UP and the UP Jal Nigam that the sewer connections to households should be connected to the sewer line and then should be taken with utmost priority as it is not connecting the households to the sewer line. As a result of which the requisite quantum of sewage is not reaching the STPs already constructed. This would amount to tremendous wastage of public money and assets if these STPs are not made operational immediately. They are presently not treating the sewage and therefore even causing pollution. The concerned stakeholders, therefore, must take appropriate steps without unnecessary delay.

KARLUA DRAIN:

i. No industry should be permitted to start its operation in the catchment area of the drain till the time it either becomes a ZLD unit or recycles its entire treated discharge for agriculture, horticulture and its own industrial purposes. The recycling or use of same water for agriculture, horticulture purposes should be permitted only when the effluent is within the

parameters which are permissible for discharge on land etc. The UPPCB and CPCB shall adhere to this direction.

ii. The Tribunal upon due examination, approves the common suggestions of the stakeholders and directs that preferably the STP should be established considering the high content of faecal coliform and BOD in the effluents. In the event, the UPJN and UPPCB are of the contrary view; they will move the Tribunal within four weeks from the date of pronouncement of the order seeking its direction to establish Oxidation pond and tertiary treatment in preference to an STP.

NAWABPURA DRAIN 1, NAWABPURA DRAIN 2, VIVEKANAND HOSPITAL-LEFT, MORADABAD, VIVEKANAND HOPSITAL-RIGHT, MIT DRAIN, MOKSH DHAM DRAIN, TDI CITY DRAIN, CHAKKAR KI MILAK, JIGAR COLONY, KATGHAR RAILWAY STATION DRAIN, BARBALAN DRAIN, UDAGHAR DRAIN, JAMA MASJID (LEFT) DRAIN, JAMA MASJID (RIGHT) DRAIN, GHOSIYAN DRAIN, JHABBU KA NALA, LALBAGH DRAIN, DATERIA/DAHERIA DRAIN AND PRABHAT NAGAR DRAIN

i. In light of the above discussion, in addition to the directions already passed *vide* our order dated 9th May, 2017 and other orders which are reiterated herein, we also direct and approve the project put forward by UP Jal Nigam in relation to tapping and interception of all the above drains and taking their effluents to the specified STPs. However, there would be provided due mechanism and anti-pollution devices for providing pre-chemical treatment of the effluent before it is taken to the STPs. We further make it clear that the industries which are operating

without obtaining consent of the Board and are water polluting industries and are discharging their effluent in all these drains shall be closed by the UPPCB without further delay. The administration and the police shall provide due co-operation and assistance to the UPPCB to implement this direction.

DEVRANIYA DRAIN (RIVER)

i. We hereby direct that both these industries shall be subject to complete, comprehensive and strict inspection by the Joint Inspection Team of CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN. This inspection team shall inspect these industries and issue directions for strict compliance to ensure that the effluent from these industries is completely recycled and if not, the effluent discharged strictly complies with the prescribed parameters without default. In the event, if they violate any of the conditions imposed by the Joint Inspection Team, these industries would be liable to be shutdown. The suggestion of the stakeholders is that the STP should be established at the end of the pipeline, where land is available, i.e. 1 kilometre before the point of confluence of the drain with river Ramganga. Technology should be finalized after collection of proper data.

ii. The Joint Inspection Team of CPCB, representative of

MoEF&CC, MoWR, UPPCB and UPJN shall satisfy themselves as to the exact flow of drain at that spot. They should also consider if there should be a mechanical STP or with UV technology or oxidation ponds should be constructed for removing all the effluents from the drain. This decision shall be taken within four weeks from the pronouncement of this order and approved project shall be executed appropriately, thereafter.

iii. The STP shall be provided with continuous, regular source of energy to ensure that the plant operates round the clock.

CHAWARI (CHAUBARI) DRAIN

i. We direct the Joint Inspection Team of CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN to finalize the technology keeping in view the load and content of the drain. The capacity should be demonstrated upon due verification. We pass this direction so that no further errors are committed in this behalf. The exercise should be completed within four weeks from the date of pronouncement of this judgement and the work should start immediately, thereafter.

NAKATIYA DRAIN

i. We direct the Committee of the CPCB, representative of MoEF&CC, MoWR, UPPCB and UPJN to examine

and decide on the appropriate technology that should treat 170 MLD of effluent i.e. UV system and/or oxidation ponds in place of mechanical STP, which would be more economically viable and environmentally better result oriented.

ii. There are agricultural lands around the proposed site thus the discharge from the STP should be utilized for irrigation purposes and least water should be released into the river. In the catchment area of the Nakatiya drain there are two major industries; one is the paper mill by the name of M/s. Rama Shyama Papers Pvt. Ltd. in regard to which the Tribunal has already passed appropriate orders that the industry should strictly complied with those orders failing which the industry would be liable to be shutdown.

iii. Other industry is M/s. Mariya Agro & Forzen Foods Pvt. Ltd., which is dealing with slaughter of animals. It was also stated that it is a non-polluting and complying industry. This industry shall be subject to a joint inspection by the representatives of CPCB, MoEF&CC, MoWR, UPPCB and UPJN.

iv. That committee will issue appropriate directions, if needed, further to ensure that this industry does not cause pollution. If the directions are issued and if the industries are not compliant, then the said industries would be liable to be shutdown without

further notice.

GANDA NALLA, COD NALLA AND HALWA KHANDA NALLA (KANPUR)

i. The Cantonment authorities are hereby directed to lay down a proper sewer line and bring the sewage of cantonment area of Kanpur which is in the catchment area of the COD Nalla to the STP at Bingawan for treatment.

ii. The existing ETP of the Ordinance Factory should be upgraded in terms of both capacity and technology, so as to ensure that no effluent in excess of the prescribed parameters enters the drain. After treatment, the discharge from the ordinance factory could either be put into the COD Nalla or in the sewer line that would be constructed by the Cantonment authorities. The Ordinance Factory shall be inspected by the Joint Inspection Team and appropriate directions shall be issued to ensure that the effluent discharge do not exceed the prescribed parameters, under any circumstances.

iii. If there is any industry or stakeholder operating in the catchment area of COD Nalla, the same shall be subject to an inspection by the Joint Inspection Team which shall issue appropriate directions for compliance as to ensure that the unit is compliant and non-polluting. In the event of default, the industry or stakeholder shall be liable to be shutdown.

PANKI NALLAH (PANKI THERMAL POWER PLANT DRAIN) AND ICI NALLAH

i. Thus, we direct that a separate independent STP at the identified point between Lucknow Road and river Pandu should be constructed having capacity of 75

MLD. The treated water from the STP should be recycled and utilized for agriculture and horticulture purposes and particularly for cooling of the thermal power plant.

ii. We further direct that the thermal power plant shall make endeavour to ensure that the fly ash content does not cause air or water pollution and discharges effluents strictly within the prescribed norms. The Joint Inspection Team shall inspect this thermal power plant and issue appropriate directions for prevention and control of water pollution. If the issued directions are not complied with by the thermal power plant within prescribed period, it shall be liable to be shutdown without any further notice.

ICI NALLAH:

i. The Joint Inspection Team shall inspect all the 40 highly polluting industries in this segment and would issue appropriate directions to ensure that discharge from these industries is strictly within the prescribed norms. If the directions issued by the Joint Inspection Team are not carried out by these industries within the prescribed time, they shall be liable to be shutdown till compliance and subject to further orders of the Tribunal.

MAMAN ROAD NALLAH, (BULANDSHAHR-I); AADIL NALLAH; CHANDBARI ROAD (BULANDSHAHR-II); CHEEL GHAT; NAHSAL GHAT; ADIL NAGAR-2; KASAI BADA; FAISALABAD ROAD, BEHIND SHANIDEV

MANDIR; DEVIPURA; BRIDGE DHAMEDA ROAD AND BEHIND CHAMUNDA MANDIR

i. We consider it appropriate to direct that the capacity of the STP and its technical design should be finalized after a study is carried out by the joint inspection team of CPCB, MoWR and UPPCB. They should also analyse the effluents. There should be complete and comprehensive inspection leaving nothing to imagination or rounding off figures. The data should be collected with exactitude in relation to flow, quality and quantum of effluent. The study in all these respects must be carried out within one month from the date of pronouncement of this judgement and wherever the project is to be executed, without undue delay.

ii. We hereby issue prohibitory directions against all these owners or all these shopkeepers running such service stations from getting rid of any effluent including oil and grease into the drains. If any of them are found to be discharging effluents into the drains after the expiry of two weeks from the date of the order, the UPPCB, the Corporation and even the Police Authorities would be liable to impose environmental compensation of Rs. 5,000/- for each violation. The said amount so collected shall be deposited with the UPPCB. Thus, we issue the above

directions for compliance.

ABU NALLAH-1

i. Other aspect is that the Daurala Sugar Industry, Sugar Distillery Division, Durala Sugar Urban Division and Daurala Sugar Chemical Division, presently discharging their effluent into this Nallah, are not adhering strictly to the prescribed standards. The UPPCB, Namami Gange and Member Secretary, CPCB shall issue directions for strict compliance to these 4 units so that they discharge their effluents strictly in accordance with the prescribed parameters and do not cause pollution. They should be subjected to joint inspection and, if they are found to be violating the prescribed parameters and are polluting, they should be ordered to be shut down.

ii. The BOD level shall be brought down by these industries. As for the STP, parameter 10 mg/l should be in accordance with the prescribed parameters irrespective of what is the prescribed value. These units have been already subjected once to the Joint Inspection, and the recommendations made by the Joint Inspection Team in relation to each of the units shall be carried out positively within three months from the date of the order, when they shall be subjected to re-inspection by the Joint Inspection Team.

iii. All the drains including Abu Nallah-1 should be cleaned and all waste removed, transported and disposed in accordance with the Solid Waste Management Rules, 2016.

iv. Direction be also issued to the Meerut Development Authority to recycle this water of these STPs for horticulture or allied purposes and reduce the extraction of ground water.

v. The dredging of all the three drains i.e. Abu Nallah- 1, Abu Nallah-2 and Odean should be done and the dredged material/silt shall be removed within three days thereafter and transported to the appropriate site as to be identified.

ABU NALLAH-2 & ODEAN DRAIN

i. The joint inspection team shall also recommend, if the STP which is proposed should be only of 210 MLD or should be of a higher capacity keeping in view that there will be remnant effluent as depending on the quality and quantum of the discharge in the drain. There are two industries in the catchment area of Abu Nallah-2 i.e. M/s. Sab Mailler India Ltd. and M/s. United Spirits Limited. Both these industries have been subjected to joint inspection and recommendations have been made. These industries will comply with the recommendations of the joint inspection team within three weeks from today.

ii. In the event of default, they shall be liable to be closed down. The joint inspection team shall further be entitled to issue directions for compliance under the orders of the Tribunal to these industries.

iii. The CPCB, SPCBs, MoEF&CC and MoWR have expressed the view that the industries located in Moradabad and Meerut are primarily using Cyanide based Zinc for electroplating industries. They should be directed to use non-cyanide based technology for electroplating purposes.

iv. We direct Central Pollution Control Board to issue directions forthwith that this would apply to the entire basin area of the river Ganga.

CHHOIYA DRAIN (RIVER KALI-EAST)

i. The Tribunal is of view that specific directions are required to be issued with regard to industries located in the catchment area of this drain. These industries should be required to comply with prescribed standards stringently and should not be permitted to cause pollution any further. The Joint Inspection Team shall conduct inspection of all the majorly polluting industries located in the catchment area of this drain and would issue appropriate directions for compliance by industries.

ii. The joint inspection should be completed and directions should be issued within six weeks from the

date of passing of this judgement. The industries should comply with said directions of Joint Inspection Team within the prescribed time stated in the conditions and in the event of default, they shall be ordered to be shut down by UPPCB without any further notice and delay.

iii. The drains should be subjected to dredging, cleaning and removing of MSW. The UPPCB shall serve a notice upon all industries located in the catchment area of this drain to lay hold of an effective Corporate Social Responsibility and to ensure that the drain is kept cleaned and no waste is permitted to be thrown into it.

HAPUR DRAIN

i. All these 7 industries falling in Hapur catchment area district shall be subjected to joint inspection. The Joint Inspection Team shall issue appropriate directions with regard to proper installation of anti-pollution devices and for taking appropriate measures so as to ensure that they are compliant and do not cause any pollution. In the event of non-compliance of directions, they shall be liable to be closed by UPPCB without further notice.

KADRABAD DRAIN

i. It is directed hereby that the industries that are contributing to the pollution to the said drains should

install anti-pollution devices and take appropriate measures.

ii. The Joint Inspection Team should issue directions to these industries stating parameters, they are required to maintain as well as the steps that they should lay hold of to prevent and control pollution. The joint inspection team should also specify the period for compliance to ensure that these industries become compliant and non-polluting within a specified period.

iii. Also following general directions need to be issued in relation to all the industries located in the catchment area of Kali-East river:

1. They should be strictly regulated.
2. Joint inspection should be conducted.
3. Compliance should be strictly made. If there is default in compliance within the prescribed period, which normally should not exceed 3 to 6 months, the industries should be shutdown.

GULAOTHI DRAIN

i. Amongst the industries causing pollution, there are two main industries in the catchment area of this drain. Both M/s V.R.S. Food Limited Unit-3 and M/s V.R.S. Food Limited Unit-4 are dairy units causing serious pollution. They should be directed to strictly adhere to the prescribed norms which should be

subjected to joint inspection. Detailed directions in terms of Section 33A of the Water Act read with Section 5 of the Environment (Protection) Act, 1986 should be issued. In the event of dis-obedience or non-adherence within the prescribed period, they should be ordered to be shut down.

ii. The UPPCB should also issue notice to these industries as well as to other industries which are discharging their untreated effluents or pollutants into this drain as to why they should not be called upon to pay environmental compensation in terms of Sections 16 and 17 of the National Green Tribunal Act, 2010.

iii. The said Board in addition to the inspection by the Joint Inspection Team along with other public authorities should conduct complete survey of this area and prepare list of the polluting industries which are discharging their effluents into this drain and submit a report to this Tribunal.

Thus, we issue the above directions for compliance by the concerned authorities and the UPJN to take steps for construction of the STP.

NEEM NALLAH:

i. As the Joint Inspection Team had not conducted inspection and taken the measurement of flow and the quality of effluent, we, therefore, direct the Joint

Inspection Team to carry out measurement of flow and the quality of effluent of the drain.

ii. Even, the UPJN has proposed construction of an oxidation pond or a constructed wetland for treating sewage. Parties are in agreement that there need not be construction of mechanical STP at the end of the drain.

PATTA NALLAH, ADANGAPUR DRAIN AND TAMMY NALLAH:

i. All the stakeholders agree that keeping in view the pollutant values of the content of the drain, it will be most appropriate to have an oxidation pond/constructed wetland to reduce the BOD and mainly coliform. This remedy would be least expensive, cost effective and most beneficial. However, for the reason best known to Jal Nigam, they have an STP of the capacity of 13 MLD at the end point of Patta Nallah, which will cost several crores, and is nearing completion. Besides, sewerage network has to be laid down to provide sewage connection. They have already completed 90% work of STP and 70% of sewer network has been laid. In these peculiar circumstances, we do believe that the project of Jal Nigam, which is not study based, was avoidable. But in view of large work having already been carried out, we permit this project to be

completed and 13 MLD STP should be made functional within three months from today.

ADANGAPUR DRAIN AND TAMMY DRAIN:

i. We permit the UPJN to complete the STP of 13 MLD at the end of Patta Nallah before it meets the river.

ii. Directions have already been issued to complete the work within three months from the date of issue of order dated 31st May, 2017 of the Tribunal.

iii. The parties would ensure the compliance as well as that the discharge from the STP should be strictly within the parameters and it is recycled, wherever possible.

iv. We further direct to construct the oxidation pond/wet lands for treatment of sewage in relation to the other two drains i.e. Adangapur Drain and Tammy Nallah.

v. Since there is considerable difference between the measures taken by the Joint Inspection Team and UPJN, we direct that the Joint Inspection Team shall measure the flow of all the three drains (Patta Nallah, Adangapur Drain and Tammy Drain). It should also examine if the flow is 6.5 MLD, as stated by the Joint Inspection Team then the possibility of other two drains being intercepted and brought to the same STP as their discharge is just 4.36 MLD and 1.52 MLD be examined. In that event, the entire discharge could be brought to the proposed STP and treated there

and, there should be no occasion to construct oxidation ponds/wet lands. This study should be completed within six weeks from the date of passing of this order.

183. The Registry of the Tribunal is directed to upload this judgement on the website of NGT today itself. Further, the Ld. Registrar General of NGT should send a personal communication to all the stakeholders, including the Secretaries of the concerned Ministries, Chief Secretary of the State of UP, NMCG and the heads of the local authorities and bodies and the Members of the Committee under this judgement, informing them that the period to be reckoned under the judgement triggers from the date of pronouncement itself and in the event of default or non-compliance, they would be liable to be proceeded against, in accordance with law.

184. In any event, the State, its instrumentalities, local authorities and all other public servants would extend their full cooperation for effectively implementing and executing the directions contained in this judgement. If any officer/official is found to be causing unnecessary impediments in compliance of the judgement, the officer/official concerned shall be liable to be proceeded against, in accordance with law including action for Contempt of Court and payment of personal costs as well.

185. We not only express a pious hope but we are confident that

all stakeholders will work in tandem and extend full cooperation to each other to implement this judgement. They shall make a concerted effort to achieve the object of this national project of cleaning and rejuvenation of river Gang and its tributaries. There is no scope for waiting any further. Stakeholders have to take both effective and remedial measures to restore the pristine nature of the holy river Ganga and its tributaries, now, atleast.

186. Ergo we dispose of the above applications and appeal to the limited extent with the directions and orders as afore-stated, while leaving the respective parties to bear their own costs.

Swatanter Kumar
Chairperson

Jawad Rahim
Judicial Member

Raghuvendra S. Rathore
Judicial Member

Bikram Singh Sajwan
Expert Member

Ajay A Deshpande
Expert Member

Nagin Nanda
Expert Member

New Delhi
13th July, 2017

No. T-12/2015-16/1086/NMCG

National Mission for Clean Ganga

Ministry of Water Resources, River Development & Ganga Rejuvenation

Government of India

1st Floor, Major Dhyan Chand

National Stadium New Delhi – 110002

Dated: 19th May 2017

To,

The Project Director, SPMG

UP State Ganga River Conservation Agency

Government of Uttar Pradesh

2, Lal Bahadur Shastri Marg

Lucknow-226001

Sub: Administrative Approval and Expenditure Sanction for the project on "Interception, Diversion & Sewage Treatment Plants (STP) Works" For Naini (District G) & Phaphamau (District F) in Allahabad city and Jhunsi Area of Allahabad district under Namami Gange Programme at an estimated cost of ₹ 767.597 Crores (Rupees Seven Hundred Sixty Seven Crores Fifty Nine Lakhs Seventy Thousand only) under Hybrid Annuity based PPP mode.

Sir,

I am directed to convey the Administrative Approval and Expenditure Sanction for the project on **"Interception, Diversion & Sewage Treatment Plants (STP) Works" For Naini (District G), Phaphamau (District F) and Jhunsi Area District: Allahabad Under Namami Gange Programme** at an estimated cost of **₹ 767.597 Crores** (Rupees Seven Hundred Sixty Seven Crores Fifty Nine Lakhs Seventy Thousand only) with 100% central funding with the following major project components.

a. **Naini (District G)**

- Construction of Nala Tappings - 05 Nos.
- Sewage Pumping Stations (New) - 3 Nos.
- Rising Main (300 + 800 + 900 mm) – (950 + 700 + 200 m).
- Interceptor/ Trunk Sewer (1400 + 1600 mm) – 6335 m (3840 + 2495 m).
- Trunk Sewer (350 + 600 mm) – 3190 m (350 + 2840 m).
- Construction of STP 42 MLD (14 + 14 + 14) - 01 no.
- Effluent channel (1600 mm) – 1 km.

b. **Phaphamau (District F)**

- Construction of Nala Tappings - 02 Nos.
- Sewage Pumping Stations (New) - 2 Nos.
- Rising Main (350 + 500 mm) – 750 + 50 m.
- Trunk Sewer (500 + 600 + 800 mm) – 985.08 m (144.36 + 245.47 + 595.25 m).
- Construction of STP 14 MLD (7 + 7) - 01 no.

- Effluent channel (1000 mm) – 1.1 km.

c. **Jhunsi:**

- Construction of Nala Tappings - 13 Nos.
- Sewage Pumping Stations (New) - 2 Nos.
- Rising Main (600 mm) - 570 m.
- Ghat Sewer Line/ Interceptor/ Trunk Sewer (200 + 250 + 300 + 400 + 800 mm) – 2700 m (585 + 520 + 240 + 255 + 1100).
- Gravity Main/ Trunk Sewer (900 mm) – 3198 m.
- Construction of STP 16 MLD (8+8) - 01 no.
- Effluent channel (900 mm) – 2 km.

d. **For all I/ D and STP Works:**

- Online Monitoring for STP - 06 Nos. (Inlet & Outlet)
- Solar Power Plant – 1 MW (Naini), 500 KW (Phaphamau) & 200 KW (Jhunsi).
- Micro Hydro Power Plant – 500 KVA (Naini), 2.5 KW (Phaphamau & Jhunsi).
- O & M for I/ D and STP Works – 15 years.

2. The summary of project cost is given below and detailed cost break-up is at **Annexure-I.**

Sl.No	Description of Work	Estimated Cost in ₹ Lakhs		
A	Costs to be borne by Central Government	Naini	Phaphamau	Jhunsi
1	Capital Works Cost	14447.21	4999.57	7635.09
2	Miscellaneous Items (ESMP,GAAP,CPO, Power Connection & Labour Cess)	434.71	225.56	271.55
3	Project Preparation & supervision Charges (limited to 4% max for each)	1155.78	399.966	610.808
	Total Capital Cost - Subtotal (1+2+3)	**16037.70**	**5625.10**	**8517.44**
4	15 Year's O & M Cost	21771.19	10918.76	13889.46
	Total Project Cost	**37808.89**	**16543.86**	**22406.91**
	Total			**76759.66**

3. Administrative Approval and Expenditure Sanction for the project is granted subjected to the conditions as per **Annexure –II.**
4. The period of completion of the project is 36 (Thirty Six) months from the date of this sanction, including bidding process, award of work, as per **Annexure – III,** and 15 years Operation & Maintenance.
5. The grantee institution i.e. 'Uttar Pradesh Rajya Ganga Nadi Sanrankshan Abhikaran', the State Programme Management Group (SPMG), is an agency of the State Government constituted with the objective of serving as the dedicated institution for effective implementation of the NGRBA programme activities at the State level, and the State is responsible in the long term for the conservation and health of the State's stretch of the river Ganga.
6. The **'Uttar Pradesh Jal Nigam'** is the executing agency for the project to take up the I/ D and STP Works pertaining to pollution abatement of the River Ganga in the identified areas of Allahabad, Uttar Pradesh along river Ganga on hybrid annuity based PPP model.
7. The compliance with the observations of TPA, NMCG & World Bank will be ensured by UPJN. Further, UPJN may ensure that there are no overlaps with the works being

undertaken by GOUP and obtain necessary NOCs, including land availability, from the State required for the project before awarding the contract.

8. The project will be implemented on hybrid annuity based PPP mode.
9. Any procurement of goods, works and consultancy if required by UPJN as part of implementing the project proposal shall be made strictly as per the prevailing procurement guidelines of Govt. of India/NGRBA framework / World Bank guidelines (if applicable).
10. The project will be funded under EAP Component -World Bank assisted project (Component A of Namami Gange), subject to the NOC received from World Bank, otherwise the funding will be from National Ganga Plan. The NMCG/Government of India reserves the right to withdraw the sanction at any stage, if it is convinced that the fund has not been properly utilized or appropriate progress is not being made.
11. In case of violation of any of the conditions of the letter of award or in case of closure or dissolution of the executing agency, the Government shall take possession of all the assets of the organization acquired out of the Government funds and use them in any manner deemed appropriate or to recover from the organization the value of such assets at its discretion.
12. This AA&ES is issued based on the appraisal and sanction of the Executive Committee (EC) vide its 3rd meeting held on 11th May 2017, and under the financial powers delegated vide OM No. 1 (3)/PF.II/2001 dated 15.11.2007 amended vide OM number 24(35)/PF-II/2012 dated 29/08/2014 of the Ministry of Finance (Deptt. Of Expenditure), with the approval of Director General – National Mission for Clean Ganga and concurrence of Director (Finance) vide Dy. No. 325/ED-Finance (NMCG) dated 17.05.2017.

Yours faithfully,

(Nityananda Ray)
Deputy Secretary, SMD

Copy forwarded for information & compliance of below mentioned conditions to:-

1) The Chief Secretary, Government of Uttar Pradesh, Lucknow-226001.
2) The Managing Director, UP Jal Nigam, 6-Maharana Pratap Marg, Lucknow, 226001

Copy forwarded for information to:-

1) PS to Hon'ble Minister (WR, RD & GR), Shram Shakti Bhawan, N. Delhi-110001
2) PPS to Secretary, MoWR, RD & GR, Shram Shakti Bhawan, New Delhi-110001
3) PS to Director General, NMCG
4) Executive Director (Finance), NMCG, N. Delhi
5) Executive Director (Projects), NMCG, N. Delhi
6) Executive Director (Technical), NMCG, N. Delhi
7) Executive Director (Admin), NMCG, N. Delhi
8) NMCG Officials / Sanction Folder /Guard File/Computer Cell, MIS/ NMCG.

(Nityananda Ray)
Deputy Secretary, SMD

Annexure-I

Summary of cost of the project proposal of "Interception, Diversion & Sewage Treatment Plants (STP) Works" For Naini (District G) & Phaphamau (District F) in Allahabad city and Jhunsi Area District of Allahabad district under Namami Gange Programme

a. **Naini:**

Sl.No	Description of Work	₹ in Lakhs
A	**Interception & Diversion Works**	
1	9.525 km trunk sewer line	4552.9
2	Nala Tapping works (5 nos.)	75.61
3	Main Sewage Pumping Station (42.5/ 60.0 MLD Avg.)	1124.5
4	Rising Main from MPS to STP (900 mm, 200 m)	53
5	Mawaiya Sewage Pumping Station (33.5/ 45 MLD Avg.)	1027.41
6	Rising Main from SPS to Trunk Sewer (800 mm, 700m)	180.31
7	Mahewaghat SPS (2.5/ 3.5 MLD Avg.)	613.1
8	Rising Main from SPS to Trunk Sewer (300 mm, 950 m)	126.11
	Sub Total (A)	**7752.94**
B	**Sewage Treatment Plant**	
1	SewageTreatment Plant (42 MLD)	5670
2	Effluent disposal arrangement (1600 mm, 1 km)	409.27
3	Installation of 1.0 MW capacity Solar Power Plant	600
4	Installation of 500 kVA capacity Micro Hydro Power Plant	15
	Sub Total (B)	**6694.27**
	Sub Total (A+B)	**14447.21**
C	**Miscellaneous Items**	
1	Communication & Public Outreach	45
2	GAAP	30
3	Environmental Mitigation Plan (EMP)	80
4	UPPCL Charges	135.24
5	Labour Cess @ 1%	144.47
	Sub Total (C)	**434.71**
	Sub Total (A+B+C)	**14881.92**
D	**Project Preparation & Supervision**	
1	Project Preparation (subject to the ceiling of 4% of A+B)	577.89
2	Project Supervision (subject to the ceiling of 4% of A+B)	577.89
	Sub Total (D)	**1155.78**
	Total Capital Works (A+B+C+D)	**16037.70**
E	**15 Year's O & M Cost**	**21771.19**
	Total Project (Naini) Cost	**37808.89**

b. Phaphamau:

Sl. No	Description of Work	₹ in Lakhs
A	**Interception & Diversion Works**	
1	0.985 km trunk sewer line (500 – 800 mm)	371.87
2	Nala Tapping works (2 nos.)	49.95
3	Shantipuram Main Sewage Pumping Station (14.0/ 21 MLD Avg.)	1007.39
4	Rising Main from MPS to STP (500 mm, 50 m)	11
5	Basna Sewage Pumping Station (5.5/ 8.0 MLD Avg.)	716.46
6	Rising Main from SPS to 350 mm Ø Trunk Sewer (750 m)	73.2
	Sub Total (A)	**2229.87**
B	**Sewage Treatment Plant**	
1	SewageTreatment Plant (14 MLD)	2100
2	Effluent disposal arrangement (1000 mm, 1.1 km)	362.2
3	Installation of 500 KW capacity Solar Power Plant	300
4	Installation of 2.5 KW capacity Micro Hydro Power Plant	7.5
	Sub Total (B)	**2769.7**
	Total (A+B)	**4999.57**
C	**Miscellaneous Items**	
1	Communication & Public Outreach	25
2	GAAP	20
3	Environmental Mitigation Plan (EMP)	40
4	UPPCL Charges	90.56
5	Labour Cess @ 1%	50
	Sub Total (C)	**225.56**
	Total (A+B+C)	**5225.13**
D	**Project Preparation & Supervision**	
1	Project Preparation (subject to the ceiling of 4% of A+B)	199.983
2	Project Supervision (subject to the ceiling of 4% of A+B)	199.983
	Sub Total (D)	**399.966**
	Grand Total Capital Works (A+B+C+D)	**5625.10**
E	**15 Year's O & M Cost**	**10918.76**
	Total Project (Phaphamau) Cost (A+B+C+D+E)	**16543.86**

c. Jhunsi:

Sl.No	Description of Work	₹ in Lakhs
A	**Interception & Diversion Works**	
1	2.7 km Ghat sewer line (200-800 mm)	563.81
2	Nala Tapping works (13 nos.)	266.78
3	Main Sewage Pumping Station (16/ 20 MLD Avg.)	916.61
4	Rising Main from MPS to STP (50 m, 600 mm)	13.81
5	Shastri Bridge SPS (16/ 20 MLD)	977.16
6	Rising Main from SPS (570 m, 600 mm)	142.23
7	3.198 Km Diversion Trunk Sewer (900 mm)	1762.28
	Sub Total (A)	**4642.68**
B	**Sewage Treatment Plant**	

1	Dismantling existing 1.5 MLD ADA Trivenipuram STP	30
2	Sewage Treatment Plant (16 MLD)	2400
3	Effluent disposal arrangement (2.0 km, 900 mm)	434.91
4	Installation of 200 KW capacity Solar Power Plant	120
5	Installation of 2.5 KW capacity Micro Hydro Power Plant	7.5
	Sub Total (B)	**2992.41**
	Sub Total (A+B)	**7635.09**
C	**Miscellaneous Items**	
1	Communication & Public Outreach	25
2	GAAP	20
3	Environmental Mitigation Plan (EMP)	40
4	UPPCL Charges for 16 MLD SPS & 16 MLD MPS	110.2
5	Labour Cess @ 1%	76.35
	Sub Total (C)	**271.55**
	Sub Total (A+B+C)	**7906.64**
D	**Project Preparation & Supervision**	
1	Project Preparation (subject to the ceiling of 4% of A+B)	305.404
2	Project Supervision (subject to the ceiling of 4% of A+B)	305.404
	Sub Total (D)	**610.808**
	Sub Total (A+B+C+D)	**8517.448**
E	**15 Year's O & M Cost**	**13889.46**
	Total Project (Jhusi) Cost of DPR	**22406.91**

Total Project Cost (Naini, Phaphamau & Jhusi) in crore rupees	**767.60**

Land required for SPS has been identified and will be purchased by the State/ Allahabad Nagar Nigam at its own cost. State/ Executing Agency has kept provision of **₹ 4.2 Crores** (Naini), **₹ 4.0 Crores** (Phaphamau) and **₹ 2.4 Crores (Jhunsi)** in the DPR towards land acquisition.

Annexure-II

Conditions on Administrative Approval and Expenditure Sanction for the project on Interception, Diversion & Treatment Works" For Naini (District G) & Phaphamau (District F) in Allahabad city and Jhunsi Area of Allahabad district under Namami Gange Programme

1.0 General Conditions:

i. 'Uttar Pradesh Ganga Nadi Sanrakshan Abhikaran', the State Programme Management Group (SPMG), which is a registered society, shall be responsible for overall planning, management and effective implementation of the project at state level.

ii. 'Nagar Nigam, Allahabad' i.e. 'Municipal Corporation of Allahabad' shall be the Urban Local body (ULB) responsible for ensuring commitment to ownership, commitment to reforms for sustainable O & M, and community involvement.

iii. The Uttar Pradesh Jal Nigam (UPJN) shall be the Executing Agency (EA) of the project to be implemented under the guidance of the SPMG, in coordination and consultation with the ULB and overall monitoring of the National Mission for clean Ganga (NMCG) as per provisions laid down in the NGRBA programme framework.

iv. The project will be executed in Hybrid Annuity based PPP model and needs to be suitably aligned with the 'Strategic Sanitation Plan'/ 'City Sanitation Plan'/ 'Master Plan' for Allahabad city. Also, synergy shall be ensured with other Central/State sponsored programme like JnNURM, UIDSSMT etc. in the city of Allahabad to avoid any overlap / duplication.

v. The cost towards 15 years Operation and Maintenance (O & M) has been included in the project cost. However, Operation and Maintenance (O & M) of the project in Hybrid Annuity based PPP model for the period beyond 15 years will be responsibility of the State Government/ Urban Local Body. Sustainable revenue generation from beneficiaries, re-use of treated effluent and waste to energy etc. shall be encouraged.

vi. State Government shall submit a final DPR including ESAMP in accordance with the TPA / NMCG / World Bank observation before bidding including compliance to the following:

   a. The detailed project implementation plan, detailed design and engineering of the project shall be undertaken by UPIN based on extensive survey and investigation before execution. Disaster management concerns shall also be taken into account while executing the project.
   b. Quotation for solar power plant needs to be obtained.
   c. Cost breakup needs to be provided for micro hydro power plant.
   d. Outfall drain level needs to be provided.
   e. Bye pass arrangements need to be provided in case of any failure of STP.
   f. Sections of gravity main and outfall channel need to be provided.
   g. Hydraulic gradients and energy lines need to be provided for the flow in proposed sewers.
   h. Justification of 1000 mm diameter pipe and effluent channel rate analysis needs to be submitted.
   i. Quotation needs to be provided for STP for which per MLD cost is too high (about 21 Cr. for 14 MLD, i.e. 1.5 Cr. per MLD).

j. BOD in the two drains is too low (Shantipuram drain BOD: 40.0 mg/L, Basna drain BOD: 36.2 mg/L). As per the GPS coordinates of the drains available in the DPR, it appears that one of the drain is a canal/river. The main issue with the water quality of drains is high Coliform. To address this issue, the tender may be called on technology neutral basis.

k. An undertaking to be provided by UPJN that trunk sewer being proposed is not being proposed in any other scheme.

l. It must be ensured that all foundations are above High Flood Level. Proper soil testing needs to be ensured before any construction.

vii. State Government / Executing Agency shall comply with all the observations of TPA/ NMCG/ WB before bidding and during implementation wherever possible.

viii. State Government / Executing Agency shall generate wastewater flow data (drain), wastewater characteristics and river water quality monitoring through actual monitoring and analysis at regular intervals (at-least monthly basis).

ix. State Government/ Executing Agency shall appoint a Transaction Advisor in consultation with NMCG for facilitating the bidding process on Hybrid Annuity based PPP model.

x. State Government/ Executing Agency shall follow the applicable procurement procedures (WB present guidelines if funded under WB Assisted Project).

xi. State Government/ Executing Agency shall ensure reuse of treated water from Naini STP to Meja Thermal Power Plant of NTPC and also explore potential reuse of the treated water from other STPs as well.

xii. All components of the project shall be completed within specified time limits and the resources and outputs and outcomes are to be ensured as envisaged in the approved project. Completion Report shall be submitted to NMCG on completion of the project.

xiii. Any additional component relevant for project or any component require modification or deletion, may be added or modified or deleted as the case may be, only with the prior approval of the Competent Authority.

xiv. Any project cost overrun or time overrun will be brought in the notice of NMCG. Decision of cost overrun and time overrun will be granted based upon discussion in Executive Committee (EC) of NMCG. Cost overrun, if any will be borne by the Central Government.

xv. Staffs that may be employed for preparation, execution or operation of the project by the EA are not to be treated as employees of the SPMG/ NMCG. The deployment of such staff at the time of completion or termination of the project will not be the concern or responsibility of the SPMG/ NMCG.

xvi. Optimal utilization of the assets relating to the project and created under Ganga Action Plan or any other Central/ State Plan shall also be ensured by the SPMG/ EA/ ULB.

xvii. All data, records, documents and material related to the project shall be stored properly and catalogued by the SPMG/ EA for reference and retrieval including regular uploading/ disclosure/ updating of such data on website.

xviii. The State/ SPMG/ EA shall ensure that all provisions of the RTI Act 2005 are adhered to as far as information pertaining to the project is concerned.

xix. The State/ SPMG/ ULB shall ensure that public is informed in the State/ city of Allahabad regarding implementation of the project and soliciting their co-operation and views as applicable.

xx. For the provisions made under IEC activities, the SPMG shall make suitable arrangements with Nagar Nigam, Allahabad for executing the 'Communication and Public Outreach'

programme under its supervision towards sensitization of people for abatement of pollution and conservation of river Ganga.

xxi. Conditions / commitments indicated in this Approval, Executive Committee Memorandum, Minutes and other documents including those to be fulfilled before finalizing the bid document(s) shall be strictly adhered to in the project implementation and management. The SPMG will ensure fulfillment of such conditions before finalizing the bid(s) by the EA. Copies of EC Memorandum, Minutes, appraisal reports, observations and other related documents are already circulated.

2.0 The release of funds is subject to the following terms and conditions:-

2.1 Annual Plan and Procurement Plan:

i. The Annual Plan and yearly Procurement Plan shall be prepared by the month of November every year for the next financial year as per the provisions made in the NGRBA programme framework and submitted by the SPMG to the NMCG for necessary approval and budget allocations.

ii. The SPMG shall furnish to the NMCG annually a report of its work within three months from the closing of the respective financial year.

2.2 Financial Aspects:

i. Funds shall be made available to the agencies strictly as per the 'Financial Management Manual (FMM)' of the NGRBA programme framework.

ii. The SPMG/ ULB shall take all necessary legal and executive measures to ensure adequate resources available for operation & maintenance of the assets created under the Project to fulfill its mandate.

iii. The funds released for the project shall be held in an interest earning NGRB project bank account of the SPMG (the mother account). The interest thus earned shall be credited to the project and reflected in the Interim Un-Audited Financial Reports (IUFRs) from time to time and shall be adjusted towards future funds release for the project. For any diversion of funds, the signatory of the bank account(s) shall be held responsible.

iv. The SPMG/ EA are not permitted to seek or utilize funds for the same purpose from any other organization (Government, semi-Government, autonomous or private) without prior approval of the competent authority.

v. The sanctioned amount should be spent exclusively thereon as per the scope of the project and within the stipulated time. For carrying forward any work(s)/ activities beyond the specified time limit prior approval of the NMCG should be obtained.

vi. It is the responsibility of the SPMG/ EA/ ULB to ensure that the assets are exclusively used for the purpose for which the grant is sanctioned and to maintain the assets and their records properly.

vii. All the assets acquired/created out of the grants shall not be disposed of, encumbered, or utilized for any purpose other than that for which sanctioned without prior approval of the Government.

2.3 Audit:

i. The Comptroller & Auditor General of India (the External Auditor) at his discretion shall have the right of access to the project related books and accounts of the SPMG/ EA for the purpose of Audit.

ii. The books of accounts of the grantee, relating to this grant, shall be open to Audit by the Internal Auditor of the SPMG and the External Auditor.

iii. The overall auditing arrangements to cover both periodical internal and annual external audit of project shall be ensured as per the 'Financial Management Manual (FMM)' of the NGRBA programme framework.

2.4 Flow of Funds:

The fund releases by the NMCG shall be remitted by Electronic transfer to the SPMG account. The fund shall flow from the SPMG account to a separate sub-project specific zero balance bank account (the 'child account') of the EA in the same bank of SPMG. The following details may be kept updated from time to time to enable electronic remittance:-

i. Bank account details of EA, both in figures and words, to SPMG.

ii. Bank account details of EA and SPMG both in figures and words to NMCG.

iii. MICR Code and IFSC Code of the Bank Branch (es).

iv. Necessary authorization by the SPMG to its Bank to receive the remittances on its behalf and to issue necessary bank receipt to the NMCG's bank for receipt of funds.

v. Necessary authorization by the EA to its bank and under such authorisation, to issue payment instruction to pay contractors / suppliers / service providers for undertaking project activities.

vi. The NMCG Bank will transfer funds from the NMCG's account to the SPMG account on submission of Interim Un-Audited Financial Report (IUFR) and other documents/ information as prescribed in the Financial Management Manual (FMM), of the NGRBA programme framework.

vii. The SPMG Bank will transfer funds from the SPMG's account (mother account) to the child account of EA as soon as payment instruction is issued by the EA to its banker for transfer funds to contractors / suppliers / service providers account on the same date through 'Real Time Gross Settlement (RTGS)" and thus at the end of any given day, the EA child account will always have a zero balance.

2.5 Submission of Monthly and Quarterly Physical Progress Report (MPPR / QPPR):

i. The Monthly Physical Progress Reports (MPPRs) shall be submitted by the 5th day of every month regularly by the EA to the SPMG and by the 10th day of every month regularly by the SPMG to the NMCG. The Quarterly Physical Progress Reports (QPPRs) shall be submitted to the Uttar Pradesh State Ganga River Conservation Authority' and NMCG within 30 days from the end of each quarter.

ii. The MPPRs in standard format, to be developed by the EA in consultation with SPMG, shall be signed by at least two designated officers of the EA, one of whom will be Chief Project Coordinator, UPJN and also by at least two designated officers of the SPMG, one of whom will be the Programme/ Project Director.

iii. The signing officers will indicate her/ his name and designation in full in capital letters and affix official seal under the signature. While MPPR submitted by fax will be acceptable for commencement of processing the case, ink-signed MPPR must follow by Post.

iv. Consistency between physical progress and expenditure shall be maintained and reasons for substantial variations i.e., more than 10% shall be appropriately explained against each item.

2.6 Submission of Accounting and Financial Reports (AFR) by the EA:

i. The EA shall furnish monthly 'Accounting and Financial reports (AFRs)' by the 10th day of every month with all relevant documents and materials as per the 'Financial Management Manual (FMM)' of the NGRBA programme framework after commencement of the project to the SPMG and by the 20th day of every month regularly by the SPMG to the NMCG.

ii. The 'Accounting and Financial Report (AFR)' in standard format, to be developed by the EA in consultation with SPMG, shall be signed and stamped by the Head of the Accounts Department and Head of the Organization, UPJN.

iii. The name and designation of the officers signing the AFR shall be clearly mentioned in full and in capital letters. While AFR submitted by fax will be acceptable for commencement of processing the case, ink-signed AFR must follow by Post.

iv. As part of the AFR, the EA shall submit the followings to the SPMG:

v. Invoices of suppliers/ contractors against which online payment instructions issued by the EA in the previous month.

vi. A list of invoices received and not paid during the previous month.

vii. A list of contracts signed during the previous month.

2.7 Submission of Utilisation Certificates (UCs):

i. The quarterly Utilisation Certificates (UCs) in the prescribed format (GFR 19A & 19B) shall be furnished by the EA to the SPMG in respect of grant-in-aid received during the various quarters within 30 days from the end of quarter, duly signed and stamped by the Head of the Organisation, Head of the Accounts Department and field level functionary at executive engineer level / Principal Investigator, as applicable.

ii. The SPMG shall submit quarterly UCs, duly countersigned and stamped by the Head of the SPMG and the State authorities within 15 days on receipt of the same from the EA.

2.8 Inspection and Monitoring:

i. The 'Uttar Pradesh State Ganga River Conservation Authority' and its Standing Executive Committee shall ensure close monitoring and evaluation of progress of the project, and also monitor implementation performance of the EA.

ii. The SPMG shall ensure appointment of agency (ies) for third party inspection (TPI)/ evaluation of the project strictly as per letter No. A-12012/2/2010-NRCD-II dated 1st September, 2010. The EA through the SPMG shall submit copies of the TPI Reports along with their responses/comments to the NMCG. Releases of funds will be subject to compliance of TPI reports.

iii. City level Citizen's Monitoring Committees (CMC) shall be constituted in the Allahabad city to serve as a transparency mechanism on flow of project / programme related information to citizens and key stakeholders and to garner their feedback on project / programme processes, as described in the NGRBA programme framework. Social audit will be conducted by the CMC as per the provisions of the NGRBA programme framework.

iv. NMCG may depute any person to visit the SPMG/ EA for the purpose of monitoring its work and accounts of the SPMG. Full co-operation shall be provided by the EA to the persons deputed for inspection.

v. Time and cost overrun leading to delay in implementation of projects is viewed with serious concern by the Central Government and as per instructions contained in Cabinet Secretary's D.O. letter No. 261/1/10/2000-Cabinet, dated June 4, 2001 read with Planning Commission's D.O. letter No. O-14015/2/98-PAMD, dated 19.08.1998 (kindly visit NGRBA website/ 'Project Monitoring' for details), mandatory review of the project must be carried out from time to time so as to assess the expenditure trend and time schedule of the project and appropriate action against those responsible for delay shall be taken, in accordance with the instructions.

vi. The Director General, NMCG may monitor overall progress of project periodically from time to time.

a. Naini:

IMPLEMENTATION PLAN FOR I& D AND STP FOR THE DRAINS & NALA OF NAINI (DISTRICT-G) OF ALLAHABAD CITY																													
ID	Task Name	Duration (Months)	Year - 1				Year - 2				Year - 3				Year - 4				Year - 5				Year - 6				Upto 15 years from commissioning			
			I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q
1	Finalisation of Bid Document	2																											
2	Publication of Bid notification	1																											
3	Receipt of Bids from Bidders	2																											
4	Bid Evaluation and Recommendation	3																											
5	Approval by NMCG	0.5																											
6	Award of Work/Contract	0.5																											
7	Construction, testing & commissioning	27																											
8	15 Years Operation & Maintenan	180																											

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b. Phaphamau

IMPLEMENTATION PLAN FOR I& D AND STP FOR THE DRAINS & NALA OF PHAPHAMAU (DISTRICT-F) OF ALLAHABAD CITY

ID	Task Name	Duration (Months)	Year - 1				Year - 2				Year - 3				Year - 4				Year - 5				Year - 6				Upto 15 years from commissioning			
			I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q
1	Finalisation of Bid Document	2																												
2	Publication of Bid notification	1																												
3	Receipt of Bids from Bidders	2																												
4	Bid Evaluation and Recommendation	3																												
5	Approval by NMCG	0.5																												
6	Award of Work/Contract	0.5																												
7	Construction, testing & commissioning	27																												
8	15 Years Operation & Maintenan	180																												

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c. **Jhunsi:**

IMPLEMENTATION PLAN FOR I& D AND STP FOR THE DRAINS & NALA OF JHUNSI AREA OF ALLAHABAD CITY

ID	Task Name	Duration (Months)	Year - 1				Year - 2				Year - 3				Year - 4				Year - 5				Year - 6				Upto 15 years from commissioning			
			I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q	I-Q	II-Q	III-Q	IV-Q
1	Finalisation of Bid Document	2																												
2	Publication of Bid notification	1																												
3	Receipt of Bids from Bidders	2																												
4	Bid Evaluation and Recommendation	3																												
5	Approval by NMCG	0.5																												
6	Award of Work/Contract	0.5																												
7	Construction, testing & commissioning	27																												
8	15 Years Operation & Maintenance	180																												

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A Guide to Decisionmaking

Technology Options for Urban Sanitation in India

30 years wsp water and sanitation program

सत्यमेव जयते
Government of India

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A Guide to Decisionmaking

Technology Options for Urban Sanitation in India

September 2008

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सत्यमेव जयते

भारत सरकार
शहरी विकास मंत्रालय
निर्माण भवन
GOVERNMENT OF INDIA
MINISTRY OF URBAN DEVELOPMENT
NIRMAN BHAWAN
नई दिल्ली–110011, तारीख दिसम्बर 4, 2007
New Delhi-110011, Dated the December 4, 2007

Foreword

As India moves ahead in the urban sector with major reform initiatives, like JNNURM and UIDSSMT, there is a need to address key capacity issues related to provision of basic services, in order to fulfill the underlying goals of these reforms. This is particularly true of the urban sanitation sector. Traditionally public policy on basic urban services in India has focused on water supply, which has enjoyed primacy in investments as well, while sanitation has lagged behind. Even today, almost one fourth of the urban populations in India do not have access to safe and adequate sanitation facilities. Inadequate access to sanitation especially in high density urban slum settlements is one of the key impediments to improving the quality of life and productivity of urban centers. In the absence of quick and effective remedial measures, we also run the risk of rapidly increasing vulnerability to disease caused by such conditions.

While urban India has invested significantly in sanitation infrastructure, this has essentially been focused on traditional sewerage networks, with some efforts directed towards individual and community toilets for economically weaker sections of society. These efforts have failed to deliver a safe sanitary environment in urban India as they typically lacked the comprehensiveness to address the full dimension of the sanitation challenge existing in the country. In particular, these efforts have failed in terms of targeting the sanitation needs of all sections of urban society, working towards triggering behavior change to ensure usage of the facilities created or their proper operation and maintenance.

Given the experience in the sector thus far, it is imperative that future efforts consider a range of technical options ranging from on-site to traditional centralized sewerage and treatment systems, on technoeconomic considerations, so as to draw up plans that are comprehensive and inclusive enough to cover all geographical locations and all sections of society. Total sanitation, in its fullest sense, must be the underlying objective of these plans. Capacity building in this regard through documentation of appropriate sanitation technology options and their technoeconomic implications, is a key need of the hour.

In this context, these guidance notes titled '**A Guide to Decisionmaking—Sanitation Technology Options for Urban India**', which have been developed by the Ministry of Urban Development (MoUD) with support from the Water and Sanitation Program-South Asia, are extremely timely. The documentation focuses on various technology options for provision of access, O&M and disposal arrangements related to sanitation services. While it has primarily been prepared to provide municipal agencies with the required sound technical advice on the planning of new investments and the delivery of sanitation services, it is also aimed at sensitizing state governments and urban local bodies in this regard. The documentation also provides guidance on implementation and financial issues, in addition to technical details.

The guidance note should be considered as an evolving document and a "work in progress" to enable it to grow on the basis of the actual experience of cities across the country. It is applicable to small interventions in specific locations and also to larger programs that aim to improve sanitation citywide. They are not aimed at being a set of rigid, exhaustive prescriptions, and should be adapted to the cities' specific circumstances in their application.

The Ministry of Urban Development wishes to thank WSP-SA and the various state and city authorities for their assistance in the preparation of these guidance notes.

M. Ramachandran
Secretary
Ministry of Urban Development

सत्यमेव जयते

भारत सरकार
शहरी विकास मंत्रालय
निर्माण भवन
GOVERNMENT OF INDIA
MINISTRY OF URBAN DEVELOPMENT
NIRMAN BHAWAN
नई दिल्ली–110011, तारीख दिसम्बर 4, 2007
New Delhi-110011, Dated the December 4, 2007

Message

South Asia contains more people without safe sanitation than any other region in the world. It is estimated that 17 percent of the urban population in India currently has no access to any sanitary facilities, while 50-80 percent of wastewater is disposed of untreated.

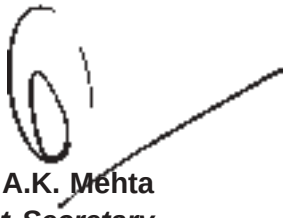
It is recognized that urban sanitation is dependant on a combination of sewerage and other on-site options and a great majority of urban residents are and will remain dependent on on-site sanitation facilities such as pour flush toilets discharging to leach pits or septic tanks. However, there is need to inform the people and the utilities on appropriate disposal of the waste and maintenance of the facilities.

In addition, municipal planners need to recognize that the worst sanitary conditions usually exist in areas inhabited by the poor and the sanition needs of these areas need to be addressed on priority. Construction of a toilet is generally regarded as the householder's responsibility but for poor households, investments in sanitation are often constrained by various issues including affordability and uncertainty over land tenure.

Special measures may therefore be needed to support service improvements for the poorest sections of the community. This does not mean subsidies and awareness campaigns only but also technology options along with a proper operations and maintenance plan, which suits the local context of these communities.

These guidance notes have been drafted to aid decisionmakers and practitioners, fully understanding the roles of each stakeholder to ensure a pragmatic and holistic sanitation plan which will focus on achieving sustainable outcomes. These guidance notes are designed to provide state governments and urban local bodies with additional information on the available technologies on sanitation and to aid them with how best and when to install them. I am confident that the guidance notes will contribute to triggering initiatives that could potentially lead to significant improvements in urban sanitation provision.

It was a privilege for me to be associated with the development of this document and I hope that the stakeholders will find them useful. I am sure that the guidance notes shall help them in realizing the vision of total sanitation. I extend my sincere thanks to the authors and peer reviewers, Water and Sanitation Program-South Asia (WSP-SA), and the various state and city authorities for their support and help in the drafting and preparation of these guidance notes.



A.K. Mehta
Joint Secretary
Ministry of Urban Development

Introduction

What this Guide is about

Poor sanitation is endemic in towns and cities across India and exacts a heavy toll on public health. In response, the Government of India has made increased funding available for the qualifying cities for sanitation infrastructure via the Jawaharlal Nehru National Urban Renewal Mission.

These resources are sorely needed, but money alone cannot solve the problem; municipal agencies need sound technical advice on the planning of new investments and the delivery of sanitation services.

This guide aims to meet some of those needs by providing advice on the selection of technology options for urban sanitation, whether for new infrastructure or the upgrading of existing services. It is applicable both to small interventions in specific locations and larger programs that aim to improve sanitation citywide.

Who is it for?

The guide has been written for both technical and nontechnical professionals responsible for urban sanitation. It is primarily intended for city managers, who may need to make decisions on sanitation investments but may not have an engineering background. The guide should help managers to make appropriate choices with simple steps and engage effectively with technical specialists.

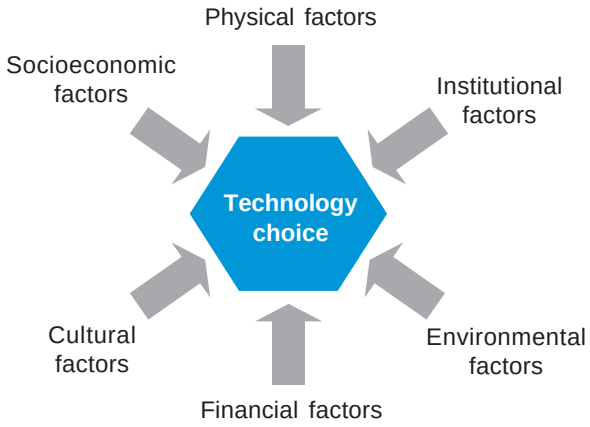
Structure of the Guide

The guide comprises four parts:

- **Part A** sets technology selection in the context of the range of issues and challenges that urban sanitation programs need to address.
- **Part B** provides an introduction to sanitation technology for nontechnical specialists.
- **Part C**—the heart of the guide—sets out a logical process for technology selection, both for new services and upgrading.
- **Part D** is a 'toolkit' comprising information sheets on sanitation technologies; management options for service delivery and maintenance; and various communication tools to facilitate community consultation and participation in decisionmaking.

Scope of the Guide

The guide focuses on technology but takes into account the full range of factors that affect the outcome of sanitation investments.



In many situations, on-site facilities may provide a more appropriate, cost-effective technology and, in some cases, an inexpensive option. The guide therefore pays particular attention to on-site options, including the removal and treatment of fecal sludge and septage.

Related Documents

The guide is concerned with technology choice but is not an engineering manual; neither does it address the strategic planning of sanitation services at city level.

For further information in these important areas, please refer to the following Government of India documents:

1. *The Manual on Sewerage and Sewage Treatment*. 1993. Prepared by the Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development. The manual is available for download from the CPHEEO website at http://cpheeo.nic.in

2. *Urban Sanitation in India—Planning for a Better Future.* Urban Sanitation Planning Guidance Notes. Ministry of Urban Development.

3. *Guide to City Sanitation Planning*. Ministry of Urban Development.

Acronyms and Abbreviations

Institutional abbreviations

CDP	City Development Plan
CPHEEO	Central Public Health and Environmental Engineering Organization
GoI	Government of India
ILCS	Integrated Low Cost Sanitation
MoUD	Ministry of Urban Development
NURM	National Urban Renewal Mission
WSP-SA	Water and Sanitation Program-South Asia

Technical abbreviations

BOD	Biochemical oxygen demand
IHL	Individual household latrine
NH_3	Ammonia
SPPF	Single-pit pour flush latrine
SS	Suspended solids
TKN	Total Kjehldahl Nitrogen
TPPF	Twin-pit pour flush latrine
UASB	Upflow Anaerobic Sludge Blanket
VIP	Ventilated Improved Pit
WWTP	Wastewater treatment plant

Part A

Setting the Scene

Before considering any technology choice, it is useful to first define sanitation, and then consider the urban sanitation problems faced across India and the sort of interventions needed to resolve them.

Defining Sanitation

For the purposes of this guide, 'sanitation' refers to *the safe management and disposal of human excreta.* It is important to understand that this involves service delivery, not just the installation of infrastructure; both service providers and users need to act in defined ways. This means that the success of sanitation investments cannot be measured only in terms of physical outputs such as the number of toilets built or kilometers of sewer laid. Instead, the focus of attention should be on *outcomes*, primarily the use and maintenance of those facilities.

Dealing effectively with human waste may also require action in related areas such as water supply, drainage, and solid waste management. Good coordination between the agencies responsible for these services is, therefore, important.

Urban Sanitation: What are the Challenges?

Broadly speaking, the challenges fall into four categories:

- Low infrastructure;
- Service coverage;
- Low service usage; and
- Weak institutional arrangements.

Low Infrastructure Coverage

South Asia contains more people without safe sanitation than any other region in the world. While infrastructure coverage is gradually improving, it has so far failed to keep pace with the rate of urban growth. In India it is estimated that 17 percent of the urban population currently has no access to any sanitary facilities at all, while 50–80 percent of wastewater is disposed of without any treatment (Draft National Urban Sanitation Policy, 2007).

It may take several decades for sewerage and other sanitation services to become available to all of urban India. In the meantime, the great majority of urban residents will remain dependent on on-site sanitation facilities such as pour flush toilets discharging to leach pits or septic tanks. Municipal sanitation plans should therefore include measures to improve on-site sanitation—otherwise they will meet the needs of just a small portion of the city.

Municipal planners should also recognize that the worst sanitary conditions tend to be found in poor areas. Construction of a toilet is generally regarded as the householder's responsibility but, for poor households, investments in sanitation are often constrained by issues relating to:

- Affordability, including the cost of connecting to sewer networks;
- Uncertainty over land tenure (fear of eviction);
- Space constraints; and
- The low priority given to sanitation (people may not appreciate its importance).

Special measures may therefore be needed to support service improvements for the poorest sections of the community. This does not just mean subsidies and awareness campaigns; technology options are also needed that suit the physical conditions in poor communities.

Limited Access to Services

Official coverage figures do not, on their own, give the full picture regarding access to sanitation services. Existing arrangements can in fact be deficient in a number of ways:

- There may be a *complete lack of facilities*. For example, there may be settlements with no toilets at all, while facilities for the safe emptying of septic tanks, and the treatment of septage, may be lacking across the entire town.

- Sanitation facilities may be available but could be *inconvenient, unpleasant* or *unhygienic.* This may be the result of inappropriate design or construction, or inadequate management arrangements. Poor management is often a problem with community toilet blocks.

- Sanitation facilities may be available, but some people have *limited access* to them. For example, people may not be able to afford to connect to an existing public sewer.

- Sanitation facilities may be in place but are *not operated or maintained properly*. Poor operation and maintenance of a facility shortens its useful life and could, at worst, result in rapid total failure.

- There may be *no provision for the treatment of wastewater or excreta***.** Local drains and sewers may simply relocate waste to another part of town where it causes local pollution. Households are primarily concerned about the cleanliness of their immediate surroundings and much less worried about the wider impact on the environment.

Low Service Usage

Even where toilets are available, some are not used or are underused, with family members defecating outside most of the time. This might be because the facilities are unacceptable in some way (for example, people may not be willing to share toilets), or because there is a long-held preference for open defecation. Alternatively, people may underuse their toilet because of misunderstandings about its functioning and maintenance. In the case of twin-pit pour flush toilets, for example, some people fear that the pits will fill rapidly if the toilet is used too often; and they may not know that the contents of a full pit can safely be removed manually once they have been given time to degrade.

Such problems indicate the need for effective communication in sanitation programs, so that community awareness, preferences and behavior are properly understood and then addressed through information, advice, and hygiene promotion.

Weak Institutional Arrangements

State agencies and municipalities sometimes make very large investments in sanitation infrastructure, but these do not always deliver their intended benefits. There can be several reasons for this, for example:

- The investments are made on an ad hoc basis when funds become available, without reference to an overarching strategy or plan.
- Within the state government and municipalities, sanitation has no 'institutional home', meaning that no single department or agency is accountable for it. Responsibilities for different aspects of sanitation are often assigned to a number of agencies, and coordination between them is not always good. There have been cases, for example, where a state agency has developed a sewage treatment plant even when there are no sewers in the town, then handed it over to a municipality that does not have the technical capacity or financial resources to operate and maintain it.
- Large capital investments are rarely matched with detailed arrangements—both practical and financial—for future operation and maintenance.
- Improvements are often implemented on a norms basis, meaning that technologies are selected without reference to local conditions or to the preferences of users. Therefore, the new facilities may not function properly, or may not be used as intended (see Box 1).
- Especially in smaller towns, municipal and line agency staff tend to have limited technical expertise or awareness of the range of nontechnical factors that affect the outcome of sanitation investments.

Box 1: The Limitations of a Norms-Based Approach

There is a strong tendency for municipal agencies to opt for conventional water-borne sewerage without first assessing the demand for it, or its technical feasibility and long term affordability.

Many sewerage systems malfunction or fail altogether, common problems being insufficient water to flush solids through the sewer pipes and high pumping costs.

Apart from the technical shortcomings, a common occurrence is that households fail to connect to new sewers after installation, especially when they already have septic tanks. Unless there is strong demand for connections, installing sewers can be a wasted investment.

There may, in fact, be other options that would suit local circumstances better. For example, in Ramagundam, Andhra Pradesh, the municipality worked closely with the community and developed a simplified, low-cost sewerage system serving 300 low-income households. The network uses shallow sewers leading into a communal septic tank.

Implications for Technology Choice

This guide does not attempt to address all of the challenges outlined above, but it is important to take them into consideration when considering technology options. Technology choice needs to be approached carefully, with proper reference to local conditions, the human and financial resources available, and the needs and preferences of service users. This includes ensuring that, for any technology selected, viable arrangements for operation and maintenance can be established and sustained.

Technology and Program Design

In order to maximize the benefits of sanitation investments, technology choice needs to be part of a planning process that addresses a range of factors affecting service delivery and use. This section highlights some key aspects of program design that have a bearing on technology choice.

Responding to Demand

Earlier in the text, it was suggested that government schemes tend to deliver infrastructure on the basis of norms and untested assumptions about what people need. As a result, schemes may be implemented where there is no demand—something that may only

become apparent when the new facilities are left unused or are misused so that they quickly fall into disrepair and are abandoned. Public toilet blocks that have been built without adequate public consultation often suffer this fate.

Today there is greater understanding of the need to respond to demand, which means providing services that people both want and are willing to pay for. This is not entirely straightforward, however, for several reasons:

- Though sanitary conditions may be poor, the demand for new facilities may be quite low.
- People tend to ask for what they know; there may be technically appropriate, low-cost options available but people are unaware of them.
- People tend to consider their personal needs without concern for the impact of their choices on the environment. For example, people may be quite happy to discharge their toilet into an open drain that empties in another nearby community.
- Municipal agencies may not have the human or financial resources to meet local demand; it may also be impractical to satisfy a range of preferences within the same street or neighborhood. For example, if a sewer has been installed it needs a lot of toilets to discharge into it, in order to work effectively; it is impractical to provide sewers for a minority of households while the remainder use leach pits or septic tanks.

For these reasons, simply responding to current demand may not be the best approach. Instead, it is often necessary first to *generate demand,* and then advise residents of potential options and their benefits or limitations so that people can make suitable choices—in other words, to *inform demand*. After that, the task is to develop the means of meeting the demand. The development of sanitation services, then, involves a mixture of technical and nontechnical tasks and this has implications for the range of actors that should be involved in sanitation programs.

Communication

Generating and informing demand requires good communication with the people for whom new services are being developed. Furthermore, once the facilities have been installed, households need advice and motivation on operation and maintenance. This is especially true in the case of septic tanks and twin-pit pour flush toilets installed under the Government of India's Integrated Low-Cost Sanitation Scheme. There is widespread misunderstanding over the functioning of this technology, not only on the part of users, but also among masons and even engineers. Many people use both pits at the same time, while others fear that the pits will fill up too fast and so use the toilet only occasionally. Clear practical advice is essential if the toilets are to be used and maintained properly.

An important question is who should take on the communication role. There is no single 'correct' answer here; what matters is to recognize the need for communication and make

arrangements for it. Some municipalities may be able to communicate effectively with residents via their own staff or ward councilors. There has been a good example of this in Alandur, Tamil Nadu (see Box 2).

Usually, however, municipalities do not have the right people for this job and it is necessary to appoint a third party, for example a nongovernmental organization to facilitate communication, promotion, and subsequent follow-up at the community level.

Some useful communication tools and techniques applicable to sanitation projects are provided in Part D.

Box 2: Alandur Sewerage Project: Successful Innovation and Partnership

Alandur is a small municipality adjacent to Chennai Metropolitan Development Area with a population of 146,000. Slums and squatter settlements constitute about a quarter of the total population. Before the project, almost 95 percent households had household toilets with individual septic tanks which discharged into open drains where much of it stagnated due to low flows, causing odor and offering sites for mosquito breeding. While a septage removal service was provided by the municipality, there was no treatment facility and waste was disposed of in low-lying areas beyond the municipal limits. Local residents were concerned about improving sanitation in the town and the mayor took up the challenge. A public awareness campaign—launched via meetings with elected councilors, resident welfare associations, and the public—succeeded in motivating the public to participate in an improvement project.

The project used conventional sewerage but developed an innovative approach to implementation based on a public-private partnership. The municipal leadership was highly proactive and ensured a high degree of transparency in all project transactions.

The funding agency insisted on a 'willingness to pay' study before proceeding with a loan, and this indicated that 97 percent of residents wanted a sewerage system and were willing to pay up to Rs 2,000 (US$49)[1] per connection. The project cost of Rs 34 crore (US$8 million) (excluding the treatment plant which was implemented with private investment under 'build, own, operate, and transfer' arrangement) was financed through a 59 percent loan component; 12 percent grant component (from the lending institution as well as the state government); and 23 percent public contribution, with the 6 percent balance funded from interest on deposits. Tamil Nadu Urban Infrastructure Financial Services Limited was nominated to coordinate project implementation and provided the necessary financial discipline.

[1] US$1 = INR 41 (approximately, as of October 2007). Conversion rates are from https://www.cia.gov/library/publications/the-world-factbook/fields/2076.html; all conversions in the text are approximations.

Promoting Demand

People are more likely to support sanitation projects that are given a high public profile; public interest generates momentum and active community engagement. This is especially important where there is a need to eradicate open defecation, a problem that is best tackled as a communitywide issue. The objective should be to make the practice socially unacceptable.

One way of catalyzing community action might be to hold inter ward competitions and offer financial rewards to wards that achieve a complete end to open defecation. This is already producing impressive results in rural Maharashtra, where the Community-Led Total Sanitation approach has been introduced with great success (see Box 3).

Community-Led Total Sanitation is based on the principle that the public health benefits of sanitation can only be realized in full when all households in a community dispose of excreta safely; even if 90 percent use sanitary toilets, the remaining 10 percent that practice open defecation or discharge human waste into the street pose a risk to the entire community. This could cancel out the benefits of the investments made by the rest of the community.

While Community-Led Total Sanitation can be very effective in promoting toilet use, it should be remembered that this is only one part of the sanitation challenge in urban areas. There are other important issues that can only be addressed by the municipality itself, not least the treatment and final disposal of wastewater.

Institutional Arrangements for Sanitation Service Delivery

A critical step in technology choice is assessing whether effective operation and maintenance arrangements could be put in place for each option, given the human and financial resources available locally. Generally speaking, the more complicated the technology, the greater the need for specialist personnel and equipment. Simpler technologies, such as flush toilets with soak pits or septic tanks, offer better prospects for management at the household or neighborhood level. This suggests that it will be best to use simple technology options where these are viable.

Box 3: The Community-Led Total Sanitation Approach in Maharashtra

Since 2002 the state government of Maharashtra has implemented a strategy for promoting rural sanitation that focuses on ending open defecation rather than building toilets. The strategy—Community-Led Total Sanitation—emphasizes both collective action and individual commitment. It aims to create demand for sanitation at the community rather than at the individual level, facilitated by the local government, and provides cash rewards to *Gram Panchayats* [a unit of local government at the village level] for the achievement of open defecation-free status (the outcome) instead of relying on subsidies to accelerate latrine construction (inputs). Till 2007, a population in excess of 4.5 million has achieved open defecation-free status—a remarkable achievement.

Whether at a local or city level, it is important that roles and responsibilities for operation and maintenance are clearly established and accepted by the relevant parties. There are a variety of potential options for doing this and the municipality does not have to be the sole player; nongovernmental or community-based organizations and private contractors could all have a role to play and might offer manpower and expertise that is unavailable within government agencies. To make the best use of these organizations, it is important that contracts (or Memoranda of Understanding) for their involvement offer incentives for good standards of service delivery and impose sanctions where these standards are not met.

Box 4 provides two examples of the successful involvement of nongovernmental and community-based organizations in service delivery.

Table 1 provides broad guidance on the possibilities for management by the public sector, community organizations, and the private sector at different levels in the service hierarchy. It suggests that individual households will normally be responsible for managing on-plot and in-house facilities while community management is usually difficult or impossible beyond the neighborhood level.

Box 4: NGO and CBO Roles in Service Delivery

Community sanitation blocks in Mumbai

The Slum Sanitation Project was launched in 1995 under the umbrella of the World Bank-funded Mumbai Sewage Disposal Project. Its objective is to develop community-managed toilet blocks in the Mumbai slums, with a target population of 1 million. Innovative toilet block designs are used that include a small residential block for the caretaker and their family, enabling them to live on-site. Each caretaker is employed by a local community-based organization that is responsible for maintaining cleanliness and collecting user charges. The facilities are operated under Memoranda of Understanding with the Municipal Corporation, which provides power, water, and sewerage connections (where viable).

Community-managed waste stabilization ponds and aquaculture in Kolkata

Waste stabilization ponds were constructed around the city of Kolkata in the early 1990s under the Ganga Action Plan. Capital costs were funded by the Government of India while operation and maintenance were the responsibility of the state government. Due to low strength sewage flows, the ponds offered significant aquaculture potential, and as a result an innovative arrangement was developed for leasing out their operation to cooperatives of fishermen. Under the lease agreement, the cooperatives were made responsible for maintenance of the ponds, but could also carry out aquaculture in the facultative and maturation ponds.

Initially, short-term leases were granted to the cooperatives but, following positive experience, the period was extended to seven years. Each cooperative pays an annual royalty to the implementing agency (Rs 200,000, or US$4,000, during first two years, Rs 300,000, or US$7,000, for the next two, and Rs 450,000, or US$10,000, for the final three years) but this still allows the cooperatives to generate a viable income.

Table 1: Possible Management Options for Urban Sanitation

Management option	Household[a]	Neighborhood[b]	Settlement[c]	District[d]/ zone	Town/ citywide
Public	Monitoring required	Monitoring on behalf of the public	Possible	Possible (current norm)	Possible (current norm)
Community	Monitoring usage required	Service provider	Possible	No	No
Private	Yes (individual households)	Possible as service provider	Possible (if there is an incentive)	Possible (but rare at present)	Possible (but rare at present)

Notes:
a. Household: A single nuclear family or an extended family living in the same building or on the same plot.
b. Neighborhood: An area containing anything between around 10 and 200 households.
c. Settlement: A more or less homogenous area, containing perhaps 200 to 1,000 households.
d. District: A part of a town or city, often an administrative area or political division, but it could be a drainage basin.

Further information on management options is provided in Part D (Appendix C).

Legislation and Standards for Urban Sanitation

While there are no specific legal provisions relating to urban sanitation, there are a number of provisions relating to sanitation services.

74th Constitutional Amendment Act, 1992

Responsibility for the planning and delivery of urban services, including sanitation, lies with urban local bodies under local municipal laws and the 74th Constitutional Amendment Act, 1992. The 12th Schedule of the Act sets out a list of critical issues for the urban local bodies including, amongst other things:

- Urban planning;
- Regulation of land-use and construction of buildings;
- Water supply for domestic, industrial, and commercial purposes;
- Public health, sanitation, conservancy, and solid waste management;
- Protection of the environment and promotion of ecological aspects; and
- Slum improvement and upgrading.

Municipal Bylaws

These enable local bodies to discharge their functions and typically include, for example, a requirement for property owners to discharge wastewater without causing nuisance; and an obligation to discharge wastewater into sewers where available. There are, however, no specific provisions for the safe removal, cartage, and disposal of septage in urban areas.

The Environment (Protection) Act, 1986

This Act applies in principle to every establishment, agency, or individual discharging any pollutant into the environment. 'Pollutant' includes treated or untreated sewage. In principle, municipalities are required to comply with discharge norms for effluent released from sewage treatment plants and to pay water cess under the Water Cess Act, 1977.

Technical Norms for Best Practice in On-Site Sanitation and Wastewater Management

The *Manual on Sewerage and Sewage Treatment* of the Central Public Health and Environmental Engineering Organization, Ministry of Urban Development (MoUD), sets out technical norms for best practice in on-site sanitation and wastewater management. The manual covers planning, design, and construction aspects for a wide range of technical options; it also includes operation and maintenance aspects and safeguards to prevent water pollution under different soil and groundwater conditions.

The norms set out in the manual are not mandatory but provide guidance for engineers. The manual also makes reference to relevant Indian Standards and Codes of Practice notified by the Bureau of Indian Standards.

The most relevant include the following:

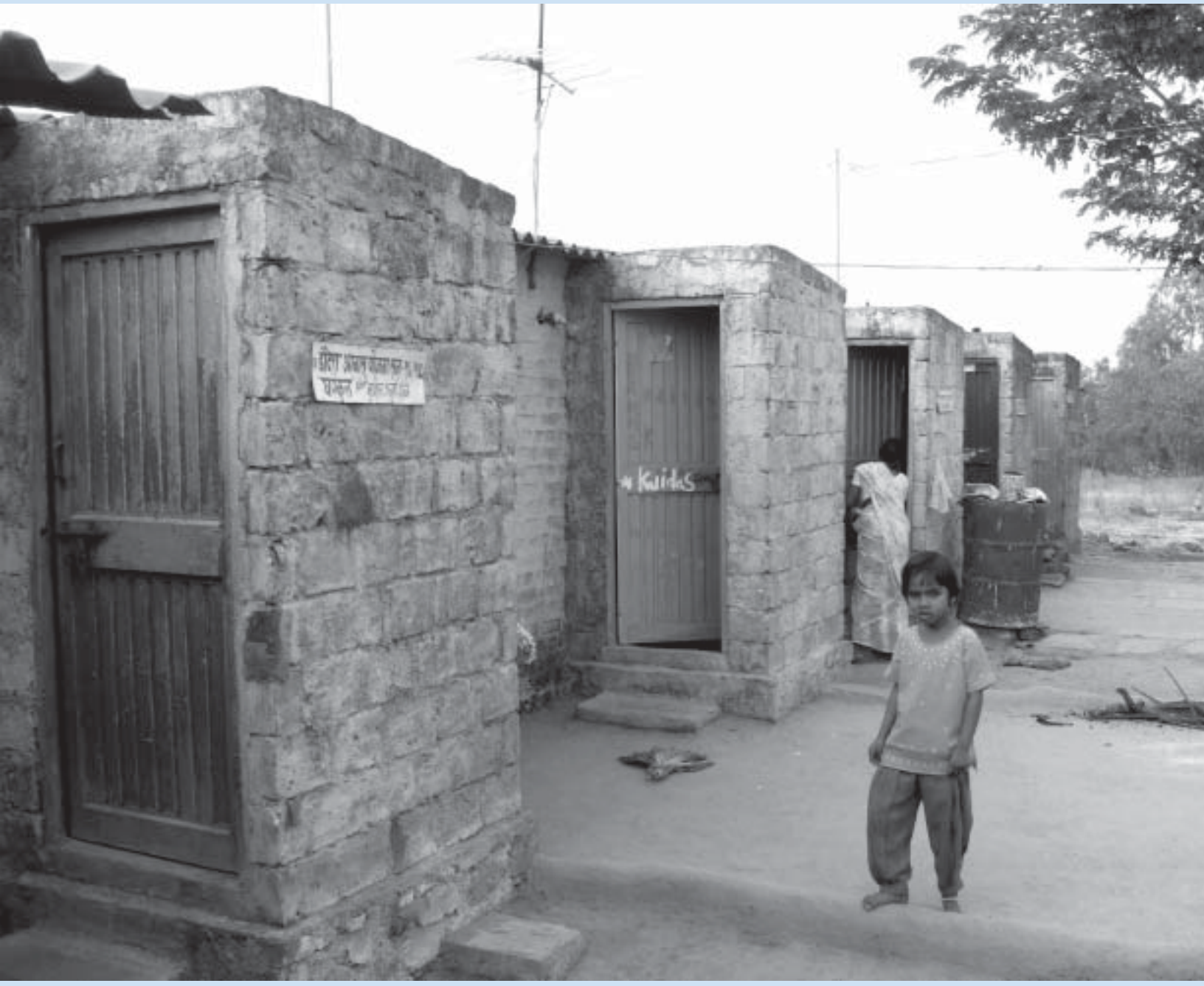
- **IS 1172:1993 –** Basic requirements for water supply, drainage, and sanitation.
- **IS 12314:1987 –** Code of Practice for sanitation with leach pits for rural communities.
- **IS 2470 (Part 1):1985 –** Code of Practice for installation of septic tank: design criteria and construction.
- **IS 2470 (Part 2):1985 –** Code of Practice for installation of septic tank: secondary treatment and disposal of septic tank effluent.
- **IS 9872:1981 –** Precast concrete septic tanks.
- **IS 5611:1987 –** Code of Practice for waste stabilization ponds (facultative type).
- **IS 10261:1982 –** Requirements for settling tanks (clarifier equipment) for wastewater treatment.
- **IS 13496:1992 –** General requirements for suction machines for cleaning sewers, manholes and so on.

In addition, the MoUD prepared a document entitled 'Technical Guidelines on Twin-Pit Pour-Flush Latrines' in 1992, which broadly follows the lines of IS 12314:1987 on leach pit construction in rural areas.

All Indian Standards' codes represent a standard of good practice and therefore take the form of recommendations. They are not mandatory unless made so under contract conditions and some are routinely ignored, for example the recommendation for the construction of soakaways, dispersion trenches, and biological filters to deal with the outflow from septic tanks; and for the regular desludging of septic tanks using specified equipment.

Part B

Introduction to Sanitation Technologies


Kids

The protection of public health should always be the primary concern for those involved in the installation and operation of sanitation systems. It is also important to consider the environmental impact of poor sanitation and, as far as possible, to minimize pollution. In addition, there may be scope for the productive reuse of wastewater.

This section provides an overview of the technologies that may be employed to achieve these objectives.

Understanding Sanitation Technologies

Wet and Dry Sanitation

All sanitation technologies can be described as being either 'wet' or 'dry':

Wet technologies require water to flush feces. Most urban sanitation in India is 'wet', involving some form of flush toilet connected to a leach pit, septic tank or sewer.

Dry technologies[2] do not use water for flushing. They include a range of different types of traditional pit latrines, ventilated improved pits, as well as contemporary designs that promote the safe reuse of excreta.

Pit latrines are rarely used in India, though in recent years some small-scale initiatives have promoted ecological sanitation (known as *ecosan*), a form of dry sanitation that involves the separation of feces and urine at source and the reuse of treated excreta. In principle, ecosan has some important advantages including (a) reduced water demand for flushing; (b) reduced wastewater management problems (no blackwater production); and (c) improved nutrient recycling, particularly the nutrients in urine.

However, the traditional practice of using water for anal cleansing, and the availability of water to the majority of households in Indian cities, mean that flush toilets are likely to remain the preferred option for most households.

[2] 'Dry technology' is not widely used in urban India except in high altitude areas.

On-Site and Off-Site Systems

Sanitation systems may be:

- On-site, retaining wastes in the vicinity of the toilet in a pit, tank or vault.
- Off-site, removing wastes from the vicinity of the toilet for disposal elsewhere.
- Hybrid, retaining solids close to the latrine but removing liquids for off-site disposal elsewhere.

In urban areas, even nominally on-site systems will normally require periodic removal of the fecal sludge and septage from pits, tanks, and vaults. As a result, no urban sanitation system is completely self-contained. To achieve total sanitation in a town, consideration must be given to the way in which household services are linked with higher level transport and disposal facilities.

System Components

Every sanitation system includes some form of *toilet*. Most toilets in India consist of a water-sealed pan but a hole in a pit latrine cover is also a basic form of toilet.
The toilet type is important because it will determine whether the sanitation system is wet or dry. This in turn will influence choices relating to other components of the sanitation system.

On-site and hybrid systems require *storage* in the form of a pit, tank or vault to retain fecal material pending desludging. Provision has to be made for the removal and *transportation of fecal sludge* to a disposal point.

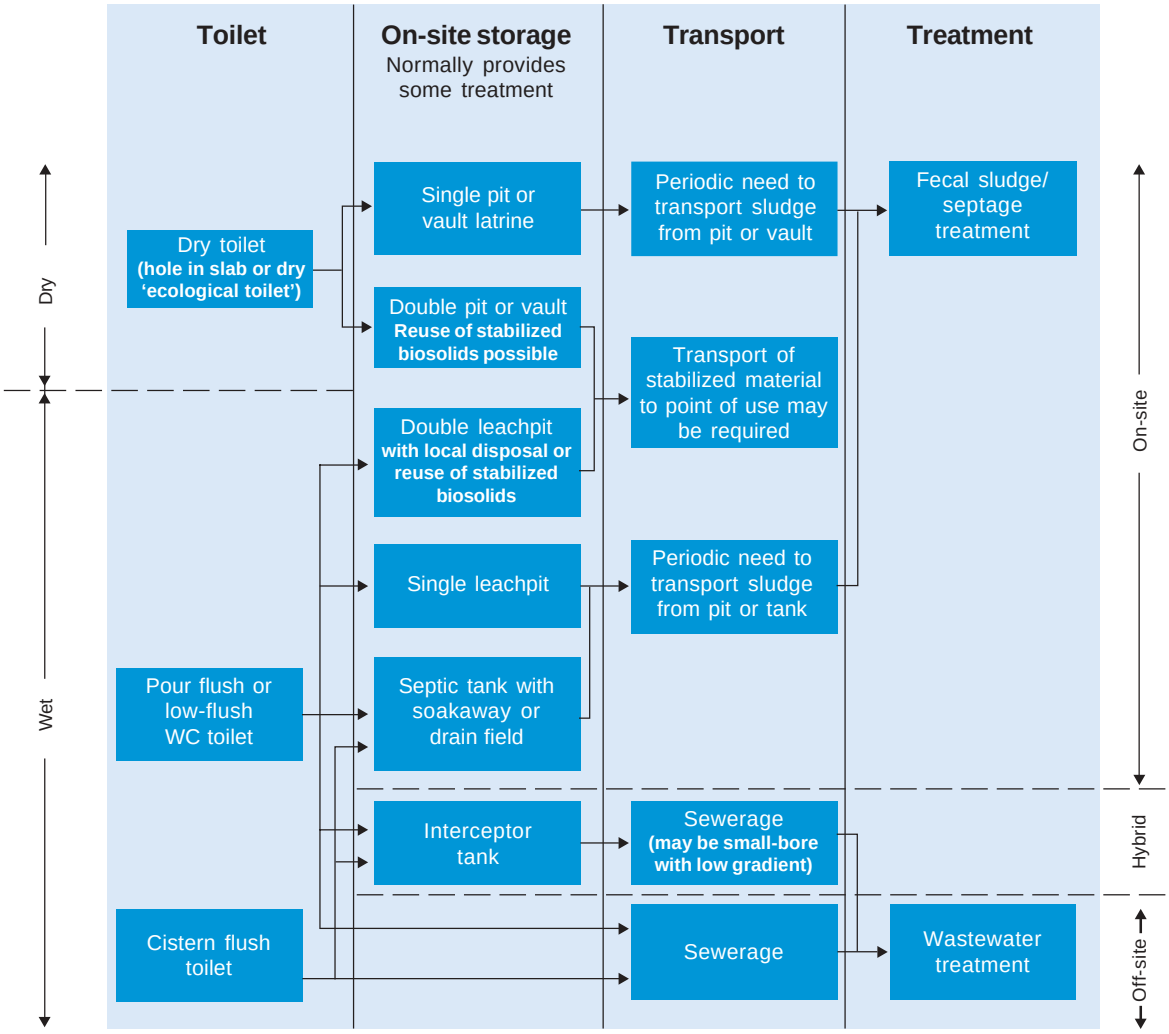
Wastewater and fecal sludge require *treatment* before they are used either as an input to agriculture or returned to the environment. Waste collection and treatment systems may serve anything from a residential area of a few hundred houses to large urban areas.

Hybrid and off-site systems require provision for *transporting wastewater* from the toilet via a system of sewers to the treatment facility.

Possible Configurations of Components

Figure 1 shows the ways in which the components introduced previously can be brought together to create complete sanitation systems, distinguishing between wet and dry systems, as well as on-site, hybrid, and off-site systems.

Figure 1: Basic Sanitation Options



Note the following key points, not all of which can be deduced from Figure 1:

- The choice between wet and dry toilets will affect subsequent choices. Dry systems are always on-site, cistern flush toilets will require wastewater to be transported off-site unless there is sufficient land to provide a fairly extensive drain field, which will not normally be the case in urban areas. Both on-site and off-site options are normally viable for pour flush toilets.
- In all dry systems the pit or vault is located directly below the 'toilet', which may be nothing more than a hole in a slab. In effect, the toilet and storage are combined. The range of options for dealing with the wastewater produced by a water-flushed toilet is much wider.
- Choices will be influenced by what already exists. So, for instance, if most households already have a pour flush or cistern flush toilet, the choice will normally be between different wastewater disposal options.

- If a component is lacking, the sanitation system will be incomplete and will not offer the full intended benefits in terms of environmental health. Inadequate provision for the collection, transportation, and treatment of sludge from on-site systems is a widespread problem in India.
- Most on-site and hybrid systems require special arrangements for the removal and treatment of fecal sludge. The only exceptions are double pit and double vault systems which, if properly operated, remove the need to handle fresh feces.
- All off-site and hybrid systems require provision for wastewater treatment.

On-Site Systems

As indicated in Figure 1, on-site systems may be either wet or dry. If properly designed and managed, both wet and dry on-site systems can provide a service that is as hygienic and convenient as sewerage. Indeed, if water use is low, on-site sanitation may provide a better service than a poorly functioning sewerage system.

All on-site systems that are feasible in Indian conditions—whether wet or dry—require a pit, vault or tank to hold fecal sludge. All wet on-site systems are dependent on percolation of wastewater into the ground. Where water use is more than about 30 liters per capita per day, separate provision will normally be needed for sullage and storm water run-off. Where water use is low, the subsoil is sandy and sufficient space is available, it may be possible to dispose of sullage water by percolation into the ground. Normally, however, a separate drainage system for sullage will be required.

Further information on dry and wet on-site systems is given below.

Dry (Ecosan) Systems

As already indicated, all the dry or ecological toilets (ecosan) systems that are likely to be feasible in Indian conditions will also be on-site. In theory a single or double pit latrine could be used although these are not widely used or popular in Indian cities.

Some NGOs have installed ecosan toilets on a pilot basis in urban and periurban areas. Most of these use a double vault design with excreta stored in the first vault while the second is filling up and vice versa. The advantage of this system is that fecal material is stored for a period of about 12 months before it is removed, giving time for natural processes to break down the material and destroy pathogens and parasites. Urine is separated and should ideally be stored and used as a fertilizer. Anal cleansing is carried out away from the latrine hole to ensure that the vault contents remain dry. In order to prevent smells and nuisance caused by flies, fine ash is kept in a container in the latrine superstructure and sprinkled over the contents of the vault every time the latrine is used.

Ecosan has yet to be implemented on anything other than a pilot scale in India. It is too early to say whether it will prove to be acceptable to users and technically viable, though

compost toilets are prevalent in the mountainous regions of India. However, two observations can be made:

- Ecosan demands more from users (in terms of behavior) than other forms of on-site sanitation.
- There are many things that can go wrong, especially in separating feces and urine.

Therefore, before deciding to use ecosan, it would be important to ensure that the intended users understood and accepted what was expected of them; also that potential problems had been identified and systems put into place to deal with them.

Wet Systems

Wet on-site systems incorporate some form of water-flushed toilet from which feces and flush water are discharged into a pit or tank. The toilet is normally a pour flush pan. In some designs, the pit or tank is located directly under the toilet, but the normal arrangement is to provide a short length of pipe to connect the toilet to one or more offset pits or tanks. Having the pit(s) or tank offset makes it easier to desludge them. Figure 1 identifies three basic categories of wet on-site system:

1. Pour flush toilet to single leach pit.
2. Pour flush toilet via division chamber to twin leach pits [the model used in integrated low cost sanitation (ILCS)].
3. Pour flush or cistern flush toilet to septic tank.

Of these, the single leach pit option requires the least space, but the contents—including fresh feces—must be removed at intervals, creating the need for a hygienic pit emptying system. Similar systems will be required for septic tanks. The twin-pit system is designed so that (as with double vault dry systems) the pit contents are stored for a minimum period before they are removed, during which time the waste decomposes and pathogens die off. This means that treated wastes can be disposed of or reused without the health risks associated with handling undigested excreta. The main drawback with this system is that it will not work properly if users do not understand, or are not interested in, the way in which the system should function.

Septic tanks consist of a chamber or series of chambers into which wastewater is discharged and contained. Sediment and solids settle to the bottom of the tank and organic wastes are decomposed by the action of bacteria. The effluent from septic tanks may contain pathogens and should be discharged into a soakaway (or drain field). In practice, many septic tanks in India discharge effluent to the nearest open drain. Where drain fields do exist, they may not function effectively due to poor design and lack of maintenance.

Where ground conditions do not permit infiltration of treated wastewater, additional treatment in the form of a constructed wetland or anaerobic filter could be provided prior to discharge into a drain or watercourse. This option should only be considered if management systems for the treatment facilities can be guaranteed, a condition that very often cannot be met.

Sludge Collection and Transportation

On-site sanitation technologies are dependent on the periodic removal of fecal sludge from vaults, pits, and tanks. The most common practice is for households to pay sweepers to empty pits manually, though this carries health risks and is banned by the Constitution of India.

Sanitary pit emptying options exist, all incorporating some form of vacuum desludging equipment; examples are given in Table 2. These have a variety of tank sizes and pumping capacities, each appropriate for a different type of on-site service or settlement type. While some municipalities and private service providers offer a vacuum service, it is more expensive than manual pit-emptying and this tends to restrict its use to institutions and more affluent households. Shortcomings in emptying, removal, and disposal services lead to the widespread dumping of untreated wastes into open drains, fields and watercourses. This causes pollution and is a serious public health concern.

It is important to understand that simply collecting fecal sludge is insufficient; the sludge must also be treated. Fecal sludge treatment options will be discussed under 'Treatment of Wastewater and Fecal Sludge' (page 22).

Table 2: Sanitary Pit Emptying Options

Type of Vehicle	
Conventional septic tank: Truck These are used in many cities in India but are expensive and have difficulties in accessing densely populated areas.	 Photo : Jonathan Parkinson
Narrow-wheel base truck Essentially the same as the above but with a smaller wheel capacity and wheel axle, enabling them to enter narrower lanes.	 Photo : Martin Strauss (SANDEC)
Trailer mounted desludger attached to a separate vehicle In South Asia, this system has been developed and promoted by the nongovernmental organization Dushtha Shasthya Kendra in Bangladesh (with the support of WaterAid) specifically to serve low-income communities in Dhaka.	 Photo : Peter Edwards
UN-HABITAT Vacutug The Vacutug is designed to provide a simple and inexpensive method for emptying pit latrines in areas where access by other forms of desludging equipment is not possible. The nongovernmental organization, Sulabh International, has been piloting the Vacutug in India.	 Photo : Iole Issaias (UN-HABITAT)

Off-Site and Hybrid Systems

All off-site and hybrid systems incorporate cistern or pour flush toilets connected to sewers. In the case of hybrid systems the toilets are connected via interceptor tanks. Blackwater and sullage are normally combined on-plot and discharged to the sewer through a single household connection. In nearly all cases, sewage treatment is required before it can be safely discharged to the environment or used for irrigation or aquaculture.

Sewerage

Sewerage, the collective name for a system of sewers, consists of a network of buried pipes that convey wastewater from a house to the point of disposal. Sewerage relies upon a sufficient quantity of wastewater flow to convey solids along the pipe to a discharge point.

Sewers remove both excreta and sullage from the household and thereby negate the need for on-site servicing facilities. This makes sewerage convenient for users. Off-site wastewater disposal via sewers is most likely to be appropriate in higher density urban areas where water consumption is relatively high and soil permeability is low. However, sewerage is not a panacea. Silt and other extraneous material may block sewers and require periodic sewer cleaning, while blockages and overloading can cause sewage to overflow from manholes onto roads and pavements. Problems of solid accumulation are likely to be particularly acute where the available fall (slope) is limited; solid waste collection is poor; and there is lack of hard surfaces. Another requirement for sewer installation is an associated investment in off-site wastewater treatment prior to effluent discharge or reuse.

Conventional sewerage is expensive and various lower-cost options have been developed to improve affordability. These work on the same principle as conventional sewerage but incorporate modifications that take into account recent theoretical research and the possibility of matching standards to local conditions, as briefly described below.

1. ***Reduced pipe diameters***. Condominial sewers in Latin America are laid with a minimum diameter of 100 mm rather than the 150 mm or 225 mm minimum standard that is common in South Asia. In theory, hydraulic efficiency increases as sewer diameter decreases. Reducing the pipe diameter reduces cost and increases structural strength. Blockages are likely to be detected quicker than in larger diameter pipes and this may mean that it is easier to clear them.
2. ***Reduced minimum depth***. In residential areas where streets are narrow, traffic loadings are often much lower than those in more congested urban areas and house connections are relatively short. These factors allow the adoption of a lower minimum depth standard than that required by conventional standards. This can result in considerable savings.
3. ***Access chambers***. Manholes are not required if sewers are laid at shallow depths. Access chambers are much cheaper and enable pipes to be cleaned without the need for a person to enter the chamber.

4. ***Solids interceptor tanks*.** These remove solids and so allow the use of small diameter sewers laid to lower gradients, reducing sewer depths throughout the system.

Treatment of Wastewater and Fecal Sludge

Treatment of wastewater and fecal sludge is required prior to discharge into the environment. This is especially important in situations where sources of drinking water are at risk from contamination or where local residents use rivers or drainage channels for bathing or washing and where the wastewater is reused for irrigating vegetables or horticultural crops.

The purpose of treatment is to reduce the concentration of potentially harmful materials to levels that will not cause harm to either the environment or the people that might come into contact with wastewater. The treatment required to achieve this objective will be influenced by the concentrations of pollutants and pathogens contained in the waste (see Table 3).

Table 3: Types and Sources of Domestic Wastewater and Fecal Sludge

Type	Source	
Fecal sludge	Pit latrines and leach pits	Decreasing concentration of pollutants and pathogens ↓
Septage	Septic tanks	
Blackwater	Water closets	
Domestic sewage	Sullage and blackwater mixed together	
Sullage (greywater)	Personal washing, laundry, cooking, and cleaning	

While some degradation of waste material may occur on-site in vaults, leachpits and septic tanks, there will almost always be a need for further treatment of fecal sludges, septage, and wastewater. While it is possible to provide this additional treatment on-site, the more common arrangement is to provide it *off-site or 'end-of-pipe'* (at the end of a sewerage system) or where fecal sludge cartage vehicles discharge wastes.

Because of their high concentration of pollutants and pathogens and relatively low volume, fecal sludge and septage should normally be dealt with separately from wastewater. For this reason, treatment processes for fecal sludge and septage are considered separately from those for wastewater below. Sullage is less polluting and less potentially harmful than sewage and blackwater, and will normally require a much lower level of treatment.

Treatment Standards

Treatment requirements depend largely on the proposed use of the effluent, but may also be governed by discharge consents if the waste is to be discharged into a natural watercourse. The purpose of discharge consents is to prevent unacceptable levels of pollution and risks to public health. In most towns little, if any, sewage is actually treated and standards set out in discharge consents are rarely met, even in cases where a treatment plant has been installed. The implication for regulatory bodies is that standards should be set at realistic levels in the light of local circumstances and tightened incrementally as local capacity for wastewater management increases.

Wastewater Treatment

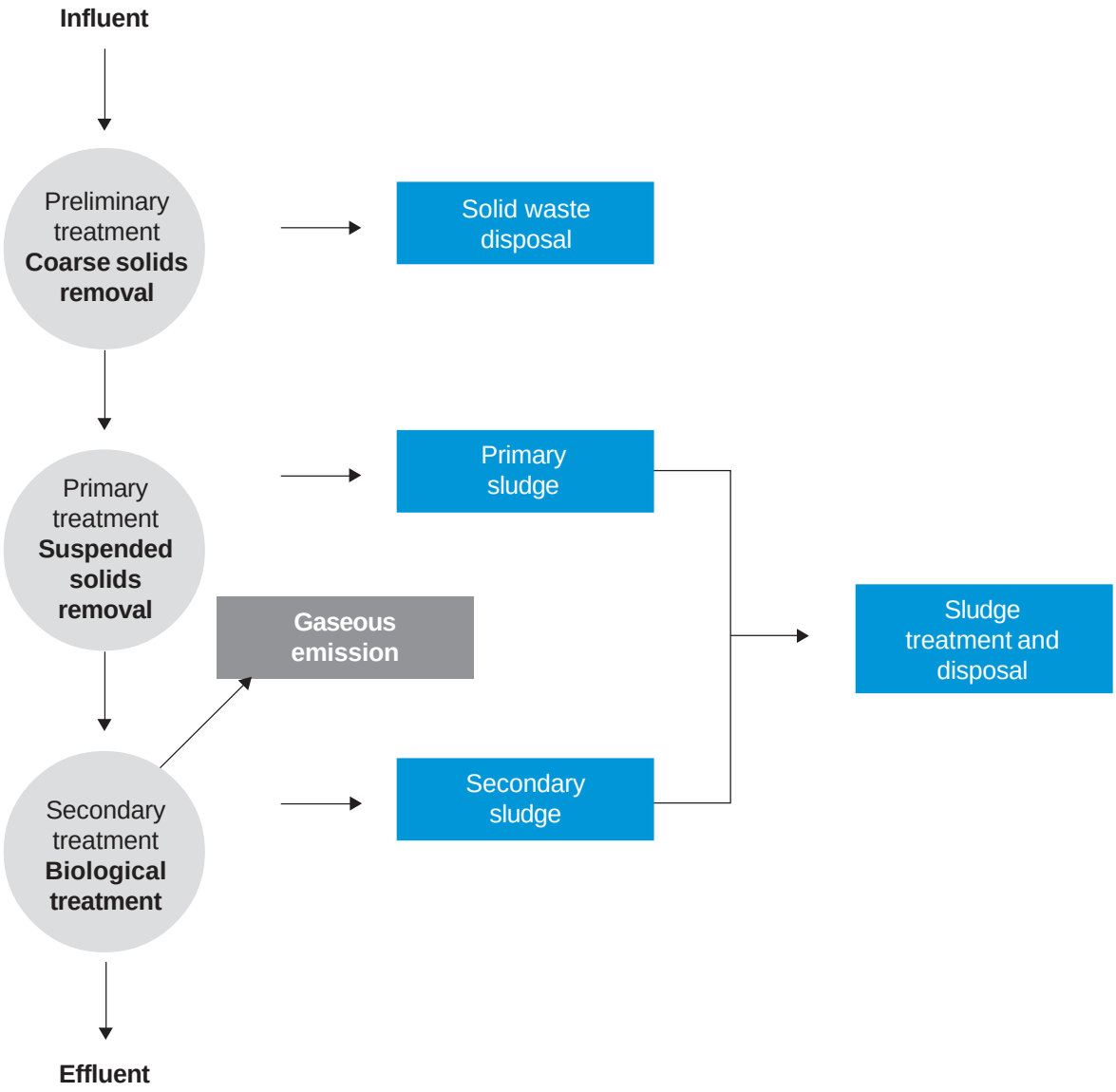
Most wastewater treatment technologies use a combination of physical and microbiological processes to remove or degrade pollutants (see Table 4).

Table 4: Types of Treatment Processes

	Process	Mode of operation	Residual end products
Physical	Screening	Removal of large particles by coarse screening	Sludge
	Sedimentation	Force of gravity causes particles to settle	Sludge
Biochemical	Aerobic degradation	Breakdown of dissolved organic matter by bacterial activity in the presence of oxygen	Carbon dioxide, water and sludge (microbial biomass)
	Anaerobic digestion	As above but bacterial action in the absence of oxygen	Methane, carbon dioxide and sludge (microbial biomass)

Conventional aerobic treatment combines these processes in a series of stages as shown in Figure 2.

Figure 2: Stages in Conventional Wastewater Treatment



Preliminary treatment normally includes coarse screening and grit removal while primary treatment is provided in settlement tanks. In both cases, the predominant mechanism is physical. Secondary treatment processes, whether in trickling filters or by activated sludge, are predominantly biological. Table 5 provides information on the typical pollutant removal efficiencies for primary and secondary processes.

Where there is a need for further reduction in pathogens or nutrients, a tertiary treatment stage may be added to conventional aerobic processes. Most tertiary treatment processes are designed to remove nitrogen, phosphorus, and industrial pollutants such as heavy metals.

There are two broad alternatives to conventional treatment: extended treatment processes based on natural processes; and anaerobic treatment. The term ‘natural’ is used here to denote processes that represent managed versions of processes that can occur in more or less the same form in nature, The main treatment options in this category are waste stabilization ponds and constructed wetlands, which are also referred to as reed beds.

Anaerobic treatment processes include upward flow anaerobic sludge blanket (UASB) systems, baffled reactors and upward flow anaerobic filters.

Conventional treatment processes produce sludges that contain high concentrations of pollutants and excreted pathogens. Providing for the safe management of these sludges is an integral component of wastewater treatment but is often overlooked.

Fecal Sludge and Septage Treatment

It is normally advisable to treat fecal sludge and wastewater separately, though they can be combined in a wastewater treatment plant if the sludge loads are relatively small. Options for separate sludge treatment include:

- Solids-liquid separation in batch-operated settling-thickening tanks;
- Primary sedimentation/anaerobic stabilization ponds;
- Sludge drying beds (unplanted; planted);
- Combined composting with organic solid waste (cocomposting); and
- Anaerobic digestion (potentially with biogas utilization).

Treatment results in two components: a solids and a liquid fraction. The solids fraction (biosolids) is of variable consistency—additional drying or treatment might be required for landfilling reuse in agriculture as a soil-conditioner and fertilizer.

Polishing treatment might be necessary for the liquid fraction too, to satisfy criteria for discharge into surface waters or to avoid long-term impacts on groundwater quality, where effluents will be allowed to infiltrate.

Reuse of Treated Wastewater and Sludge

Wastewater is used for irrigation in many parts of India, nearly always without pretreatment. Similarly, untreated fecal sludges are often used on fields or in fishponds.

These practices bring financial benefits to farmers but can harm the health of both farm workers and consumers of products produced using the waste. While this may be difficult to stop in the short term, pretreatment should be introduced in the longer term, possibly as part of the resource recovery process.

In the case of reuse, health risks from enteric pathogens must be reduced as much as possible. This is especially important where wastewater is used to irrigate parks and other public places, or food crops that may be eaten raw. Long retention in a waste stabilization pond system is recommended.

Where it is not possible to provide the required level of treatment (due, for example, to a shortage of land) then other strategies are needed to reduce health risks. These could include restricting the types of crops that can be irrigated with wastewater; using drip irrigation rather than spray irrigation; and providing farm workers with boots and gloves.

Stabilized biosolids make a good soil conditioner as they contain valuable nutrients and minerals. Wastewater is not usually suitable, however, due to a high concentration of dissolved salts.

Nutrients can also be reused as fertilizer for aquaculture, that is, for the cultivation of fish or aquatic plants such as duckweed.

Summary of Common Technology Options

Variations in housing type, density and settlement layout; poverty status; and access to networked services (especially water supply) mean that different solutions may be needed in different parts of the city or even within the same neighborhood. Rarely is a single option (for example, sewerage) viable for an entire town. For guidance purposes, Table 5 provides an idea of common upgrading options that may be appropriate for different settlements.

Table 5: Sanitation Options for Different Residential Settlement Types

	Settlement characteristics	Typical existing sanitation services	Key issues	Options for upgrading	
				On-site	Off-site
High-income residential	Low-density development with large plots and ample open space.	Most properties have septic tanks with or without a soakaway. In some cases there are sewer connections.	Septic tanks are often poorly maintained, and partially treated wastewater is discharged into open drains, creating a public health risk. Demand for water for irrigation of gardens.	Promote or enforce improved septic tank maintenance, including periodic emptying of pits. Addition of tertiary treatment at household level (anaerobic filter or reed bed).	Off-site treatment and disposal of septage. Sewerage combined with off-site wastewater.
Medium-income residential	Medium-sized plots with some space around houses.	Cistern flush and pour flush toilets connected to septic tanks or leach pits. Sewers are laid in some areas but system is only partial.	As above: on-site sanitation is often poorly operated and maintained. Partially treated wastewater is discharged into open drains, creating a public health risk.	Promote or enforce improved operation and maintenance, including periodic emptying of pits. Connect household toilets to small bore sewers which discharge into municipal sewers or to a decentralized wastewater treatment system.	Septage collection and off-site treatment. Sewerage combined with off-site wastewater treatment.

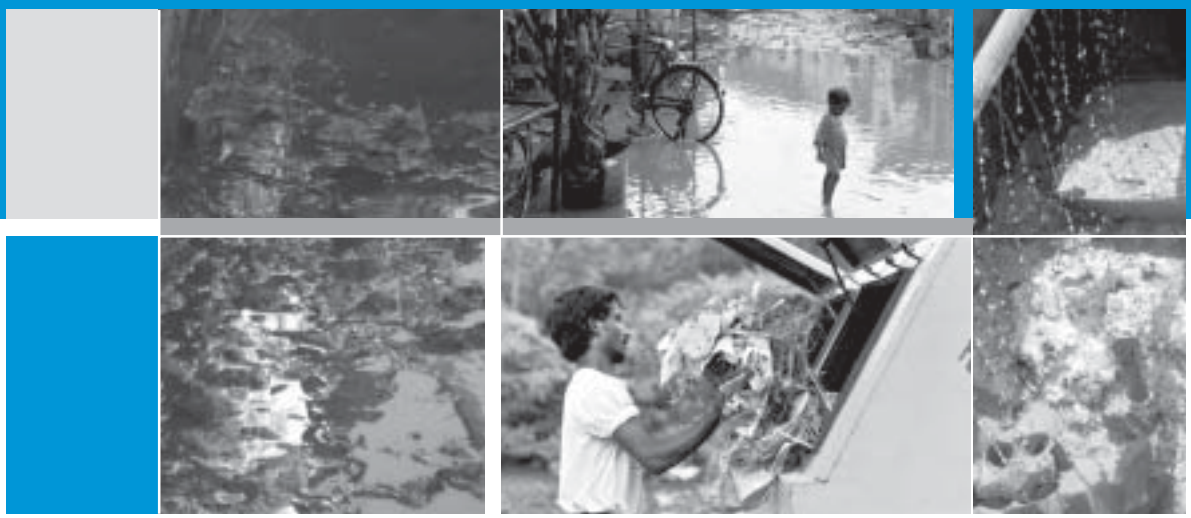
	Settlement characteristics	Typical existing sanitation services	Key issues	Options for upgrading	
				On-site	Off-site
Low-income residential (formal development)	Medium-density housing with small plots developed according to planning norms (road width, plot sizes, and so on).	Pour flush toilets connected to leach pits or septic tanks, the latter discharging into open drains or sometimes sewers.	As above.	As above.	As above.
Multistorey residential apartments	High-density, medium-low income.	Either connected to sewerage or have shared septic tanks.	Malfunction of septic tanks and soak pits.	Shared septic tank followed by: a) anaerobic filter and reed bed prior to discharge into surface water; or b) discharge to small bore sewerage system.	Septage transportation and off-site treatment. Sewerage combined with off-site wastewater
Low-income informal settlements	Unplanned development with medium- to high-density housing and small plots. Many plots subdivided and/or houses converted to multistorey. Residents may lack tenure.	Some households have no private facility. Existing leach pits and septic tanks discharging directly into street drains. Community or public toilets may be available. Inadequate drainage and water supply.	Septic tanks and leach pits are poorly maintained. Community toilets are often poorly maintained and unhygienic. Ponding of wastewater on surfaces.	Promote or enforce improved operation and maintenance, including periodic emptying of pits. Improved operation and management of community toilet blocks with septic tank or sewer connection.	Fecal sludge/ septage transportation and off-site treatment. Connect household toilets to small-bore sewers discharging to municipal sewers or decentralized wastewater treatment system.

	Settlement characteristics	Typical existing sanitation services	Key issues	Options for upgrading	
				On-site	Off-site
Illegal squatter slum settlements (*jhughi-jhopri* clusters)	High-density, very low-income population, lack of tenure, precarious housing. Narrow access lanes with poor services. Quality of construction and servicing of facilities is very poor.	Some households have their own toilet. Many use shared or communal toilets, or practice open defecation.	Need to eradicate open defecation. May be insufficient space to build household toilets for all. Lack of land tenure may constrain spending on improvements. Existing toilets may discharge into street drains (*nala*s), creating a public health risk.	Pour flush toilets with leach pits or shared septic tanks where space permits; or Simplified sewerage connecting existing and new toilets to municipal sewerage network. Community toilet blocks with septic tank or sewer connection.	Fecal sludge/ septage transportation and off-site treatment. Sewerage and off-site treatment of wastewater.
Resettlement colony	Medium-high population density. Basic infrastructure and some level of access to municipal services.	In some cases, development is planned and houses are constructed with toilets and leach pits. In others, many houses lack a toilet. Community toilets with septic tanks may be available.	Poor maintenance, inadequate services for fecal sludge collection and treatment. Open defecation may be common. Poor maintenance of community toilets.	Promote or enforce improved maintenance including emptying of leach pits. Provide communal toilet block(s) with: a) constructed wetland or anaerobic filter taking discharge from septic tanks; or b) sewer connection. Simplified sewerage connecting existing and new toilets to municipal sewerage network.	Fecal sludge transportation and off-site treatment.

	Settlement characteristics	Typical existing sanitation services	Key issues	Options for upgrading	
				On-site	Off-site
Urban village, former rural village overtaken by urban spread	Medium-high density, mixed income.	Coverage variable; existing toilets mostly have septic tanks or leach pits discharging into open drains or *nalas.*	Poor maintenance of toilets, inadequate services for fecal sludge collection and treatment. Open defecation may be common. Possible demand for wastewater from farmers.	Promote/enforce improved operation and maintenance, including periodic emptying of pits. Simplified sewerage in denser areas, with on-site treatment. Integrated wastewater treatment and resource recovery through aquaculture.	Septage transportation and treatment. Reuse of wastewater or sale of fish or animal feed.
Institutional buildings (academic campuses, army cantonment, hospitals) and hotels	Large areas of open space surrounding large buildings.	Large septic tanks with soakaways.	Poor maintenance. Unregulated septage removal and inadequate treatment.	Extended septic tanks (with baffles). Additional treatment (anaerobic filter or reed bed). Separate greywater treatment. On-site wastewater reuse.	Septage transportation and off-site treatment.

Part C

Framework for Decisionmaking



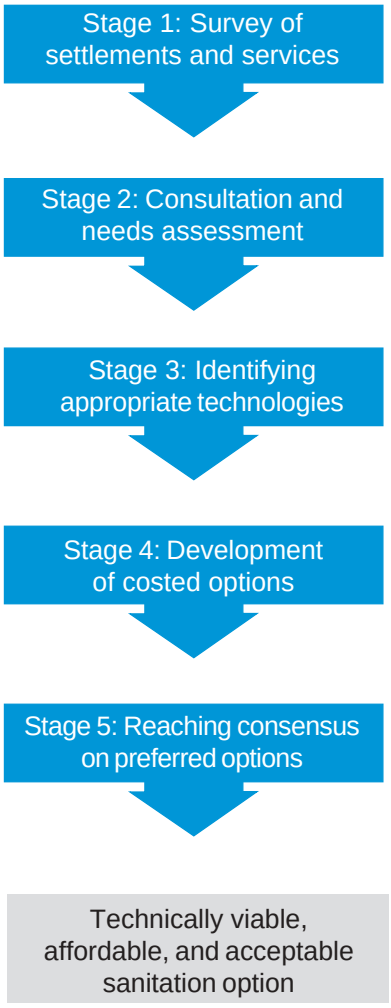
Overview of the Decisionmaking Process

Part C sets out a step-by-step process for selecting technology and service delivery options that are appropriate under local conditions and best meet the needs and preferences of the community.

The decisionmaking process has been broken down into five key stages, as illustrated in Figure 3. Although the stages are presented as a sequence, in practice it may be necessary to revisit some steps as the process unfolds.

While working through the process, reference should be made to the Tools section of the guide (Part D). This includes information on sanitation and wastewater treatment technologies; management options; and tools for community consultation and planning.

Figure 3: Five Key Stages in the Decisionmaking Process



Stage 1: Outline Survey of Settlements and Services

The objective of the first stage is to gather information about the coverage and quality of existing services to clarify the key problems to be addressed and priority locations for improvement. This investigation might be done citywide or within areas of the town that have already been earmarked for attention. The information can be obtained from (a) maps and other secondary sources; (b) from a rapid physical inspection on the ground; and (c) from informal discussion with residents.

This preparatory work does not involve systematic user consultation, which follows in Stage 2. The output includes one or more maps that show the existing sanitation infrastructure and services, and highlights areas where sanitation problems are most acute.

Key Questions

- What sanitation infrastructure and services are in place, and how effective are they?
- Where are sanitation problems most acute?
- Where is there is a need for new infrastructure or services, and where is there a need for upgrading?
- Which areas should be prioritized for improvement?

Map Existing Land Use and Settlement Types

Existing city maps can provide a considerable amount of relevant information, but they rapidly become out-of-date as cities expand and new settlements spring up. A common problem is that unplanned informal settlements—often inhabited by poor communities and urgently needing improved sanitation—are literally off the map. It may therefore be necessary to prepare some simple but accurate up-to-date maps to ensure that these areas are not neglected in the planning of service improvements.

Table 6 sets out some key characteristics of residential settlements and shows how these can affect technology choice. While noting the current situation, it is also important to consider how a neighborhood may change in future. For example, increasing populations and housing density result in larger quantities of waste and place additional demands on sanitation infrastructure. The increased volume of excreta and wastewater produced per unit area may overload existing sanitation systems, and there may be insufficient space to install new household toilets.

Table 6: Settlement Characteristics and their Influence on Sanitation Technologies

Housing layout	Availability of private and public open space determines the scope for installing new facilities. Access for servicing vehicles may also be a constraint.
Housing type	Multistorey buildings usually need flush systems.
Land ownership	Affects entitlement to public services and householders' willingness to invest in sanitation improvements.
Socioeconomic status	Poorer communities may need assistance with the costs of household facilities or sewer connections.

An estimate of population density can be used to indicate the amount of available space for latrine construction and installation of treatment systems, but may be misleading if the area contains multistorey apartment buildings. A visit to the settlement would enable a more accurate assessment of the space available for toilets and on-site storage facilities.

Even where space for a toilet compartment can be found, there can be other constraints. For example:

1. *Insufficient storage space.* This is more likely to be a problem for vaults, which are normally raised above floor level, than for pits and tanks, which can be located below ground level, allowing that space to be used for other activities.
2. *Inadequate access for desludging of on-site sanitation systems*. In very dense informal settlements narrow roads may be a constraint for access by conventional pit desludging equipment. Alternative equipment, as described in Part B, may be needed.
3. *Insufficient space for wastewater absorption into the ground.* This will mainly be a problem for cistern flush toilets discharging to septic tanks followed either by soakaways or drain fields.

Gather Information about Existing Sanitation Infrastructure and Services

In most settlements, investments in sanitation will already have been made, whether by government agencies, households or others. The condition and functionality of these facilities will have a strong influence on the options for improvement. For example, household latrines may have been installed but without any provision for the collection, treatment, and disposal of wastewater. In other areas, periurban residents may be reusing wastewater for irrigation but without any form of treatment, which poses significant health risks.

Table 7 summarizes the information needed at this stage. Key questions to address include:

1. Is the existing infrastructure appropriate to local circumstances? Could it accommodate waste from additional sanitation facilities?
2. How effectively are existing facilities being maintained?
3. Is there an existing collector sewer or major drain in the vicinity of the area into which wastewater could discharge?

This assessment can be led by municipal or Public Health Engineering Department engineers but it may also be necessary to draw on the expertise of other agencies or private consultants for some issues (for example, problems with pumping stations or treatment works). Local residents can also provide valuable information and insights on

Table 7: Relevant Information about Existing Services

Latrines and on-site treatment	
Water availability	Information on existing water supply services (including daily consumption per household) can be used to estimate daily wastewater production.
Sanitation facilities	Current levels of service (household and shared facilities), including approximate household coverage and number and location of communal or public toilets.
On-site treatment	Types of on-site sanitation system serving households, for example, leach pit or septic tanks.
Waste collection and conveyance	
Existing sewerage infrastructure	Coverage of sewerage and proportion of households with household connections.
Fecal sludge and septage collection services	Coverage and frequency of servicing.
Off-site wastewater treatment and reuse	
Wastewater treatment	Location and types of wastewater treatment infrastructure (if any exists).
Discharge or reuse	Locations where wastewater and fecal sludge is disposed or reused.

the adequacy of existing infrastructure and services. Transect walks and informal interviews provide two options for obtaining this information rapidly (see Table 8).

Table 8: Participatory Tools to Assist in Initial Investigations

	Description of activity	Purpose
Transect walk	Transect walks involve a walk through the settlement accompanied by a small number of key informants from the community.	Provides an introduction to existing sanitation services and an initial understanding of the condition from the perspective of local residents.
Informal interviews	Informal interviews with community members to discuss aspects of sanitation service provision in their locality.	Help to understand the existing situation and analyze causes of problems that may not be immediately obvious to the outsider.

While municipal and other government agencies are the principal service providers, small-scale private enterprises may also have a role, for example, by emptying septic tanks. In addition, there may be nongovernmental organizations supporting sanitation improvements in some areas. Personnel from these organizations may have valuable knowledge and insights on the adequacy of current services and priorities for improvement.

Outcome from Stage 1

The outcome from this stage should be a clear understanding of the problems to be addressed, both in terms of location and type, at the household, neighborhood and city levels. It should also be clear which locations require new infrastructure or services and which are suitable for upgrading. While some of the challenges will relate to household facilities in specific locations, the survey may also reveal a need for improvements to secondary infrastructure, calling for an area-based approach, or to primary facilities such as sewage treatment plants and trunk sewers. Some problems may also point to a need for citywide improvements in the way that services are managed and delivered.

This information will provide the basis for a more detailed, participatory investigation in Stage 2.

Stage 2: Needs Assessment and Consultation

Key Questions

- What is the nature and extent of current sanitation problems from the users' point of view?
- What type of improvements would users prefer?

Stage 2 entails a more detailed analysis of the current situation to reveal what types of improvements are needed and where they will have the most beneficial impact. It involves further technical investigations in priority areas identified from Stage 1, plus an assessment of existing services from the users' point of view. This should provide a fuller understanding of why existing services have failed or are otherwise inadequate.

This is also an opportunity to find out what type of improvements users want and would be willing to pay for, or at least contribute towards.

Community Consultation

While residents may not fully understand the causes of sanitation problems from a technical perspective, they may be well aware of deficiencies in service delivery, for example the inadequate cleaning of drains, sewers, and poor maintenance of community toilets. Generally, it is important to draw on local knowledge as service users may have valuable experience and insights that are different than those of municipal staff. The consultation process can also be used to generate community interest in the proposed improvements, thereby improving the chances that any new facilities will be used and properly maintained.

Establishing the level of demand for improvements is critical, since people are unlikely to support (financially or through their behavior) services that they do not want. Where facilities are installed without consultation, on the assumption that people 'need' them, the result is often wasted investments: facilities that are left unused soon fall into disrepair and become unhygienic.

Organizing the Consultation

There is no single correct way to organize a community consultation exercise; much depends on circumstances including the type of community and the issues being investigated. It is, however, important that the process is participatory. With this in mind a range of operational tools is provided in Appendix A.

In practical terms, it is useful to hold not only public meetings with local stakeholders, but also household interviews and discussions with small groups to get detailed insights into people's perceptions both of current problems and the possible solutions. Within this framework, a number of tools and techniques from the toolkit can be used; some commonly used ones are outlined in Table 9.

It is also advisable to consult local leaders and community representatives such as ward councilors and members of relevant community-based or nongovernmental organizations. Amongst other things, they should have a good understanding of how improvements could be managed at a community level.

Table 9: Participatory Tools Useful for Needs Assessment

Focus group discussions and semistructured interviews	Focus group discussions and structured interviews can be used to explore specific issues arising from surveys and participatory mapping in more detail.
Timelines	These can help to generate a clear understanding about what has happened in the past, what is happening now and what could happen in the future.
Community mapping	A representative group of residents is invited to make a map of the colony, showing key features relevant to sanitation (for example, open defecation areas, houses with or without toilets, location of sewers, and so on). This generates important baseline information and provides the basis for a discussion on the causes of current problems and possible solutions.
Questionnaire surveys	Questionnaires may be used to help focus and guide semistructured interviews of local residents, to learn more about their perceptions of sanitation and the problems related to fecal sludge and wastewater management.
Sanitation ladder	A set of pictures, each showing a sanitation technology option, is given to a group. They rank the options from best to worst; select one picture that best illustrates the current position in that colony and another representing the level of improvement they would like to reach.

It may not be advisable to hold consultations with all stakeholder groups at the same time as the presence of some, such as local politicians, may discourage the others from airing their views. Likewise, it may be advisable to hold some separate consultations with women only.

There are risks associated with the consultation because a poorly managed process can produce unreliable information or proposals that are unrealistic or do not represent the view of the majority of the community. It is therefore recommended that external specialists are contracted to facilitate the consultation process. An additional benefit of doing this is that residents may be more willing to speak openly to a third party than to a representative of the municipality.

At the end of the consultation exercise, stakeholders should have an opportunity to comment on the findings, including the priorities for action, and to correct any misunderstandings. The output from the various activities should therefore be recorded accurately, be it on paper or using photographs or audio tapes.

Outcome from Stage 2

The consultation should provide answers to both the key questions for this stage. This should include an indication of:

- ***Willingness to pay for improvements***
  The extent to which residents are willing to pay for, or at least contribute towards, improved services indicates how strongly they want them. In Stage 4, specific costs and proposed community contributions for one or more technology options will be presented and discussed in detail. At this stage, a broad indication of willingness to pay should be sought and taken into consideration when compiling a shortlist of technology options.

- ***The level of service to be provided***
  'Level of service' (see Table 10) refers to the location and convenience of sanitation facilities. There are three potential levels of service for toilets: household, shared or communal (public). Determining which level to provide is a critical step in the technology selection process.

Doubtless all residents would prefer to have a household latrine but this is not always possible, for a variety of reasons including affordability, land tenure restrictions or a lack of space. Where household toilets cannot be provided, alternative options will have to be explored and locations identified for any new facilities. (As a general rule, toilets shared by a small, self-selected group of households tend to be more heavily used, and better maintained, than communal blocks.)

Table 10: Level of Sanitation Service Provision

Household	The immediate access, convenience, and privacy offered by household sanitation will mean that this option will be the preferred option for residents. The main problems relate to the affordability for construction and the need to have a reliable servicing—notably for on-site sanitation systems—and the cost of installing a network of sewerage and off-site treatment if wastewater production is high.
Shared	In areas where there is not enough space for individual household latrines, the sharing of latrines between several families may provide a useful solution. The ownership of the latrines generally belongs to one of the houses, the owner of all the houses, or else ownership is shared between the households. Costs of pit emptying and other repairs can be included in the rent, but this can cause problems if the owner does not live there. Alternatively, residents can collaborate to clean the latrine and collect money to get it emptied when necessary.
Communal	Communal (or community) toilets are usually constructed in low-income residential areas and slums to cater to the local community who would otherwise have no access to sanitation. Provided these are managed well and maintained, this system can be effective in meeting the needs of the local community and promoting improved public health.
Public	Public latrines are provided for use for the general public in places such as bus stands, markets, and other facilities, which have a large throughput of people. One of the success stories of sanitation in India has been the public latrines developed by the organization Sulabh International.

Residents are generally more concerned about the cleanliness of their immediate surroundings than the wider impact on the environment caused by the discharge of untreated fecal sludge and wastewater. However, there may be an underlying public awareness for the need to improve the quality of the urban environment and to reduce pollution of natural watercourses.

- ***Specific concerns related to wastewater disposal or reuse***
  In some communities, especially on the outskirts of smaller towns, there may be an established practice of reusing wastewater as fertilizer, though this may be unregulated and could pose a potential public health risk. If there is ongoing demand for this, the technical feasibility of doing this safely should be assessed in Stage 3. If there is no demand, then treatment and disposal will be needed.

Stage 3: Identifying Appropriate Technologies

Overview

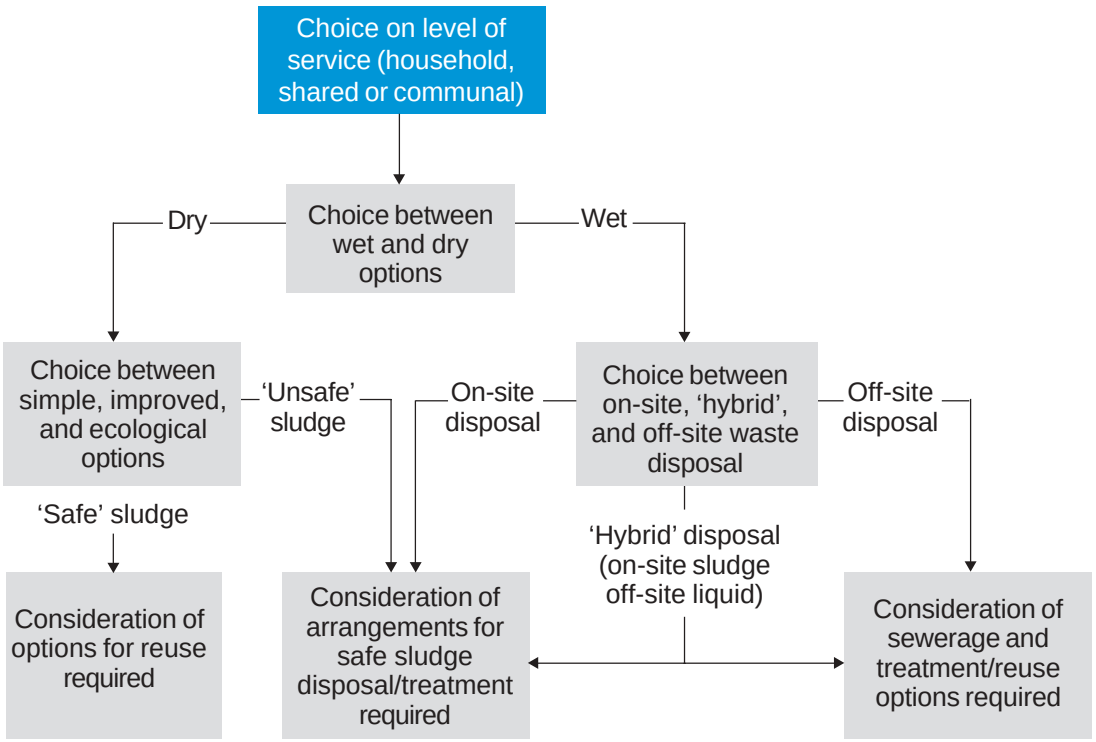
The objective of this stage is to eliminate technologies that are unlikely to be viable from a technical perspective and thus narrow the field of options. The key question for each option at this stage is: 'Could it work?' A variety of additional factors (some of them financial and managerial) affect whether an option *would* in fact be viable and these are considered in Stage 4.

Key Questions

- Can wastewater be disposed of on-site?
- When and where is sewerage required and viable?
- What arrangements are required for the management of wastewater or fecal sludge?
- How does the demand for reuse influence the choice of technology?

Figure 4 sets out a logical sequence for assessing all the potential technology options. In practice, dry sanitation is not considered an acceptable option in India and it is not, therefore, investigated further in this chapter.

Figure 4: Key Sanitation Choices and their Implications



On-Site or Off-Site Disposal?

All forms of wet sanitation produce blackwater which has a high oxygen demand and may also contain high concentrations of pathogens. As illustrated in Figure 1, the options for dealing with this blackwater are:

- On-site disposal to a leach pit or drain field.
- On-site disposal to a septic tank with soakaway or drain field.
- On-site retention of solids in an interceptor tank combined with off-site disposal of settled wastewater (hybrid system).
- Off-site disposal of blackwater via sewerage.

The first and second options may require separate provision for disposal of sullage water while the third and fourth options work best if blackwater and sullage water are combined and dealt with together as sewage. The choice made between these options will depend on a number of factors including:

- The quantity of wastewater produced;
- Soil type, groundwater depth and topography;
- Housing density and available space;
- The source of water; and
- The presence of sewers and drainage channels into which local sewers might discharge.

These factors are considered below.

Quantity of Wastewater Produced

The total quantity of wastewater produced will depend on water consumption, which in turn will depend on the location of the water source and the length of time for which water is available each day (see Table 11).

Table 11: Approximate Water Consumption Figures for Different Levels of Water Supply Service

Type of supply	Water consumption (lpcd)		
	Minimum	Average	Maximum
Standpost	15	20	30
Yard tap, hand-operated well or in-house connection with intermittent supply	25	50	70
In-house connection or well with electrically powered pump	90	120	180

When per capita consumption is relatively low (less than 30 lpcd) then, depending on ground conditions and population density, it should be possible to deal with all of the wastewater on-site. When per capita consumption is higher, on-site disposal of blackwater is still possible, but sullage water will need to be disposed of off-site. Off-site disposal of all wastewater will be required if blackwater and sullage water flows are combined on-site to produce sewage (see Table 12).

Table 12: Relationship between Water Use and Disposal Option

	Level of water use		
	Low <30 lpcd	**Medium** 30–80 lpcd	**High** >80 lpcd
Blackwater	Discharge wastewater to leach pit on or close to plot	Leach pit disposal possible if kept separate from sullage. Otherwise, sewerage and treatment required	Leach pit disposal possible if kept separate from sullage. Otherwise, sewerage and treatment required
Sullage (Greywater)	Discharge to soakaway or use for garden watering.	Soakaway disposal may be possible in permeable soils but off-plot disposal via a drain or sewer will normally be required.	Off-plot disposal—sewerage or drainage required.

The quantity of wastewater and, in particular, the quantity of blackwater produced is also influenced by the type of toilet used. Table 13 summarizes types of toilet and provides estimates of wastewater production based upon standard flush volumes and an estimate on the number of uses per day.

Table 13: Types of Toilet and Estimates of Water Consumption/Wastewater Production

Type	Description	Typical flush volume (liters)	Estimated wastewater per day l cap^{-1} day^{-1}
Pour flush toilets	Use considerably less water than water closet toilets but have less appeal for more affluent households.	2.5	10–25
Dual flush toilets	Use less water than a full flush system (especially when used for flushing urine).	3/6	20–40
Full flush toilets	Use large volumes of water for flushing.	6–9	30–60

The key points to note are:

1. Full flush toilets use a significant amount of water and can only be used when a reliable water supply is provided via in-house connections.
2. Full flush toilets may create more blackwater than can be absorbed from an on-plot leach pit or soakaway, thus precluding on-site wastewater disposal.

Soil Type

The soil type will affect the operation of soakaways due to the infiltration capacity of the soil. Table 14 provides guidance on the maximum volume of wastewater that can be infiltrated on-site for different soil types. The last column calculates the maximum theoretical infiltration capacity for a 1 m^3 (wetted area of 5 m^2) assuming that there is no constraint due to clogging or waterlogging.

Table 14 shows the considerable difference in infiltration rate between clay and sandy soils. In areas with heavy clay soils, infiltration from leach pits and soakaways may not be feasible, whereas in sandy soils it may be possible to deal with flows from cistern flush toilets and even moderate amounts of sullage water on-site. Some caution is needed, since infiltration capacity will tend to reduce over time due to clogging with fecal solids from these theoretical values. Nevertheless, the figures given provide an indication for the potential for infiltration of treated wastewater.

Table 14: Theoretical Infiltration Capacity for Different Soil Types*

Soil type	Infiltration rate		
	mm hr^{-1}	l m^{-2} day^{-1}	Maximum capacity for a 1 m^3 pit (liters day^{-1})
Silty clay	0–1	0–24	0–120
Sandy clay	1–4	24–96	120–400
Silt	4–8	96–192	400–1,000
Sand	8–12	192–288	>1,000

* Assuming that the soil is free draining and not clogged.

In areas where the ground is rocky, it will be difficult and expensive to install pit latrines, septic tanks and sewers. In such situations, dry sanitation systems with chambers constructed partially or fully above ground level may provide a feasible sanitation technology.

In some parts of India, notably in the hilly areas in the north, the ground may become impenetrable during the winter months due to frozen soil conditions. In addition, latrines that use water for flushing excreta (such as pour flush latrines and water closets) may freeze and therefore dry latrines may provide an appropriate option in these situations.

Groundwater Level and Topography

In normal sandy and silty soils, the base of leach pits should be at least 1.5 m above the wet season water table. Where the groundwater level is near the surface, the scope for infiltration of treated wastewater into the soil will be reduced. Two possible options for overcoming these problems are:

a) Install dry latrines with vaults partially or totally above ground level (as in the case for rocky soils described above); and
b) Use drain fields instead of soakaways. These take up more space but promote infiltration into topsoil.

If neither of these options is possible, hybrid and off-site options should be considered. However, conventional sewerage will also be problematic where the topography is flat and there is a high water table, since the need to provide self-cleansing velocities will mean that many sewers have to be laid below the water table. This will lead to construction problems and potentially high rates of infiltration into sewers. The use of hybrid systems incorporating interceptor tanks can reduce this problem as solids-free sewers can be laid to much flatter gradients than conventional sewers.

Even where the groundwater table is low, conventional sewers can be problematic in flat areas. Laying sewers to self-cleansing gradients will result in high pumping costs. Experience shows that operators often attempt to reduce pumping costs by allowing the incoming sewer to surcharge. Surcharged sewers will silt quickly and thus need high levels of maintenance. In practice, there will often be a need for compromise between laying to self-cleansing gradients and keeping the depth of the sewer down in order to reduce pumping costs. One possibility in such situations will be to provide a hybrid system with interceptor tanks on house connections followed by solids-free sewers laid to flat gradients.

Housing Density and Availability of Space

As housing and population density increase, the volume of excreta and wastewater produced per unit area also increases, while space available decreases and may preclude the installation of household toilets. Even where space for a toilet compartment can be found, there may be other constraints, for example:

- *Insufficient space to store fecal waste*. This is more likely to be a problem for vaults, which are normally raised above floor level, than for pits and tanks, which can be located below a floor, allowing that space to be used for other activities.
- *Insufficient space to allow absorption of wastewater into the ground.* This will mainly be a problem for cistern flush toilets discharging to *septic tanks followed by either soakaways or drain fields.* Another factor to be taken into account is that seepage from leach pits and soakaways sited close to buildings can cause damp problems in buildings and result in structural damage. Damp problems can be countered by providing an effective damp-proof course.

Population density provides an indicator of the amount of open space available for the construction of latrines and treatment systems. Calculating the population density for a particular area will require field surveys during which other factors can be assessed. In particular, a quick qualitative assessment of typical plot layouts will provide information on the space available for toilets and on-site storage facilities.

In very dense informal settlements, narrow roads may be a constraint for pit desludging equipment. However, as described under 'Options for Removal and Transport of Fecal Sludge and Septage' (on page 49), alternative equipment is available which can be used in this situation.

The Source of Water

Where people rely on household wells and tubewells for their drinking water, the possibility of groundwater contamination must be considered. This is a potential problem mainly for on-site technologies. A minimum distance of 10 m should be allowed between a leach pit and a shallow well but this standard will be almost impossible to achieve in most urban areas. Where the groundwater table is more than 1.5 m below the bottom of the pit, the most likely contamination route will be along the side of the well or tubewell itself. This suggests that, if off-site technologies are not feasible, the focus should be on blocking the potential contamination route along the side of the well or tubewell, for instance by introducing a puddled clay layer.

Existing Facilities

The cost of off-site wastewater disposal will be reduced considerably if new sewers can be connected by gravity to an existing collector sewer or drain that has the requisite capacity.

Choice between On-Site and Off-Site Options: Conclusions

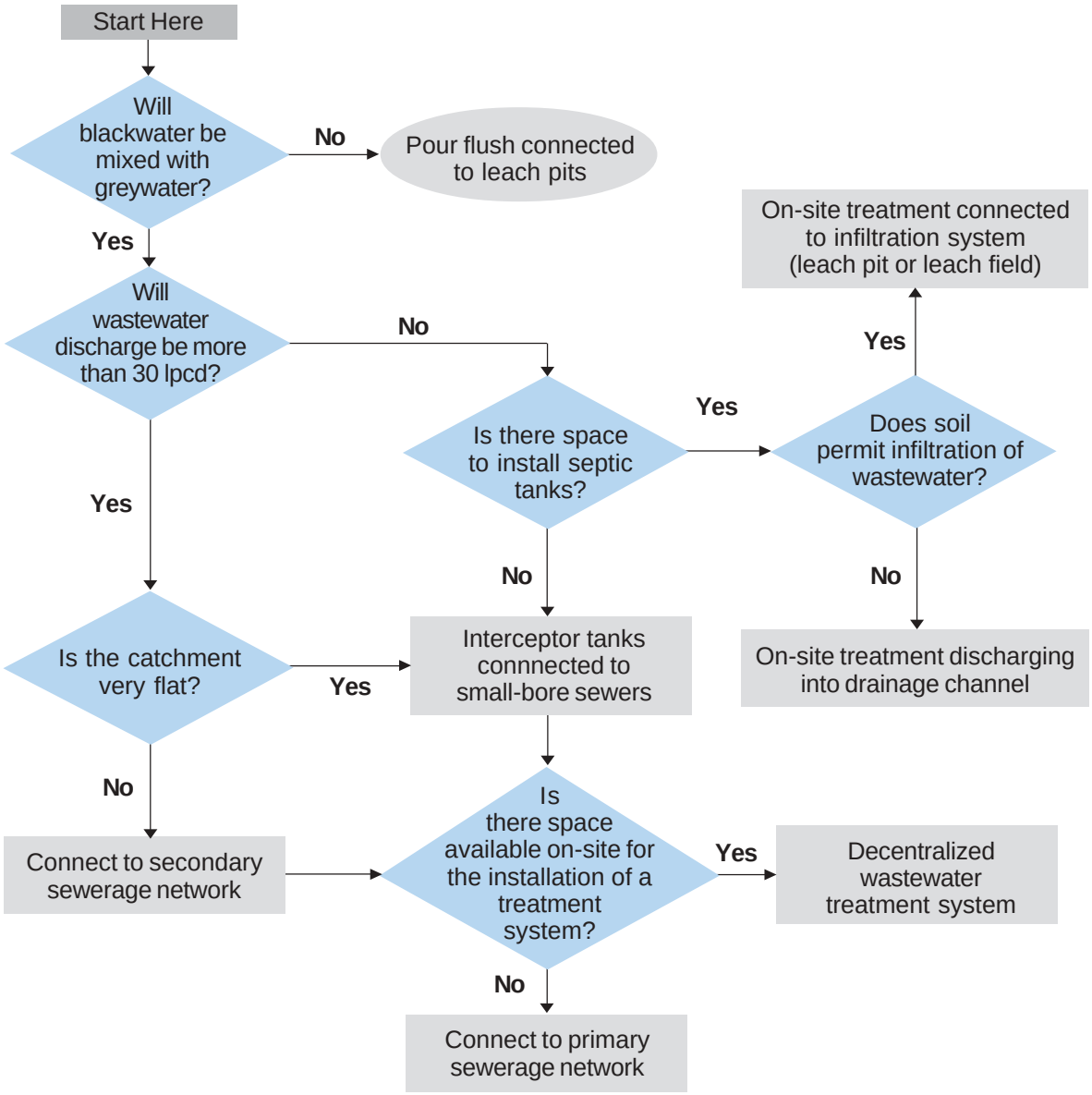
As a general rule:

- On-site options will be most appropriate in areas of low-density housing (typically less than 40 housing units per hectare), relatively low water consumption, and ground conditions that allow the absorption of wastewater without harm to an aquifer.

- Off-site options will be most appropriate where housing density is high (>40 houses per hectare), there is a reliable water supply on or close to the plot and sufficient fall is available to transport solids through the sewer without pumping.
- On-site disposal of blackwater via leach pits or soakaways, with off-site disposal of sullage water may be possible, even for relatively high density areas and relatively high water consumption, provided that ground conditions allow that and there is no problem of contaminating water supplies.
- Hybrid systems may be appropriate in medium- to high-density areas with a flat topography, particularly where the water table is high.

Further guidance on choices is given in Figure 5.

Figure 5: Options for Collection and Drainage of Wastewater



Options for Removal and Transport of Fecal Sludge and Septage

The long-term viability of on-site sanitation depends upon the availability of a service to remove fecal sludge and septage from pits or tanks, and then transport it to a suitable disposal facility. In most towns in India, only crude and unhygienic sludge removal services are available and so any proposal to introduce or improve on-site sanitation facilities should include consideration of sanitary options for the collection, transport, treatment, and disposal or reuse of fecal sludge and septage. This section deals with options for removing and transporting sludge while 'Treatment Options' (on page 51) deals with treatment options. Table 15 summarizes the different types of sludge, their characteristics and the implications for sludge collection and transport systems. Manual removal of untreated waste poses a significant health risk and should be avoided. As a result some form of motorized pumping equipment is recommended (see Part B).

Table 15: Types of Fecal Sludge and Implications on Cartage

Source	Characteristics	Emptying and cartage implications
Dry pits/vaults	Highly concentrated quasi-solids with high pathogen content (depending upon residence time in latrine).	Vacuum desludging systems are required for cleaning of single pit latrines.
Leach pits	As above, but higher moisture content.	Twin pits can be emptied manually without the need for specialized equipment.
Septic tanks	Varies enormously depending on the number of people utilizing the septic tank, water consumption, tank size, and pumping frequency.	Septage vacuum trucks are widely utilized for cleaning of septic tanks.

If it is not possible to guarantee hygienic collection, transport and treatment systems, the option of installing twin-pit systems, from which pit contents can be safely removed manually without the need for special disposal arrangements, should be considered. Note, however, that:

- This system only works if the pit that is not in use has been left undisturbed without water logging for a period of 18 months; and
- Users must be educated to use the pits alternately as required by the design.

Informal discussions with the users of twin pit ILCS latrines suggest that the second requirement is not always met at present.

Another question to be asked is who will be responsible for emptying twin pits. It is often assumed that the householder will do it but it is more likely that householders will employ sweepers. Again, user education is important to ensure that both users and those who empty pits are aware of the health risks associated with handling fresh feces.

Sewerage Options

All off-site and hybrid sanitation options require sewerage to transport wastewater to the point of disposal. The options for sewage disposal relate to the type of sewerage adopted and the extent of the system.

Sewerage constructed in accordance with conventional standards tends to be expensive to install and to maintain—especially where pumping is involved. Maintenance costs are likely to be high in areas with inadequate solid waste management or large unpaved and ungrassed areas, which are likely to generate high silt loads. Construction costs can be reduced by adopting standards that are appropriate to local conditions while pumping and maintenance costs may be reduced by installing interceptor tanks on household connections. Possible options for reducing the cost of sewerage are given in Table 16.

Shallow sewers are, in essence, conventional sewers constructed to relaxed standards. In particular, the shallow depth made possible by low traffic loads and short connection lengths allows the use of inspection chambers rather than manholes. Since these are not designed for entry of persons, they can be much smaller and cheaper than manholes, thus considerably reducing the cost of sewerage.

A type of shallow sewerage know as ‘condominial’ sewerage was developed in Brazil. As with shallow sewerage, sewers are laid at a shallow depth. Where possible, sewers are laid in private land, at the front or back of plots, or in sidewalks. The original assumption was that householders would take direct responsibility for sewers in private land although it seems that this practice is not as widespread as originally envisaged in Brazil. The condominial option may be feasible in some relatively low-density periurban settlements in India but is less likely to be applicable in high-density areas where houses commonly extend to both the front and back of plots, and there is no sidewalk. In such areas, it would be more appropriate to consider the use of shallow ‘lane’ sewers.

Another consideration is whether to design on the assumption that wastewater and storm water are disposed of separately. The accepted view is that separate systems should be the norm but there are likely to be situations in which it is very hard to separate flows on-plot, in which case the possibility of a combined system should not be discounted.

Table 16: Alternative Sewerage Options for Residential Areas

Terminology	Description	Benefits	Where it could be applied	Limitations
Shallow sewers	Sewers are laid to shallow depths and manholes are replaced with access chambers for cleaning.	Reduced cost and ease of maintenance.	In residential areas where traffic loads are low.	Protection, in the form of concrete surround or cover slab, required at road crossings.
Small-bore sewerage (also known as solids-free sewerage or SITS—sewered interceptor tank systems)	Interceptor tanks on household connections and small pipes of 100 mm diameter.	Removal of settleable solids in interceptor tanks reduces sedimentation in sewers and allows them to be laid to much shallower gradients.	Where ground slope is low or the water table is high.	Regular removal of solids from interceptor tanks required. Vulnerable to illegal connections by householders.

Treatment Options

All disposal and reuse strategies require waste treatment in order to mitigate environmental pollution and health risks. The focus for on-site systems will normally be on the treatment of fecal sludges and septage. That for off-site systems will normally be on wastewater treatment, although there will also be a need to consider options for treating the sewage sludge produced during treatment.

The choice of treatment process will be influenced by:

- The effluent quality to be achieved, which in turn will depend on what is done with the effluent.
- Wastewater characteristics, in particular its strength and likely variations in flow.
- Location and availability of land.
- Operational requirements in relation to available skills and management systems.

Each of these is discussed below.

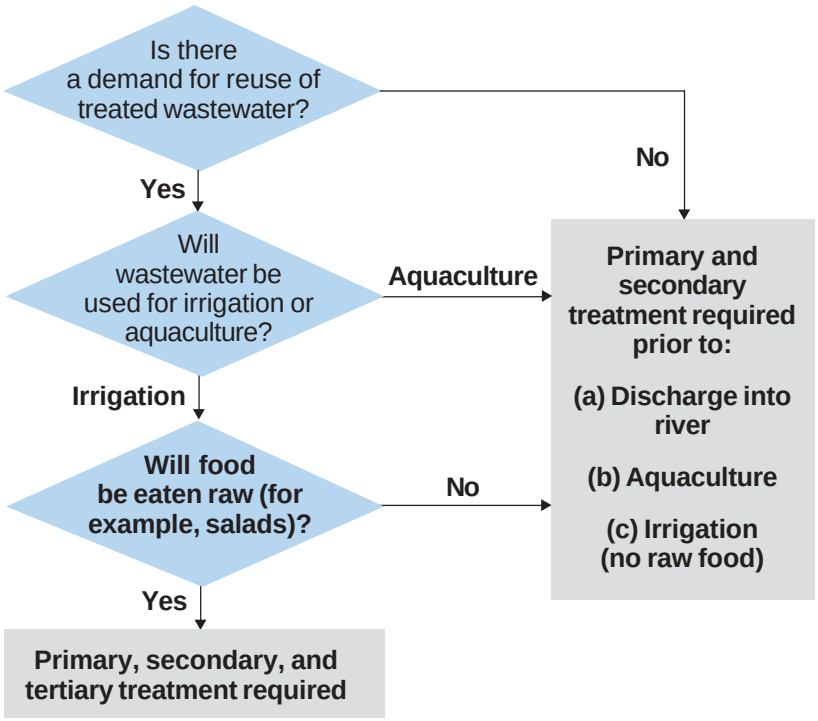
Required Effluent Quality

Most ‘conventional’ sewage treatment systems are designed to remove visually offensive solids, organic material, and suspended solids, all of which are likely to affect the quality of the receiving watercourse. The demand for wastewater reuse will have been identified in Stage 2 (‘Needs Assessment and Consultation’, on page 38). Suspended solids may also block drip

irrigation systems. However, the most important consideration when using wastewater for irrigation is the need to reduce pathogen levels. In general, the longer the retention time in the treatment facility, the greater the pathogen removal. WHO guidelines suggest that extensive waste stabilization pond treatment is required to achieve the microbiological standards required if wastewater is to be used for either unrestricted or restricted irrigation.

Figure 6 indicates the level of treatment that is required if the effluent is to be reused or discharged into a water recipient.

Figure 6: Level of Treatment Required for Wastewater Reuse



Wastewater Characteristics

The ways in which wastewater characteristics might influence the choice of treatment process are summarized in Table 17.

Location and Availability of Land

All wastewater treatment processes require land but the amount of land required varies considerably depending on the treatment process. As a general rule, less complex wastewater treatment technologies require more land than more sophisticated technologies. Anaerobic treatment technologies are fairly compact and decentralized systems can often be located on small parcels of public land. However, additional land will be required for additional treatment to achieve normal consent conditions. Natural aerobic wastewater treatment systems such as waste stabilization ponds and constructed wetlands require a large land area. For initial planning purposes, assume that activated

Table 17: Impact of Wastewater Characteristics on the Choice of Wastewater Treatment Process

Parameter	Notes	Technology choice
Flow rate	The average dry weather flow is proportional to the contributing population. Variations in dry weather flow occur during the day with peak factors decreasing as the contributing population increases. Storm flows can lead to large variations in flow even in nominally separate systems.	Some types of treatment systems—notably those which use a 'sludge blanket' or 'attached biofilm'—are sensitive to variations in changes in influent flow due to possible washout of active bacteria. The shorter the retention period, the more sensitive they are to variations in flow.
Concentration	Concentration of wastewater varies considerably according to the source, the type of sanitation, the mix between blackwater, sullage and storm water, and time of day.	In general, anaerobic treatment systems are more appropriate for more concentrated wastewaters.
Presence of toxins	Wastewater in municipal systems that receive discharges from commercial and industrial sources may contain a wider variety of pollutants than domestic wastewater and therefore be more difficult to treat.	A more complex treatment system consisting of an increased number of unit processes and more advanced treatment is required to treat municipal wastewaters. Aerobic treatment systems are more suitable for combined municipal wastewater.

sludge treatment requires about 0.06 m^2 per person. Trickling filters and extended aeration will require rather more, perhaps up to 0.1 m^2 per person. More land will be required if high effluent standards are to be achieved. Waste stabilization ponds and constructed wetlands require much more land, typically 3–5 m^2 per person, depending on ambient temperatures. The advantage of these technologies is that their long retention period makes them more effective than other treatment methods in removing pathogens.

Where land is in short supply or expensive, the following options should be explored:

- Extend the wastewater collection system and site the treatment facility further from the town, where relatively inexpensive land is available.
- Use a more intensive treatment technology, even though this may be more expensive to construct and operate.

- Combine relatively local primary anaerobic treatment, perhaps in the form of baffled reactors or upward flow anaerobic filters, with extensive secondary treatment located at a distance from the town.

The second option will not be possible where there is a need to achieve high rates of pathogen removal, for instance when wastewater is to be used for unrestricted irrigation.

Anaerobic waste stabilization ponds should be located some distance from housing, ideally 1 km but at least 500 meters from the nearest dwelling.

Table 18 summarizes potential options for treatment of wastewater from different sizes of catchments from household up to the city level.

Operational Requirements and Performance Reliability

High-rate aerobic treatment systems are often highly mechanized and require sophisticated operation and maintenance. This needs large amounts of power for pumping and aeration. They are therefore at risk from power supply failures and cost of operation is prone to large fluctuations (normally increases) according to the cost of oil. This is a very important point since power outages are fairly common in India.

Discharge consents can be met by designing the treatment plant according to the appropriate hydraulic and organic pollutant loading parameters for each technology. Thus, to treat the wastewater to a higher level, it is generally possible to increase the size of the plant. But, this subsequently has implications on the amount of land that is required for plant installation.

Table 18: Options for Wastewater Treatment According to the Level of Centralization

Scale	Options
Household-level treatment	Septic tank with anaerobic filter connected to surface water drainage channel.
Small communal wastewater system	Baffled septic tank or septic tank followed by anaerobic filter or constructed wetlands.
Off-site (local) small-scale treatment systems	Waste stabilization ponds (if land is available). Reed beds (constructed wetlands).
Off-site (remote) large scale treatment systems	Waste stabilization ponds. Activated sludge process. Aerated lagoons.

Performance stability under variations in influent loadings will be an issue to consider as some treatment systems (for example, UASBs) are sensitive to such hydraulic or pollutant load variations. It is important to consider what might happen if treatment systems become overloaded. In many cases this will lead to the generation of septic conditions resulting in bad odors, which creates a nuisance for people living close to the treatment plant and adversely affects treatment efficiency and contaminant removal.

Other Factors

Sludge production and management: Smaller quantities of sludge are produced if anaerobic treatment is used compared with aerobic treatment. Large quantities of sludge to aerobic digestion processes can create a sludge disposal problem. Both aerobic and anaerobic wastewater treatment processes produce a highly concentrated sludge, which is generally treated on the same site as the wastewater treatment plant.

Emission of odorous and corrosive gases: Anaerobic digestion of wastewater and organic waste produces odorous and corrosive (methane and hydrogen sulphide) gases. Therefore, similar problems arise from septic tanks and sedimentation tanks (primary treatment), and anaerobic waste stabilization ponds should be located some distance from houses.

Biogas production: Anaerobic treatment becomes more favorable when treating high concentration wastewater and sludge, but the methane produced is malodorous and also contributes towards greenhouse gas emissions. Reuse of methane 'biogas' is more attractive as it can be used on-site for cooking, heating water or electricity generation. Although biogas production in itself does not provide a justification for adopting anaerobic treatment, it can provide an additional incentive for ensuring that the treatment system is well managed.

Output from Stage 3

Based on the considerations above, it should be possible to produce a shortlist of technology options for different areas.

Although there may initially appear to be a wide range of technological possibilities, the number of options that are practically feasible will probably be quite limited in the light of local circumstances, including the nature of the services already in place.

In Stage 4, the financial and operational viability of the shortlisted options will be tested to produce a final list of options.

Stage 4: Developing Costed Options

Stage 3 identified technology options that are viable from a technical perspective. In order that technology choices can be made, this stage estimates the capital and operating costs associated with each option over its anticipated lifetime, and considers how the new services could be operated and maintained. This should confirm whether the technologies are viable in terms of the human and financial resources available locally. For those that are viable, costed packages can be presented to the community in Stage 5 and agreement reached on the final choice.

Assessing the Costs

Detailed costings will not be needed until a technology option has been selected and works are to go ahead. At this stage, a reasonable estimate of the cost per household should be sufficient to indicate the relative affordability of each option.

In comparing the options it is important to consider the *full life cycle costs* of each. This means taking into account not only the capital and recurrent costs over the anticipated lifespan of new facilities, but also the need eventually to replace some components. Full life cycle costing might show that the option that is cheapest to install in the short term may not be the most cost-effective in the long term. Further information on life cycle costing is provided in Appendix B.

It should also be borne in mind that existing infrastructure represents 'sunk costs', meaning that the capital investment has already been made and will be lost if an alternative system is introduced. This may be an important consideration where households have already invested in facilities, such as septic tanks, that will become obsolete if sewers are installed.

Capital Cost

This should include all the components of a sanitation system: not only household facilities, but associated secondary and tertiary infrastructure if it is not already in place.

Caution is needed when determining the unit cost of technology options. Standard cost estimates used in government sanitation schemes may be out-of-date and quite unrealistic bearing in mind the current price of raw materials and labor. Wherever possible, new estimates should be made against standard designs, using current market prices for labor, components, and construction materials.

Capital costs should also include other project implementation costs such as:

- Training and other capacity building for municipal staff or service users;
- Communication costs, especially where a new technology or service delivery model is proposed;

- Community mobilization;
- Sanitation and hygiene promotion;
- Demand generation; and
- Strengthening the local supply of materials and skilled labor.

Operation and Maintenance Costs

Broadly speaking, operation means the running of a service on a daily basis, whereas maintenance refers to less frequent activities that are necessary to keep a technology in proper working condition.

Operation and maintenance costs are often underestimated or, at worst, overlooked altogether. Infrequent operations are the ones that are *most likely to be ignored and it* is often *these that are costly*. While costs can vary greatly according to local conditions, they are normally substantial for sewerage, especially in flat areas where poor solid waste management results in sewers being choked with garbage.

The allocation of responsibilities for paying capital and operation and maintenance costs also needs to be considered. Costs at household level are normally the responsibility of the users, in which case there is no direct burden on the local authority, but there may be indirect costs associated with monitoring and regulation. Where on-site sanitation is installed, costs at household level arise not only from the routine cleaning and care of household toilets, but also from the need for periodic emptying of pits.

Appendix B provides guidance on calculating capital and operation and maintenance costs for both on-site and networked services.

Sources of Funding

The affordability of technology options depends not only on their life cycle costs but also on the availability of dedicated funds from third parties. Where the bulk of capital costs are covered by a grant from the state or central government, or a donor, then the size of the initial outlay may not be of much concern to the municipality; operation and maintenance costs may pose a much greater challenge.

Revenue Potential

A realistic estimate of the revenue potential of new or improved services should be factored into the cost of providing the service. Unlike water supply, sanitation services suffer the problems of uncertain demand, significant capital costs and limited scope for revenue generation. Some municipalities seek to recover some sanitation costs via property tax or as a percentage of the water bill, but both are problematic and tend to generate only nominal sums. Where sewerage is proposed there can be a dual problem of high operational costs and the risk that only a few people will connect to the service. Where households use on-site facilities there is often no scope for revenue generation, though the costs to the municipality may in any case be minimal.

Pay-and-use toilets are the obvious exception here; where they are well managed, users are often willing to pay and this can generate sufficient revenue to cover operation and maintenance costs.

Revenue Potential from Wastewater Reuse

There may be scope to generate revenue from the sale of treated wastewater or sludge to farmers. In Rajasthan, for example, wastewater has traditionally been sold to farmers for much of the year. Other possibilities include combined wastewater treatment-reuse systems such as waste stabilization ponds combined with duckweed or water hyacinth aquaculture or fish production (pisciculture). The data sheet in Appendix A provides more information about treatment using duckweed. The revenues from such operations are unlikely to cover the full operation and maintenance cost of sanitation services but may subsidize them to some extent. However, a lot of land is required and, in some cases, the acquisition costs might cancel out any financial gains.

The Role of Subsidies

The risks associated with the use of subsidies were discussed in Part A. There may nevertheless be a case for some level of carefully targeted subsidy to stimulate household investment, provided a genuine demand for the new service has been identified. It may also be necessary to subsidize the transaction costs of project implementation. The availability of any subsidies, whether at household or municipal level, should be factored into the cost estimates.

Service Delivery and Maintenance Options

No sanitation technology, however simple, is entirely maintenance-free. Identifying how each of the potential technologies could be operated and sustained is an integral part of the decisionmaking process. There is no special methodology for doing this; this matter needs proper attention since operation and maintenance will not take care of itself. Any technology is only as good as the operational framework within which it is used.

Typical operation and maintenance tasks at household, neighborhood and city level are outlined in Table 19.

Table 19: Operation and Maintenance Tasks

Level	Typical tasks
Household level	Cleaning of toilets; emptying of leach pits and septic tanks; unblocking of household connections.
Lane and neighborhood level services	Management of communal septic tanks and toilet blocks; cleaning of lane sewers.
City level	Operation of sewage treatment plants, pumping stations and septage/sludge treatment facilities.

Contracting out

It is often difficult for local authorities to service and meet all maintenance needs. There is considerable potential for harnessing the resources of other parties—not least the users of the service themselves, who may know how best to provide services effectively at the local level, and can mobilize their own resources to supplement what the government provides. It may also be beneficial to contract out some aspects of service delivery or maintenance, particularly where skilled personnel or equipment are required that are not available in-house.

Key considerations in the assignment of operation and maintenance responsibilities at each level are outlined below.

Household and Shared Facilities

In most cases, users should be responsible for the operation, maintenance, and eventual replacement of household facilities and toilets shared by small, self-selected groups. There are nevertheless roles for the municipality in terms of:

Enabling

- Providing technical information and advice on the use and maintenance of the facilities; and
- Ensuring that local services are available for the safe emptying of pits and septic tanks and treatment and disposal of wastes.

Monitoring and Regulation

- Ensuring that households dispose of waste material safely; and
- Resolving operational problems as they arise, which may include enforcement action in cases of unsafe practices (such as the discharge of excreta directly into the street).

Lane and Neighborhood Level Services

Tasks at this level are listed in Table 19. In this case there are a range of possible institutional arrangements that might involve only the municipality (or a line department) but could include roles for community-based and nongovernmental organizations, individuals or private contractors.

City Level Services

Activities at this level include the operation of sewage treatment plants, pumping stations, and sludge treatment and disposal facilities. As with neighborhood services, there may be scope for the municipality or line department operating the service directly, but there may be potential gains from contracting out some services.

Appendix C provides further information on the various stakeholders in sanitation services, their potential roles and possible contractual arrangements. In practice, much will depend on the capacity of the municipality and, where this falls short, the availability of relevant expertise within the local private and nongovernmental organization sectors. Where tasks are assigned to a third party, the quality of service delivery will depend largely on the design and management of contractual arrangements. The challenge is to create incentives for good performance and to penalize poor performance. Where the private sector is involved, there must be scope for making a reasonable profit, otherwise there will be a strong incentive to cut corners and reduce the quality of work. Effective budgeting is, therefore, essential.

Output from Stage 4

At the end of Stage 4, options that would be unaffordable to the municipality, or for which the operation and maintenance prospects look poor, can be eliminated. For those options that remain (which may be only one or two in many cases) outline life cycle costs and potential management arrangements can be presented to the community in Stage 5 to reach a consensus on the final choice (see Tables 20 and 21).

Table 20: Comparative Life Cycle Costs of Technology Options

	Capital cost per household		Net annual operation and maintenance cost per household	
Option (examples)	**User**	**Municipality**	**User**	**Municipality**
1. Pour flush toilet with twin pits				
2. Pour flush toilet with septic tank				
3. Pour flush toilet with sewer connection				
and so on…				

Table 21: Management Options

	Proposed operation and maintenance arrangements		
	Household	**Neighborhood**	**City**
1. Pour flush toilet with twin pits			
2. Pour flush toilet with septic tank			
3. Pour flush toilet with sewer connection			
and so on…			

Stage 5: Reaching Consensus on Preferred Options

In the final stage, the options developed in Stage 4 can be presented back to the community. For each package, the technical, managerial and financial implications—including proposed operation and maintenance arrangements—need to be explained clearly. This should enable residents to engage in an informed discussion with municipal representatives resulting, hopefully, in consensus on the way forward.

Facilitating the Process

Stage 5 is, in effect, a continuation of the process begun in Stage 2, and again requires good facilitation skills. It is therefore appropriate that the agency that carried out the consultation in Stage 2 also facilitates the final activity, which could take the form of one or more public meetings; possibly also focus group discussions to ensure that the views of all stakeholders are heard. On this occasion, however, municipal representatives should also be present since negotiations and formal decisionmaking are involved.

Where on-plot sanitation is concerned, it may be possible to accommodate more than one design within the same street or neighborhood, but more commonly a single choice will need to be selected, especially where there will be sewers. This may require some degree of negotiation and compromise on the part of both users and the municipality, though this needs to be handled carefully, especially in relation to user contributions.

Detailed explanations of the design, function and maintenance requirements associated with each option should be provided, especially where a technology is unfamiliar to the community. It is best to visualize the presentation: scale models could be used but, for household facilities at least, a better idea might be to build one or more demonstration toilets, or take a group of residents to see the technology in operation elsewhere.

Some options may be unfamiliar both to local masons and to the community, so that training or technical advice would be needed if those options were selected. Further practical advice and motivation may be needed to promote good operation and maintenance postinstallation if an unfamiliar technology is adopted. This might focus, for example, on the emptying of leach pits or the need to avoid the clogging of sewers and drains with solid waste.

Even when local behavioral and cultural factors have been taken into account, some options may meet with a negative response due to residents' concerns over issues such as the level of service, cost sharing arrangements or operation and maintenance requirements.

Alternatively, the community may display only moderate interest in the options at first. This might not indicate that the options are inappropriate; rather it could indicate the need for a

promotional campaign to generate real demand before going ahead with any works. This might occur where the community's preferred option has proved to be nonviable, or where users do not perceive the importance of a proposed investment. There may, for example, be limited initial interest in making house connections to a proposed sewer if people have already invested in septic tanks which they perceive to be perfectly adequate.

Proposals for centralized facilities such as wastewater treatment plants might not generate much interest among residents since they have no direct impact at community level. This could make technology choice a simple matter for the municipality, unless there was a proposal to introduce or increase user charges for the service; people unconcerned about the safe disposal of effluent are unlikely to spend money on it. For the same reason, people might be indifferent to the proposed introduction of pit emptying and treatment services. Some level of hygiene promotion and awareness-building may be needed and, where current pollution problems are severe, the municipality may even need to consider a program of enforcement action.

If all of the proposed options are found to be unacceptable, then it may be necessary to revert to previous stages of the decisionmaking process and consider other technologies or service delivery and financing arrangements.

Outcome from Stage 5

The outcome of Stage 5 should be clarity and consensus on the preferred option(s) in technical, financial, and managerial terms. The feedback from this consultation should also enable the municipality to design an appropriate implementation process that encompasses not only physical works but addresses communication needs (not least for demand generation and hygiene promotion).

Part D

Toolkit

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Appendix A

Participatory Communication Tools

Community Mapping

Purpose

Community social maps represent a popular planning, evaluation, and monitoring tool because they reveal a lot that is never possible to know from written records. They help to visually represent and analyze the community situation regarding all water and sanitation facilities, including informal facilities as well as government services and those provided by specific projects. The mapping procedure helps to understand the access of different socioeconomic groups to these services. It also helps to assess which households pay for services (and how much) in relation to service access obtained.

To do social mapping well requires a considerable amount of time and excellent facilitation. The venue chosen for mapping should be a well lit central place, where a large group can gather for an extended period of time, protected from the weather, and accessible to all classes and both genders.

Preparation

A day before, facilitators discuss this activity with community representatives (both women and men) and agree on the area to be mapped. For project planning purposes, the entire population to be covered by a project intervention would have to be included.

For large settlements, it is often too cumbersome to map the whole neighborhood down to the household level. Instead, a general layout of the area is drawn showing relevant infrastructure and services, as well as the rich, poor, and intermediate sections.

Process

The facilitator explains the purpose of the exercise, and helps start a discussion to develop a list of features that need to be indicated on the map. Women and men make the map, either together or in separate groups, as gender relations allow.

The map is then drawn on a larger sheet of paper, or on the ground using locally available materials such as pebbles, colored powder, coins, twigs, leaves, and so on, to represent key features such as houses, temples, roads, and so forth.

The team uses the map to gather information and generate discussion on existing sanitary conditions and the type of improvements people would prefer. This would

include information on the number, type, and location of sanitation facilities, both public and private; and about households that do not have easy access to a sanitary toilet. The adequacy, reliability, and coverage of water supply services are also investigated since this affects the range of choice of sanitation technologies that could work effectively.

Pocket Voting

Purpose

This tool is particularly useful for eliciting information on sensitive subjects about which people feel inhibited to state their views publicly. In essence, a range of options or scenarios is presented, and then individuals make a secret 'vote' for one of them in answer to a question posed by the facilitator. People might, for example, use their 'vote' to confirm that they currently practice open defecation. The voting is done in the focus groups of men or women, rich or poor.

Process

The facilitator poses a question, and a set of pictures of sites representing possible answers is presented, typically by attaching them to a large cloth which is hung before the group. Under each picture is a small pocket sewn into the cloth. The cloth is then hung in a concealed place (for example, in a small room) and group members approach one by one to cast their secret vote by placing a small stone or token in the appropriate pocket.

After each voting session, the group lays out the votes for an analysis of the findings. The facilitator draws the group's attention to voting patterns to analyze similarities, differences, and changes. This provides the basis for further discussion on current practices or services and the need for change.

Pictures can be used to investigate many aspects of the current situation and also to find out what sort of improvements people would prefer. Useful information emerging from the use of this tool might include:

- Existing water sources and the purposes for which they are used. (For example: Are shallow wells used for drinking?)
- Defecation practices including the level of use of existing facilities by men, women, and children from richer and poorer households.
- Differences in behavior and preferences for improvement between women and men, rich and poor.
- The priority attached to sanitation as compared with other possible improvements in infrastructure and services.

Stakeholders' Meeting

Purpose

A stakeholders' meeting uses a variety of activities to stimulate and nurture open discussion on the issues under investigation, which in this case could be sanitary conditions in the community and priorities for improvement. Participants include representatives of public and (where relevant) private sector providers of water supply and sanitation services.

Process

In small- and medium-size towns, stakeholders' meetings are best organized at the ward or zonal level. A neutral place with adequate space, as opposed to the offices of the public service provider, is appropriate for the meeting.

To the extent possible, participants should include representatives of:

- Service delivery agencies, including managers, engineers, and social development staff (if any).
- Relevant social intermediaries (nongovernmental organizations, community-based organizations), if any.
- Other relevant institutions, for example, schools where improvements to school sanitation are envisaged.
- Other specialist workers in water and sanitation-related functions, such as masons or community health workers involved in hygiene promotion.

Activities

A typical meeting might proceed as follows.

1. **Formal opening,** including self-introduction by the participants.
2. **Introductory icebreaker exercise.** An icebreaker serves to break down hierarchical barriers to interaction and create an informal, relaxed climate conducive to sharing and learning together.
3. **Facilitated discussion** on the key topics on the agenda. It is important that everybody's views are heard and the views of different stakeholder groups recorded.

The stakeholders' meeting is, by virtue of the range of participants, a significant challenge for the facilitator. All efforts must be made to ensure that the hierarchy of institutions is not reflected in the proceedings, that is, the poorer or female participants are not relegated to the background while the community elite and project staff take centre stage. Special care must be taken to ensure equal participation by all. It is advisable to use the services of

professional facilitators adept in the local language. A team of one facilitator and one or two cofacilitators or recorders is preferable.

It is important that the facilitator and recorders are very alert—they should be able to capture the special features of the group dynamics between the different categories of participants and make notes when views differ consistently.

Transect Walk

Purpose

A transect walk can be used to gain an overview of existing water- and sanitation-related facilities in a community from the perspective of the local residents.

Process

During the transect walk, a representative user group of women and men from the local community, together with the facilitators (one of whom should be an engineer), walk from one end of the community to the other. Interactions with residents during the walk yield information about the use, functionality, and adequacy of existing services, as well as financial and institutional arrangements for their operation and maintenance.

The walk should provide an opportunity for observations regarding:

- Water supply sources, in relation to their use for sanitation (flushing, anal cleansing, and personal hygiene).
- Toilet-owning households from different socioeconomic groups.
- Shared and public sanitation facilities.
- Drainage and sewerage systems.
- Locations where wastewater is discharged into drainage channels or natural water courses.
- Areas where wastewater is reused (in this case, further discussion with the users of the wastewater will be beneficial).

It can also be used to cross-check some of the information derived from the community mapping exercise. Key information obtained during the walk should be recorded and should provide an overview of the key needs and challenges in that community.

Appendix B

Costing Technology Options

A preliminary assessment of the cost of a technological option involves an estimation of capital and operation and maintenance costs, and a consideration of the options available for project financing, cost sharing, and revenue generation. The latter is important if operation and maintenance is to be sustained.

At this stage, the costs do not need to be accurate, but it is important to recognize what all the potential costs are, including hidden operational costs associated with staffing and other overheads.

All components of a sanitation system should be considered in the costing, including those relating to off-site sewers and wastewater treatment where applicable. When comparing the costs of different options, it is important to bear in mind that existing facilities represent 'sunk costs', meaning expenditure that has already been made and would be lost if an alternative system was adopted. Two broad approaches can be used to estimate capital and recurrent costs: one for on-site facilities, the other for networked systems.

The cost of on-plot facilities such as household toilets and drains can be calculated using typical house layouts. Normally these costs, and the cost of a sewer connection, are borne by the users unless subsidies are available under a special project or scheme. As such they do not form part of the municipality's costs but have important implications for users in terms of affordability and willingness to pay. For networked systems such as sewerage and drainage, the normal practice is to calculate the capital and recurrent costs of a scheme, and then divide these by the number of households to be served to arrive at an average cost per household for the public or shared components.

Capital Costs of On-Plot Facilities

The costs for individual items may be estimated from either:

1. **Lump sum costs based upon market rates for complete items** (including the cost of labor and the contractors' profit). The simplest approach to estimating the cost of a standard unit (for instance, a pit latrine to be produced to a standard design) is to refer to prices quoted by contractors for previous schemes. This does not, however, provide information on the costs of specific components, hence it can be difficult to adjust the price to allow for price increases or design modifications.

2. **Bill of quantities.** In this case the price is derived based on the combined costs of components, materials, and labor, using local standard rates can be obtained for each unit. This will enable a fuller understanding of the true costs of each technology under consideration and can be used as a benchmark to compare with market prices.

Estimating the Cost of a Networked System

The first step in estimating the cost for a networked system is to establish a hierarchy of components for primary, secondary, and tertiary facilities. The costs of the different components at each level can then be estimated as follows.

Primary and Secondary Facilities

For main drains and collector sewers, the cost can be calculated based on unit costs for pipes of different sizes and the length required for each. Professional assistance is needed for this area of costing.

Costs can be summarized in a table giving the length of each sewer or drain, its size, cost per unit length, and any additional costs required (for example, road reinstatement). For some items—for instance, pumping stations—it will be necessary to make separate allowances for these items. The total cost can then be calculated using these data.

Tertiary Facilities

The cost per hectare of tertiary level facilities (local sewers and drains) can be calculated as follows:

1. Choose areas with housing types and densities typical of the locality.
2. Determine the number of households contained (or potentially contained) within each area.
3. Design a tertiary sewerage and/or drainage system to serve that area, assuming that the system will connect to a secondary facility at the edge of the area.
4. Prepare a bill of quantities using estimates of the cost of materials and labor that would be required for this tertiary system. The cost estimate should exclude house connections, which should be included in household-level estimates.
5. Divide the total calculated cost by the area to provide the average cost per hectare, and by the number of households to give the average cost per household.

This exercise should be carried out for a number of typical areas and the results averaged. The results can be used to estimate the cost of tertiary facilities for all areas with similar characteristics.

Estimation of Recurrent Costs

Recurrent costs are those incurred for the operation and maintenance of facilities, including management overheads. They will vary greatly according to local conditions; for instance, the cost of operating and maintaining a sewer is likely to be much higher in flat areas with poor solid waste management than in an area with good gradients and adequate waste collection services.

Operational, maintenance, and rehabilitation costs should take into account:

- Routine cleaning of drains and waste disposal;
- Purchase of equipment and materials;
- Maintenance of facilities, for instance, public toilets, and so on; and
- Spare parts and replacement costs.

There is often little useful information available on recurrent costs. It may, therefore, be necessary to pilot operation and maintenance procedures in a range of representative areas and to record the costs. The stages in doing this would be to:

1. Select suitable areas large enough to enable meaningful estimates to be made (for example, a whole ward or housing development).
2. Agree on the operation and maintenance procedures to be followed.
3. Implement those procedures over a period of weeks, monitoring the costs, the quality of service provided, and any problems that are encountered.
4. If necessary, make adjustments to operation and maintenance procedures and repeat the exercise to obtain a better idea of the relationship between inputs and the outputs achieved.
5. Extrapolate the results of the exercise to the town as a whole.

Life Cycle Costing

Life cycle costing takes into account capital and recurrent costs and the need to replace infrastructure at the end of its life cycle. A spreadsheet can be developed showing the relevant costs and revenues for each technology over a given time period, and used to help identify the most cost-effective option.

Accounting for Inflation

As financial analysis involves an estimation of the actual amount of money paid and received by the project over a period of time, it is necessary to make adjustments to take into account the impact of inflation on each component where considered to be significant. Differing inflation rates may apply to different components and it should be applied to both expenditures and revenues (but not for capital and interest payments).

Systems that expose the user to high and uncertain levels of operation and maintenance expenditure are risky in an inflationary environment. In general, technologies that have more predictable construction costs or depend less on imports, are less ‘risky’ with respect to inflation, which may be an important factor in the choice of a system.

Appendix C

Institutional Options for Operation and Maintenance

Table 22 (on page 75) summarizes a range of options for the operation and maintenance of urban sanitation services.

The main areas to consider are:

- Management of household and neighborhood facilities.
- Management of zonal and city-level (primary) infrastructure.
- Managing communication and community liaison.

Operation and maintenance at household level is generally regarded as a household responsibility; municipal involvement is usually confined to the installation of toilets under government programs such as the Integrated Low Cost Sanitation Scheme. However, there may be some services that need external support, not least the desludging of leach pits and septic tanks and disposal of the effluent. It may be necessary both to promote pit emptying and to ensure that an emptying service is available. The municipality, a line department, nongovernmental organizations or private operators could all potentially provide this service.

Some programs have formalized the roles of the community and municipal agencies, based on the level of infrastructure concerned. Typically, households—perhaps via lane or neighborhood committees—are made responsible for 'internal' infrastructure and services, meaning local level drains, sewers, waste collection points, water distribution networks, and so on; government agencies retain responsibility for 'external' infrastructure and services such as secondary and trunk drains and sewers, bulk water supply lines, and so forth. Maintaining good operational links between municipal and community-managed activities is important.

Where more than one management option appears possible, it is important to consider the capacity of the different sectors. So, for instance, if municipal agencies are short of skills or resources for community liaison, but there are strong community organizations, then community management may be the preferred option at the neighborhood level.

It is also important to consider what *incentives* for good performance would operate under the various management options. There are some areas of service delivery that have been traditionally managed by municipalities or Public Health Engineering Departments, but with very disappointing outcomes—public toilets are a prime example. Contracting out operation and maintenance to informal or private sector operators can result in better quality of service delivery, so long as the service is commercially viable and the contract provides incentives for good performance and imposes penalties where specified standards are not met.

Some additional comments on the various institutional options are provided below.

Municipal Service Delivery

Most municipalities have a large and mostly unskilled sanitation workforce, making it ideal for unskilled and semiskilled labor-intensive tasks such as the maintenance and cleaning of drains and sewers. Some also offer a pit or septic tank emptying service for a fee.

There is often quite limited capacity to provide more complex services such as the operation of treatment plants, especially in smaller municipalities that do not have specialist equipment or staff, though this may be the responsibility of a state agency, typically the Public Health Engineering Departments.

Whatever organizations are involved, the municipality has a central role that it cannot give up: to monitor and enforce standards of service delivery, whether the services are delivered in-house or contracted out. Where monitoring is lacking, service providers can easily avoid their responsibilities and let standards slide.

Nongovernmental Organizations' Involvement

Very often, the added value that such organizations bring to a sanitation program is their ability to work closely with the community: in the initial planning and needs assessment; in capacity building; during the installation of new household facilities; and in operation and maintenance. Managing communication between the municipality and local residents may be central to this role. It is, therefore, important for the municipality to treat nongovernmental organizations not just as private contractors but as partners, especially where community support is central to the success of the new investment. In some cases, it may be better to work with such organizations under a Memorandum of Understanding rather than a contract, so that the organization's independence is not compromised in the eyes of the community.

Where a potential role for nongovernmental organizations has been identified, it should not be assumed that any local organization could fulfil the task or legitimately represent the community. It is important to check whether an organization has the right range of skills for the task, proven experience and the capacity to operate at the scale required. Some nongovernmental organizations are very effective on a small scale but cannot meet the managerial demands of a service once it expands.

It is also important to recognize that, while such organizations have humanitarian objectives, they need to cover their operating costs. They should, therefore, be compensated adequately for any work assigned to them. Continuity is also important; it can be difficult for nongovernmental organizations to continue funding their staff if there are long periods of inactivity between municipal assignments.

Community Management

Community management implies long term community responsibility for a facility or service and in some cases it includes legal ownership of the infrastructure or service. This is usually done though neighborhood groups or other community-based organizations. Community members may carry out the work themselves or play a managerial role and pay a third party, such as a contractor or a community-based organization, to do it for them.

While some initiatives in community management have been successful, rarely can community groups manage services effectively without some level of support from, and coordination with, existing city level management structures. Furthermore, the assumption that poor people have the time and motivation to carry out important tasks on a purely voluntary basis is very misguided, especially in urban settlements that lack the close-knit community structure found in villages. As with private contractors, it is important to consider the financial viability of the service and the incentives for doing the work to a high standard.

Private Sector Participation

Table 22 includes a wide array of options for private sector participation in operation and maintenance, from the provision of specialized, time-bound services to fully independent service provision whereby the private agency develops and delivers a service using its own resources. Generally speaking, the need to harness private sector capacity increases with the complexity of the technology adopted. This is especially true in the case of smaller municipalities without specialist engineering staff. Having said this, the availability of affordable specialist contractors is often limited in smaller towns, reinforcing the case for adopting simple technology as far as possible.

Getting the best out of private sector participation depends on the selection of appropriate contractors and on the effective design and supervision of contracts. Standards of service delivery need to be spelled out clearly and enforced by the municipality.

Multistakeholder Involvement

There can be much to gain from establishing partnerships whereby the municipality, civil society organizations, and private contractors work together towards a common purpose under the umbrella of a partnership agreement. For example, a decentralized wastewater treatment plant might be established on the initiative of the municipality, with government funding, with a nongovernmental organization facilitating community involvement and a private contractor appointed for specialist maintenance tasks.

At their best, partnerships draw on the different strengths of the institutions involved to achieve a comprehensive service delivery package that addresses the full range of service delivery needs: technical, institutional, communication, and so on. The careful assignment of roles and responsibilities within partnerships is important, so that roles match each partner's strengths. A willingness to share not only information but decisionmaking within the partnership is also vital if the partnership is to maximize its potential.

Table 22: Institutional Options for the Construction, Delivery, and Maintenance of Urban Sanitation Services

Title	Description	Applicability	Examples
Municipal service delivery	Direct service provision by municipality's own workforce.	Labor-intensive unskilled and semiskilled tasks, especially, operation and maintenance of secondary and primary infrastructure. However, both capacity and incentives to do a good job may be limited.	Sewer maintenance. Operation of treatment plants. Desludging of septic tanks.
Community or community-based organization involvement			
Community contracting	The community is given responsibility (usually via a community-based organization) for specified construction works and/or maintenance tasks. Community members may execute the work directly or hire others.	Labor-intensive works that do not require very specialized skills. Can be used as a form of capacity-building and income-generating support; also to enhance community ownership of new or improved facilities.	Construction of household toilets. Excavation and laying of shallow sewers.
Community management	Community ownership and control of local facilities (usually via a community-based organization). The community may manage the facilities directly or appoint a third party.	Household and neighborhood facilities that do not require expensive or highly specialized skills for their maintenance.	Operation of public toilet blocks. Emptying of septic tanks?

Title	Description	Applicability	Examples
Nongovernmental organization involvement			
Support to community contracting or management	Nongovernmental organization builds capacity or facilitates community management or contracting; and liaises with the municipal agencies on the community's behalf.	Willingness of municipality to recognize and coordinate with community-managed service.	Construction of on-site facilities. Management of public toilet blocks.
Nongovernmental organization management	Nongovernmental organization manages construction, service delivery and/or maintenance of facilities at local level, possibly within a partnership (see below).	Scope of the nongovernmental organization's role depends on its technical and managerial capacity and skills in community-based approaches.	Construction of on-site facilities. Management of public toilet blocks.
Private sector involvement			
Specialist support to in-house services	Government agency operates sanitation services directly but brings in the private sector, usually for a short period, to fill specific expertise gaps.	Time-bound activities requiring skills and/or equipment that are unavailable within the municipality or line departments.	Use of specialists in no-dig sewer construction.
Service contracts	Government agency is the main service provider but contracts out specific aspects of service delivery (typically two or three years).	Applicable where the municipality lacks the human or financial resources to provide the service directly.	Emptying septic tanks and treatment or disposal of the contents. Provision of IEC, communications.

Title	Description	Applicability	Examples
Management contract—without construction	Experienced operator appointed to take over management of all, or part of, a sanitation service (typically five or seven years).	Municipality has acquired new infrastructure or services but lacks the capacity to manage them in-house; also where local private sector capacity offers added value (such as specialist skills or equipment).	Operation of treatment plant(s). Operation of public toilet blocks.
Management contract—with construction	As above, but includes capital works funded by the public sector (typically five or seven years).	Applicable where construction by management contractor would be more cost-effective than by a municipal agency.	Construction and operation of decentralized wastewater treatment plants, public toilet blocks.
Leasing	Private operator takes complete control of all aspects of a service and controls the revenue stream. Operator pays an annual fee, assets remain in public ownership (usually 12+ years).	There must be scope for significant revenue generation, to incentivize maintenance.	Operation of decentralized sewerage systems, public toilet blocks.
Independent service provision	Local services developed and delivered directly by the informal or private sector using their own resources.	There must be significant local demand for the service.	Construction and operation of private toilet blocks. [Promotion and] construction of household toilets. Emptying of septic tanks and/or transportation and disposal of sludge.

Title	Description	Applicability	Examples
Multistakeholder involvement			
Bi- and tri-sector partnerships	Public, private and/or civil society organizations work within a shared operational framework established by a contract or memorandum of understanding. May include establishment of a service company jointly operated and staffed.	Stakeholders have valuable skills and resources and are willing to work together.	Development of on-site sanitation facilities in low-income communities where community mobilization skills are needed alongside the technical capacity of the private sector.

Appendix D

Technology Data Sheets

On-Site Sanitation

- Pour flush toilet with single leach pit
- Pour flush toilet with double leach pit
- Septic tank
- Communal toilet block

Waste Transportation

- Desludging trucks (Vacutug)
- Conventional sewerage
- Shallow sewerage
- Conventional sewerage

Wastewater and Fecal Sludge Treatment

- Oxidation ditch
- Rotating biological contactors
- Anaerobic baffled reactor
- Reed beds
- Waste stabilization ponds
- Activated sludge process
- Biological trickling filter
- Fluidized aerated bed reactor
- Upflow Anaerobic Sludge Blanket (UASB)
- Upflow anaerobic filter
- Duckweed ponds

Note: For all technologies, the exact capital and operation cost is dependent on type and availability of material, labor, and location. The figure stated is a broad estimate as of 2007.

On-Site Sanitation: Pour Flush Toilet with Single Leach Pit

What is it?

- A technology for on-site disposal of blackwater and storage of excreta for long periods for partial digestion, prior to removal and further treatment. Excreta is flushed into a pit by pouring one or three liters of water. Pour flush toilets have a water seal to reduce odor and insect problems.
- Fecal matter is accumulated in an underground pit normally lined with open-jointed brickwork to enable water to percolate into the ground.
- The pit may be located directly under the latrine superstructure or can be offset so as to enable access for desludging.

Where is it applicable?

- Single leach pits are a simple and relatively inexpensive form of on-site sanitation that have widespread application in urban areas but are dependent upon the provision of an affordable and hygienic fecal sludge collection and treatment service.
- Leach pits are appropriate when water use is at least 25 liters per capita per day. However, they may be used to deal with all household wastewater when per capita water use does not exceed about 50 liters per day, depending upon soil characteristics and groundwater level. If wastewater production is higher, leach pits may still be used for disposal of blackwater with off-site disposal of grey water via a drainage or sewerage system.
- Impermeable soils such as clay or rock preclude the use of leach pits. A high water table may also reduce the capacity of the soil to infiltrate wastewater. In these situations, the pits and latrine superstructure should be raised and a layer of sand provided around the pits to promote infiltration of wastewater.
- Care should be taken when using leach pits in situations where groundwater is used for water supply. A minimum distance of 10 meters should be allowed between a leach pit and a shallow well.

Operation and maintenance requirements

- Once the pit is full, it must be desludged. The methods used should prevent operators or cleaners from coming into contact with fecal material. The undigested and unstabilized sludge must be treated and disposed of safely.

Additional infrastructure or treatment requirements

- Periodically, sludge must be collected and treated prior to reuse or disposal. Collection methods need to be hygienic, preventing contact between workers and feces.

Limitations and risks

- The widespread practice of manual desludging of excreta and its indiscriminate disposal presents a major health risk.
- Pollution of groundwater is likely if the bottom of the pit is less than 2 meters above the groundwater table and people collect drinking water from shallow wells located close to pits. Deeper groundwater may also become contaminated if the underlying ground is fissured rock.
- There are many instances where pits work well initially but problems arise later when water use increases. In this situation, residents often connect their toilets to the surface water drainage system.
- Leach pits are not normally designed to cater for sullage water, nevertheless it is sometimes discharged to pits and can result in overflowing, causing nuisance and a potential health hazard close to houses.

Management arrangements

- Responsibility for maintenance rests primarily with the householder, who will need to pay a private or public service provider to remove the pit contents and transport off-site for treatment and disposal.

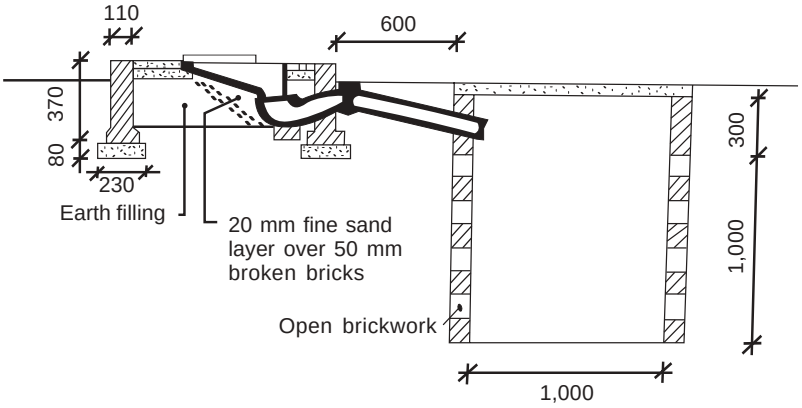
How much does it cost?

- *Capital costs*: Varies considerably from Rs 3,500 (US$85)[3] upwards, depending on superstructure construction and ground conditions. Raising the latrine above ground level will increase the construction cost.
- *Operating costs*: Approximately Rs 200–300 (US$5–7) per year.

Links to other technologies

- Pit emptying and fecal sludge treatment.

Figure 7: Pour Flush Latrine with Offset Single Pit



Source: Cairncross, Sandy, and Richard Feachem. Environmental Health Engineering in the Tropics: An Introductory Text.

[3] US$1 = INR 41 (approximately, as of October 2007). Conversion rates are from https://www.cia.gov/library/publications/the-world-factbook/fields/2076.html; all conversions in the text are approximations.

On-Site Sanitation: Pour Flush Toilet with Double Leach Pit

What is it?

- A technology for on-site disposal of blackwater while storing fecal material for a period long enough for digestion to render it harmless. Digested sludge can be used as a fertilizer or soil conditioner without further treatment.
- Two underground chambers are provided to hold fecal matter. These are normally offset from the toilet and should be at least 1 meter apart. A single pipe leads from the toilet to a small diversion chamber, from which separate pipes lead to the two underground chambers. The pits should be lined with open-jointed brickwork, similar to the single pit design. Each pit should be designed to hold at least 12 months' accumulation of fecal sludge.
- Blackwater is discharged to one chamber until it is full of fecal sludge. Discharge is then switched to the second chamber. Just before the second chamber is full of fecal sludge, the contents of the first pit are dug out. During the time of storage, digestion should ensure that it is odorless and free of pathogens.

Where is it applicable?

- In low- to medium-density areas, particularly periurban areas, where there is space on or immediately outside the plot to install the pits and where the digested sludge can be applied to local fields and/or gardens as a fertilizer and soil conditioner. This technology has been widely used in the Government of India's Integrated Low Cost Sanitation Scheme (ILCS).
- Where water use is in the range 30–50 liters per capita per day depending upon the characteristics of the soil or groundwater level.
- Where the depth to the water table is 3 meters or more, allowing a clear 2-meter vertical distance between the bottom of the pit and the water table.
- Constraints for single leach pits relating to impermeable soils and the proximity of wells and tubewells also apply to double leach pits.

Operation and maintenance requirements

- The pits must be used alternately and the diversion chamber must be accessible so that flow can be diverted between chambers.
- Wastewater should never be diverted back to the first chamber before digested sludge has been removed from it.

Additional infrastructure or treatment requirements

- If digested material cannot be used in local fields and gardens, provision will have to be made for transportation to areas outside the city for reuse on agricultural land.

Limitations and risks

- Householders may not understand the system and as a result may not use the pits alternately, or may omit to rest the filled pit at least for one year so that the contents degrade and become harmless. Explanation of the operation and maintenance requirements is therefore essential at the time of installation.
- Water may percolate through the soil surrounding the pit and pollute groundwater, which is a potential problem if water is used for drinking.

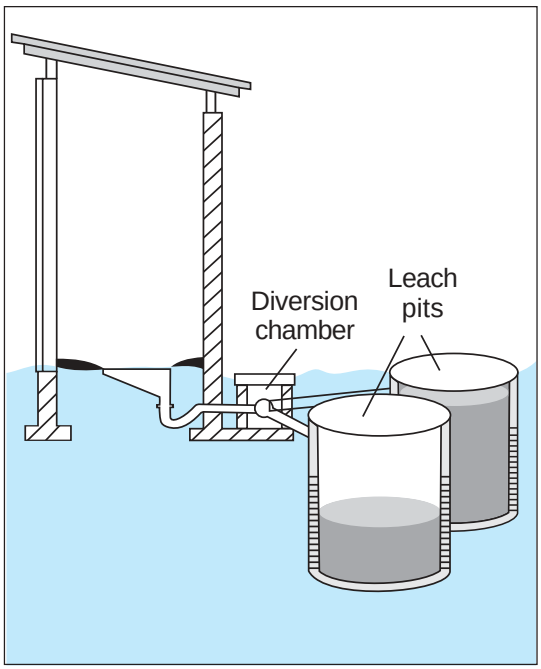
Management arrangements

Responsibility for operation and maintenance rests primarily with the householder, who needs to ensure that the pits are used in the correct sequence and are emptied at the appropriate time.

How much does it cost?

- *Capital costs*: Varies, depending on superstructure construction details and the ease of digging, but the minimum cost of the standard Integrated Low Cost Sanitation Scheme design is Rs 5,000 (US$120).
- *Operating costs*: Roughly, Rs 200–300 (US$5–7) per year.

Figure 8: Pour Flush Latrine with Offset Twin Pit



Source: WHO 2003. Reproduced with permission from the World Health Organization, Geneva.

On-Site Sanitation: Septic Tank

What is it?

- A septic tank is a buried chamber that collects and stores domestic wastewater (usually both blackwater and sullage) and treats organic waste under anaerobic conditions.
- Effluent from septic tanks should be discharged to an on-site infiltration system (soakaway or drain field) or a small-bore sewerage system, or be treated on-site before discharge into surface water. In practice, many septic tanks discharge pathogenic effluent directly into open drains, posing a public health risk.
- The standard septic tank design incorporates two chambers. Some septic tank designs adopted in India have three chambers. Most of the treatment takes place in the first chamber.
- A well-managed septic tank will remove about 50–60 percent of the biological load in the wastewater.

Where is it applicable?

- Septic tanks are widely used to provide partial treatment of wastewater from individual homes, clusters of houses or institutional buildings where there is no sewerage network.
- Appropriate in periurban settlements or less dense urban areas due to the fact that they do not require any centralized infrastructure.
- Normally associated with *pucca* [permanent] houses for middle and higher income households.
- For soakaways to function, soil conditions must be suitable for infiltration of effluent from septic tanks. A microwetland can help through increased evapo-transpiration losses and moisture uptake. Sullage must not be discharged into a septic tank.

Mode of operation

- Solids settle in the tank and digest anaerobically. This reduces sludge volume and enables wastewater to infiltrate into the ground without clogging the leaching system.
- Sludge settles in the tank and digests anaerobically over time, releasing methane and other gases.

Operation and maintenance requirements

- Septage must be removed from septic tanks and transported off-site for treatment prior to disposal.

Additional infrastructure

- Septic tank desludging.
- Septage treatment.

Limitations and risks

- The biggest disadvantages of septic tanks are the cost and space requirements for the soakaway or drain field. The leaching system is often not constructed and common practice is to discharge effluent directly into an open drain.
- Septic tanks often receive too much wastewater. As a result, the retention time in the septic tank is insufficient and the soakaway becomes hydraulically overloaded. This means that the septic tanks needs to be desludged regularly, but more commonly the householder bypasses the soakaway and connects the overflow directly to a surface water drain.
- Shock loadings and disturbance of settling zones caused by large inflows (typically from sullage discharges) can affect the efficiency of the septic tank and cause excess solids to flow into the soakaway.
- Performance monitoring of septic tanks is rarely undertaken and regulation to control private desludging operators is problematic.

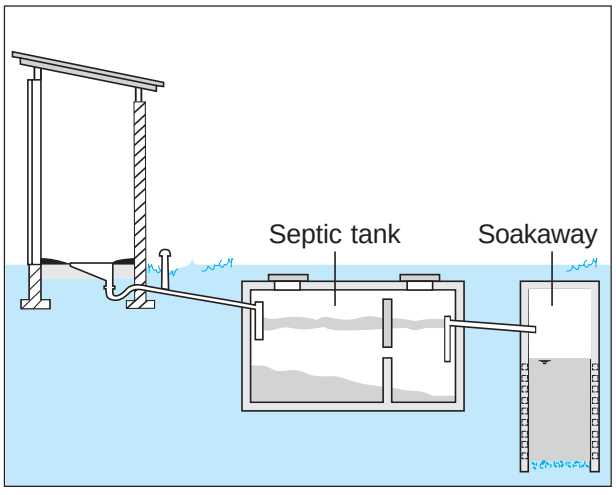
Management arrangements

- Responsibility for operation and maintenance lies with the owner of the property.
- Municipal utility or private contractors are required for desludging of septic tanks and to ensure safe disposal of septage at a treatment plant.

How much does it cost?

- *Capital costs*: A conventional septic tank constructed from brick or concrete is a considerable household investment, but cheaper options are available, made from prefabricated plastic or concrete rings. Costs range from Rs 6,000–15,000 (US$140–360).
- *Operating costs*: Varies from Rs 500–1,500 (US$12–37) once every few years depending on the frequency of emptying, size of tank and distance to treatment plant.

Figure 9: Pour Flush Latrine with Septic Tank and Soakaway



Source: WHO 2003. Reproduced with permission from the World Health Organization, Geneva.

On-Site Sanitation: Communal Toilet Block

What is it?

- A communal toilet block is a shared facility provided for a group of residents or an entire settlement. Pour flush technology is generally used though dry 'ecological sanitation' (ecosan) toilet blocks have been piloted in a few locations. Washing facilities are sometimes included in the block.

Where is it applicable?

There are two situations where a communal toilet block is appropriate:

- Communal toilet blocks are used primarily in low-income informal and illegal settlements where house connections are too expensive or nonviable due to a lack of space and/or land tenure problems.
- Public toilet blocks are provided for occasional use by the general public in places such as markets, train stations or other public areas where there is a considerable number of people passing by.

Operation and maintenance requirements

- Operation and maintenance requirements depend upon the technology adopted: (a) If the facility discharges into a sewer, then the operation and maintenance requirements will primarily concern keeping the toilet block clean; and (b) If the toilet block has on-site wastewater collection and treatment then the operation and maintenance burden (including desludging) will be higher.

Additional infrastructure or treatment requirements

- Toilets blocks either discharge to a sewer or into a septic tank—potentially with additional on-site treatment depending on the discharge or reuse requirements.

Limitations and risks

- The main risk is that the municipality (or contracted operator) does not maintain the block adequately so that it becomes unsanitary and falls into disuse.
- People may be deterred by the user charge and the facility is underused.
- Reliable water and electricity supplies are essential, but not always available.
- Women and children may not use the facility if they consider it unsafe to go there.

Management arrangements

- A range of management options are possible depending upon whether the toilet block is communal or public. Communal blocks are commonly managed by the municipality, a nongovernment organization (NGO) or a community-based organization with NGO support.

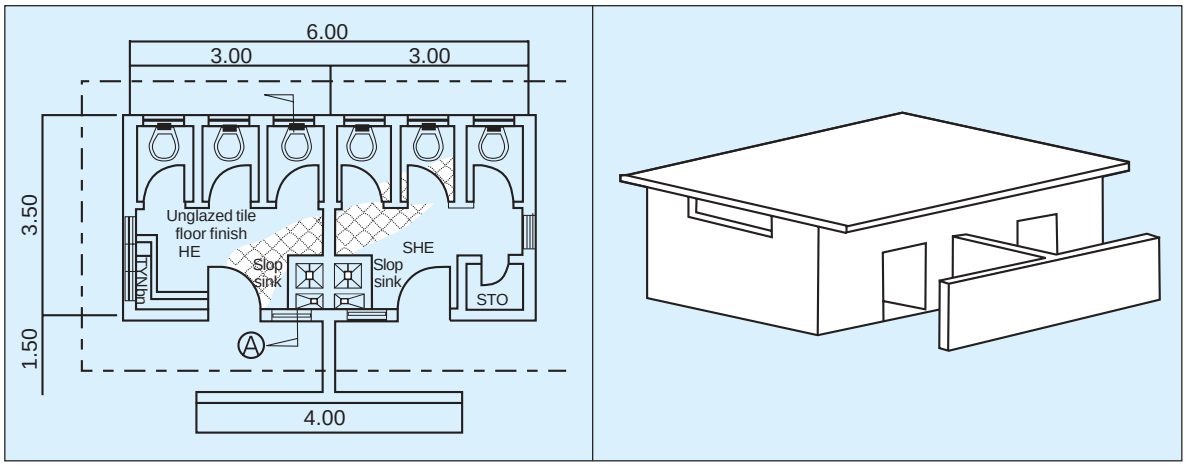
How much does it cost?

- *Capital costs*: Depends on many factors such as location, waste disposal arrangement, contract duration, and so on. The initial investment cost can be in the range of Rs 800,000 (US$19,500).
- *Operating costs*: Also varies depending on size, location, and so on, but can be more than Rs 200,000 (US$4,000) per annum.

Examples

- Sulabh International pioneered the nongovernment organization-managed toilet block in India and operates facilities in many cities.
- CBOs and NGOs such as SPARC and Shelter Associates have promoted community management of toilet blocks in Mumbai and Pune. The approach adopted by SPARC was incorporated into a World Bank-funded project in Mumbai. Under this program the typical per seat cost was Rs 80,000 (US$2,000) and the toilet block included water supply, overhead tank, electricity, septic tank, and a caretaker's room.
- BORDA and its nongovernment organization partners (including FEDINA, EXNORA) have promoted community managed toilet blocks in Bangalore and other cities. These are successfully managed by community-based organizations but require ongoing support to help with technical issues, especially where there is on-site treatment.
- In New Delhi, the municipal bodies have piloted the involvement of private entrepreneurs via Build, Operate, and Transfer contracts. A novel feature of the contracts is that the operators are allowed to use the road-facing walls of the premises as advertising space. This enables them to generate substantial revenues.

Figure 10: Community Toilet Block



Source: Philippines Sanitation Sourcebook and Decision Aid, WSP-EAP.

Waste Transportation: Desludging Vehicle (Vacutug)

What is it?

- The Vacutug is a device for emptying pit latrines and leach pits with a vacuum pump discharging into a 500-liter tank fitted onto a wheelbase with a small engine for driving it around.
- A modified system (known as Vacutug Mark II) developed in Dhaka, Bangladesh, has a larger capacity tank on a trailer which is pulled by a vehicle.

Where is it applicable?

- Can be used in high-density informal settlements with narrow lanes where conventional vacuum trucks are unavailable or vehicular access is difficult.
- Used for cartage of fecal sludge over a short distance (maximum 1 km for Mark I and 5 km for Mark II) from the point of collection to a treatment facility, municipal sewer or an intermediate collection point, from which waste can be collected using larger conventional sludge trucks.

Mode of operation

- A small diameter hose is inserted into the pit and used for evacuating the excreta under vacuum pressure, which is generated by a motor located on the chassis of the Vacutug.
- Pits frequently require the addition of water to loosen compacted solids that have consolidated over time.
- After motoring to the discharge point, the Vacutug tank is emptied by gravity or under pressure if the waste needs to be lifted up to an elevated storage tank.

Operation and maintenance requirements

- Two trained operators can operate the Vacutug under supervision and can be responsible for cleaning and maintaining the machine, emptying the pits, driving the machine to the disposal point, and carrying out minor repairs.
- The operators should be warned about the hazardous nature of latrine wastes and should be provided with rubber boots, rubber gloves, overalls, and disinfectant soap.
- The Vacutug is designed to be operated and maintained with a minimum of servicing and spare parts, but some preventative servicing will ensure its optimum life and operational performance. Maintenance requires one part-time mechanic for a weekly check-up and when it breaks down.

Additional infrastructure or treatment requirements

- Collected sludge needs to be discharged into a treatment facility or sewerage system. Alternatively, the waste can be stored temporarily prior to transportation to a larger sludge processing facility.

Limitations and risks

- Regulation of operators is important to prevent dumping of fecal sludge into local drainage channels.
- The suction pump may not be powerful enough to raise hardened sludge from a deep (>2 m) latrine.
- Solid waste in the pits can block and tear the suction pipe.
- The system is only financially viable if users are prepared to pay emptying charges, which may be higher than those of informal contractors using unsanitary methods.

Management arrangements

- Small-scale desludging operations using the Vacutug can be managed by nongovernmental organizations or small private entrepreneurs working in low-income settlements.

How much does it cost?

- *Capital costs:* Varies considerably depending on the use of imported or locally-manufactured equipment.
- *Operating costs*: Varies depending on the need to import spare parts.

Links to other technologies

- Fecal sludge treatment.

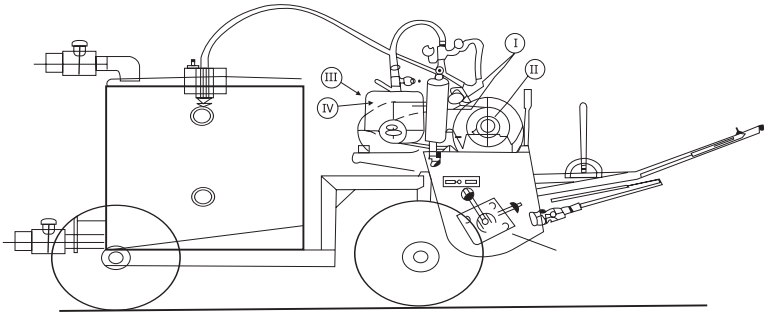
Examples of application

- Sulabh International Social Service Organisation, India.

Sources of further information

- UN-HABITAT Operating and Maintenance Manual for Mark II Vacutug Latrine Emptying Vehicle. UN-HABITAT/United Nations Human Settlement Program, Nairobi.
- Alabaster, G., and I. Issaias. 2003. 'Removing Human Waste: The Vacutug Solution**.** Habitat Debate, Case Studies'. September 2003, Vol 9 (No 3). UN-HABITAT, Nairobi.

Figure 11: A Vacutug



Source: Reproduced with permission from UN-HABITAT, Nairobi.

Wastewater Transportation: Conventional Sewerage

What is it?

- Conventional sewerage consists of a closed system of pipes, manholes, and pumping stations (in flat areas), which takes wastewater from domestic and other properties to disposal or treatment facilities.

Where is it applicable?

- Conventional sewerage is used extensively in urban areas to dispose of wastewater from residential, commercial, and industrial areas.

Operation and maintenance requirements

- Sewers and manhole chambers will occasionally require structural repair or replacement, and broken and missing manhole covers should be replaced immediately.
- In gravity sewers, wastewater and solids are flushed along the sewer line to a treatment plant. If sewers are laid to self-cleansing velocities, they should require little routine maintenance. However, silting can be a problem where falls are limited and/or storm run-off carrying silt enters sewers. In such situations, periodic rodding, flushing or jetting will be required to remove blockages.
- Where pumping is required, considerably more attention will be required to operate and maintain pumps and other associated electro-mechanical equipment.

Additional infrastructure or treatment requirements

- Requires off-site wastewater treatment.

Limitations and risks

- Operation and maintenance costs can be high, especially where pumping is required or silt and other solids cannot effectively be excluded from the sewer. As a result, many service providers rely upon subsidies to keep the system functional.
- Sewers often become heavily silted and lose hydraulic capacity or become completely blocked.
- Illegal storm water collections may lead to hydraulic overload of the sewerage system during heavy rainfall events. This may result in the flow of runoff contaminated with excreta flowing in streets and sometimes houses.
- In order to save electricity costs, pumping station operators often maintain wastewater levels in the wet well above the invert level of the incoming sewer. This reduces flow velocities in the incoming sewer and leads to rapid siltation.
- In many cases a sewerage system is built in isolation from the sewage treatment plant and the two do not connect.
- Households may not connect their facilities to the sewer network due to high connection charges and low willingness to pay.

Wastewater Transportation: Shallow Sewerage

What is it?

- Developed for use in residential areas, these sewers can be laid at relatively shallow depths due to the absence of heavy traffic.
- A simplified design and layout is used with inspection chambers instead of manholes. This reduces construction costs, facilitates cleaning, and makes it easier and cheaper to connect households to the system.

Where is it applicable?

- Particularly appropriate for dense informal settlements where laying sewer lines is often problematic due to the unplanned, irregular layout of buildings and streets.
- Can also be used in higher income residential areas to reduce installation costs.
- Can be supported by a decentralized sewage treatment facility.

Operation and maintenance requirements

- Shallow sewerage may require occasional flushing to remove blockages, but no more so than conventional sewers unless they are laid to flatter gradients.
- Sewers and inspection chambers will occasionally require structural repair or replacement.

Additional infrastructure or treatment requirements

- Requires off-site wastewater treatment.

Limitations and risks

- Can be problematic to install through private properties requiring considerable efforts to work with local communities. Residents need to be motivated to connect to the system and to maintain the private component.
- Communities often need support from the public agency to deal with blockages. Such problems can be aggravated in communities with a changing population, since new residents may be unaware or unwilling to take on their operation and maintenance responsibilities.

Management arrangements

- The network may be managed by a centralized service or, alternatively, can be divided into private (house connections and lane sewers) and public (collector and main sewers) components. Users can be made responsible for maintaining lane sewers, while the public service provider remains responsible for the main sewers. The users may employ the services of a private operator or form a cooperative.

How much does it cost?

- The technology is cheaper than conventional sewerage. Cost reductions stem mainly from:
  - Lower excavation volumes.
  - Use of simplified inspection chambers instead of costly manholes.
  - Reduced pipe diameters and layout length.
- *Capital costs:* Approximately Rs 50,000/m^3/day flow (US$1,200). Low to medium investment costs if population density is high, number of connections is large, and three to four households share one connection.
- *Operating costs:* Rs 215/m^3 (US$5) or Rs 1,800/m (US$40) of pipeline based on regular cleaning of the system, sewer line and inspection.

Examples of practical experience

- The Ramagundam municipality in Andhra Pradesh has also adopted this technology for slum sanitation to good effect.
- Shallow sewerage (also known as 'condominial' sewerage) has been used extensively in Brazil since the 1980s in both high- and low-income residential areas. More recently, the technology has been piloted in Bolivia, Peru, and South Africa.

Sources of further information

- CPHEEO. 1993. *Manual on Sewerage and Sewage Treatment of the Central Public Health and Environmental Engineering Organization.* Ministry of Urban Development.
- Water and Sanitation Program. 2005. *The Experience of Condominial Water and Sewerage Systems in Brazil.* Washington D. C.

Wastewater Transportation: Small-Bore Sewerage

Otherwise known as Septic Tank Effluent Disposal Scheme (STEDS) or Sewered Inceptor Tank Systems (SITS)

What is it?

- A hybrid system comprising interceptor tanks connected to small-diameter sewers for drainage of domestic wastewater. Removal of solids in the interceptor tanks means that sewers carry only liquid and so can be of smaller diameter, and laid to flatter gradients, than conventional sewerage.

Where is it applicable?

- Appropriate where wastewater production is at least 25 lpcd.
- Lower gradients result in reduced excavation depths where topography is flat. So, small-bore sewerage may be a good option in flat areas, particularly where the water table is near the surface.
- Can provide a cost-effective way to upgrade septic tanks to a level of service comparable with conventional sewers.
- Can be used where effluent from pour flush toilets and household sullage cannot be disposed of on-site due to soil and/or groundwater conditions, but there is insufficient water to allow for operation of conventional sewerage.

Mode of operation

- Solids settle in the bottom of the tanks and partial anaerobic degradation of wastewater occurs. The supernatant liquid is discharged into the sewer, together with finely divided digested solids.

Operation and maintenance requirements

- Interceptor tanks need periodical desludging and disposal of solids.

Additional infrastructure or treatment requirements

- The effluent from interceptor tanks transported through small-bore sewerage can be discharged into conventional sewerage or treated locally in a decentralized wastewater treatment plant.

Limitations and risks

- Small-bore sewerage systems may have the same operational and maintenance problems associated with both septic tanks combined with the need for maintenance of the sewers. This situation is exacerbated where the ownership and roles and responsibilities for operation and maintenance are not well defined or not accepted.

Management arrangements

- Individual households are normally responsible for maintenance of each interceptor tank (as with septic tanks) while the sewer network requires a communal management arrangement. This may involve a central service provider or small private operator employed to maintain the system and clean the tanks regularly.

How much does it cost?

- *Capital costs:* Considerably lower than for conventional systems. Approximately Rs 28,100 (US$685) for the unit illustrated. Desluding costs roughly Rs 2,500 (US$60) every five years.
- *Operating costs:* Depends on topography. Reduced pumping costs due to reduced depth must be balanced against cost of periodic removal of sludge from tanks.

Links to other technologies

- Desludging of fecal sludge.

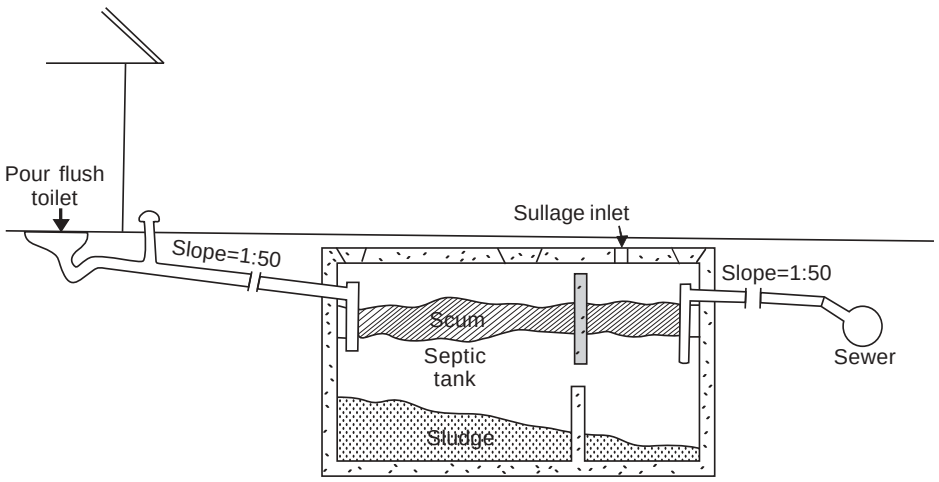
Examples of practical experience

- Sewered Interceptor Tank Systems (SITS) have been used successfully in Australia; there are also examples in Pakistan, South Africa, and the Maldives.

Sources of further information

- Otis, R. J., and D. D. Mara. 1985. *Design of Small Bore Sewerage Systems*. Series TAG Technical Note #14. The World Bank, Washington D. C. Sanicon website at www.sanicon.net/titles/topicintro.php3?topicId=8. Website www-wds.worldbank.org

Figure 12: Small Bore Sewerage



Source: After Kalbermatten et al. 1982.

Wastewater Treatment: Oxidation Ditch

What is it?

- An activated sludge treatment process with a long solids retention time to improve the efficiency of pollutant removal.
- Typically consists of a single or multichannel configuration within a ring-, oval- or horseshoe-shaped basin.
- Horizontally or vertically mounted aerators ensure that the wastewater is oxygenated and promote a circular flow of wastewater through the channel.

Where is it applicable?

- Most appropriate for treatment of intermittent flows from small communities and isolated institutions where there is sufficient land for installation.

Mode of operation

- Long hydraulic retention time and complete mixing reduces the impact of shock loads or hydraulic surges.
- Produces less sludge than other aerobic treatment processes due to long solids retention times and extended biological activity.

Operation and maintenance requirements

- Needs a skilled wastewater engineer and electro-mechanic technician to keep the treatment plant working efficiently.
- Sludge tends to have high water content but is relatively easy to dewater and smaller in volume than sludge from conventional activated sludge plants.
- Total power costs are higher than for conventional activated sludge due to the extended retention time.

Additional infrastructure or treatment requirements

- May be preceded by a primary sedimentation tank but many systems omit primary sedimentation.
- Excess biomass is removed in a clarifier and some is returned to the oxidation ditch to maintain sufficient concentration of active biomass in the reactor. The excess sludge collected by the clarifier must be dewatered and treated before disposal.

Limitations and risks

- Effluent suspended solids' concentrations are relatively high compared to other modifications of the activated sludge process.
- Power requirement is higher than for conventional activated sludge processes-leading to high power costs and the need for a reliable power supply.

Management arrangements

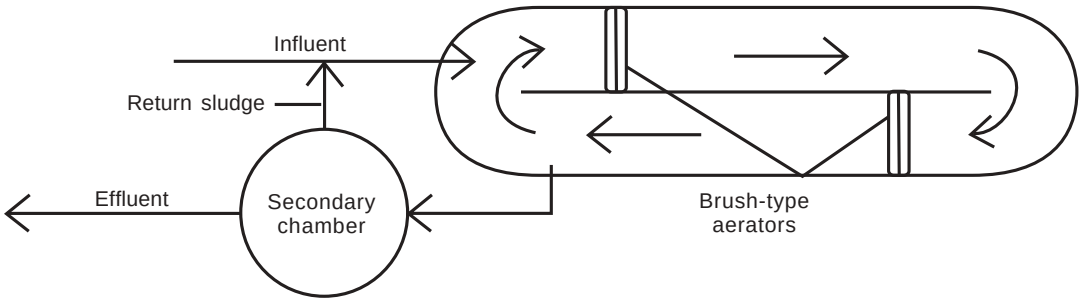
- Oxidation ditches are simpler to operate than activated sludge plants but are considerably more complex than waste stabilization ponds.

How much does it cost?

Plant capacity (m^3/day)	Capital costs (in US$)*	Annual O&M costs (in US$)
200	419,400	4,900
600	777,200	6,900
2,000	1,470,500	10,300

*US$1 = INR 41 (approximately, as of October 2007). Conversion rates are from https://www.cia.gov/library/publications/the-world-factbook/fields/2076.html; all conversions in the text are approximations.

Figure 13: Oxidation Ditch



Source: Photo is from Philippines Sanitation Sourcebook and Decision Aid, WSP-EAP.

Wastewater Treatment: Rotating Biological Contactor

What is it?

- A rotating biological contactor consists of a series of discs which are partially immersed in the wastewater and rotate slowly to allow active bacteria to digest dissolved organic wastes.

Where is it applicable?

- This technology is most effective for small communities and isolated institutions where there is enough land for installation. However, due to operational and maintenance problems (see below), it is not generally recommended for use in India.
- Domestic sewage, effluents, and process wastewater from dairies, bakeries, food processors, pulp and paper mills, and other biodegradable industrial discharges can be treated by the process.

Mode of operation

- As the discs rotate, a film of biomass grows on their surface, comes into contact with the wastewater and treats biodegradable organic matter. Atmospheric oxygen is supplied to the bacteria in the biofilm when the discs are out of the wastewater.
- Excess biomass sloughs off the discs by the shearing forces exerted as the discs rotate combined with the force of gravity.
- Advantages of rotating biological contactor technology include:·
  - A higher level of treatment than conventional high-rate trickling filters due to a longer contact time (8 to 10 times greater); and
  - Reduced susceptibility to changes in hydraulic or organic loading than the conventional activated sludge process.
- The rotating biological contactor process can be designed to remove 80–90 percent of the biochemical oxygen demand (BOD) but full nitrification can only be achieved when the organic loading rate is less than 5 g BOD/m^2/day.

Operation and maintenance

On a daily basis, there is little need for operation and maintenance, but there can be problems with breakage of the shaft and the mechanism that turns the discs.

Additional treatment requirements

- Raw municipal wastewater should not be applied to a rotating biological contactor. Primary settling tanks are required for removal of grit, debris, and excessive oil or grease prior to the rotating biological contactor process. In some cases, fine screens (0.03–0.06 inches) may be installed.
- Excess biomass is removed in a clarifier that follows the rotating biological contactor. It then requires sludge treatment.

Limitations and risks

- As the motor is dependent upon electricity, the rotating biological contactor is prone to failure as a result of power cuts.
- The shaft, discs, and motor all require maintenance.

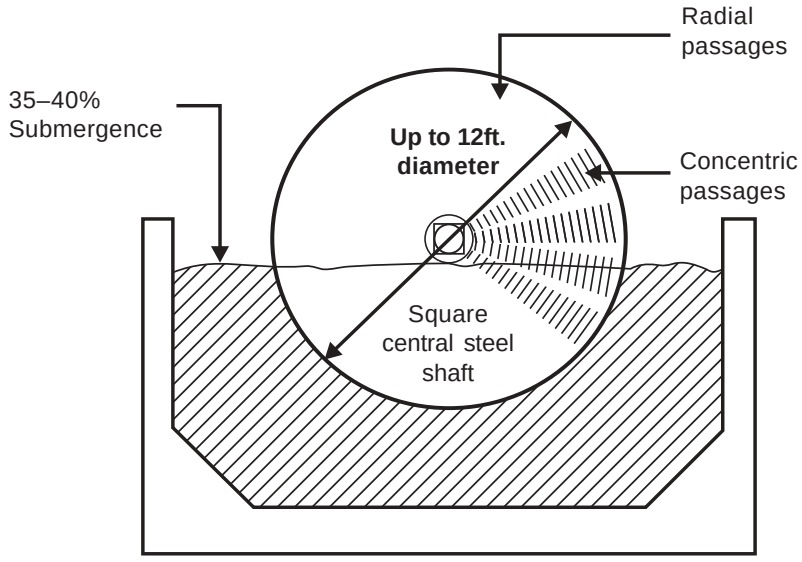
Management arrangements

- A self-enclosed system with few day-to-day management arrangements. However, the system's reliance on mechanical parts means that skilled personnel are required for maintenance and repair.

How much does it cost?

- *Capital costs*: Rs 3.36 million (US$81,000) per MLD capacity.
- *Operating costs*: High operating costs, in the region of Rs 14,000 (US$340) per month.

Figure 14: Rotating Biological Contactor



Source: Philippines Sanitation Sourcebook and Decision Aid, WSP-EAP.

Wastewater Treatment: Anaerobic Baffled Reactor

Otherwise know as Baffled Septic Tanks.

What is it?

- An anaerobic baffled reactor consists of a settling compartment with the same dimensions as the first compartment of a conventional septic tank, followed by a number of smaller compartments arranged in series.
- After passing through the first compartment, sewage passes from bottom to top through the remaining compartments in turn. Intensive contact between resident sludge and incoming liquid increases treatment efficiency.

Where is it applicable?

- The baffled reactor tank is suitable for all kind of wastewaters (including domestic) but its efficiency increases with higher organic loadings and is therefore most appropriate for the treatment of blackwater.
- Suitable for small community schemes and housing developments with no access to municipal sewerage.

Mode of operation

- Baffled reactors involve a combination of physical treatment and anaerobic digestion as the incoming wastewater passes through a blanket of suspended flocculations of active bacterial sludge in each compartment.
- Wastewater flows from bottom to top with the effect that sludge particles settle against the upstream flow of liquid. Digestion of substances that are difficult to degrade takes place in the upward flow baffled reactors after more easily degradable material has been digested in the front chamber.
- Treatment performance depends on the availability of active bacterial mass but is normally 65 percent COD (70 percent BOD) removal.

Operation and maintenance

- Adequate arrangements must be made for periodic removal of sludge from the first compartment. Sludge accumulation in the baffled compartments should be much less.
- Although desludging at regular intervals is necessary, it is important that some active sludge is left in each of the compartments to maintain a stable treatment process.

Additional treatment requirements

- The last chamber may consist of an anaerobic filter to improve treatment performance.
- A reed bed or maturation pond for posttreatment is necessary to eliminate septicity and increase dissolved oxygen level before releasing into surface water or using for irrigation.

Limitations and risks

- Operation and maintenance is easily ignored, leading to deterioration in performance.

Management arrangements

- The system is fairly robust and relatively easy to operate but nevertheless requires organized technical management.

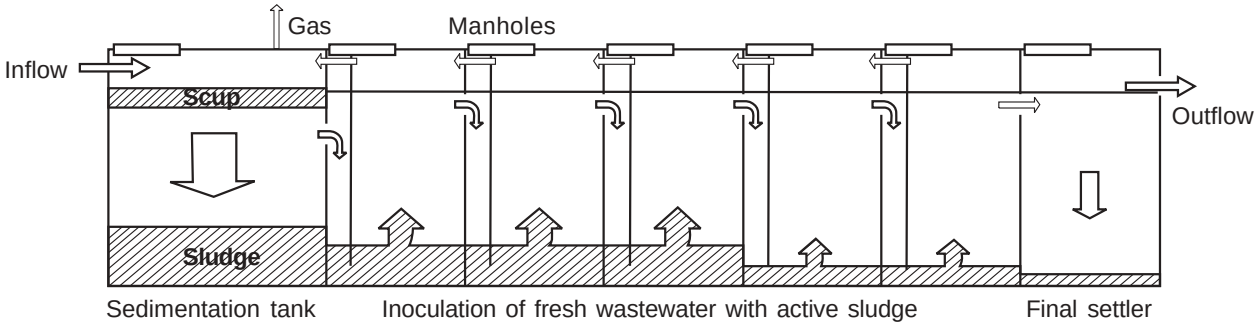
How much does it cost?

- *Capital costs:* Rs 750,000 (US$18,200) for a 14,000 liter/day plant.
- *Operating costs*: Rs 12,000 (US$300) per annum for a 14,000 liter/day plant, equivalent to Rs 0.86/liter/day (US$0.02/liter/day)

Sources of further information

Sasse, L. 1998. *DEWATS: Decentralized Wastewater Treatment Systems in Developing Countries*. Bremen Overseas Research and Development Association, (BORDA), Bremen, Germany.

Figure 15: Anaerobic Baffled Reactor



Source: Philippines Sanitation Sourcebook and Decision Aid, WSP-EAP.

Wastewater Treatment: Reed Beds

Also known as constructed wetlands, planted horizontal gravel filters, subsurface flow wetlands or root zone treatment.

What are they?

- Reed beds are engineered natural treatment systems that use fast growing plant species to assimilate dissolved organic impurities. A combination of physical settlement, photosynthesis, uptake by plants, degradation by bacteria in the root-zone, and filtration bring about improvement in wastewater quality.
- There are various types of reed beds for different treatment applications. Horizontal sub-surface flow systems are most appropriate for domestic wastewater treatment whereas vertical flow is used for dewatering of sludge and treatment of septage.
- Reeds are planted in the media. Commonly used plants are cattails, bulrushes and reeds, with *Phragmites australis* being ideal due to its extensive root system.

Where are they applicable?

- Reed beds provide secondary and tertiary treatment and can treat a wide range of wastewaters, septage, and fecal sludges of varying strengths and composition.
- They are suitable for pretreated (presettled) domestic or industrial wastewater with a COD content less than 150–200 mg/l (BOD 70–90 mg/l) and are generally good at handling intermittent and variable flows.
- The most common use is to provide additional or advanced treatment of wastewater from homes, businesses, and small communities. The technology is also well-suited for hotels, campsites, resorts, and recreational areas.

Mode of operation

- Reed beds mimic the treatment that occurs in natural wetlands by relying on plants and a combination of naturally occurring biological, chemical, and physical processes to remove pollutants from the water.
- Treatment is mostly anaerobic as the layers of media and soil remain saturated and unexposed to the atmosphere.
- The main role of the plants is to transport oxygen via their roots into the filter media though the roots also reduce clogging of the filter.

Operation and maintenance requirements

- Operation and maintenance requirements are simple but essential to ensure system performance. They include removal of excess weed, occasional scraping of the top layer of filter media, and removal of the floating scum layer, plastic and other debris.
- Insect and odor problems should not be a problem as long as the wastewater remains under the gravel and sand. Otherwise, insecticide spray should be used to control mosquitoes and other insects.
- Inlet and outlet structures should be cleaned periodically. The filter media will eventually become clogged and should be changed every 8 to 15 years.
- Plants need to be harvested.

Additional treatment requirements

- To prevent clogging of the media, wastewater must be pretreated to reduce suspended solids. For this reason, reed beds are best used for secondary treatment following primary treatment in a sedimentation tank, septic tank, baffled reactor or other form of anaerobic treatment.
- Sludge production is relatively low as solids are retained in or on the reed bed.

Limitations and risks

- Careful design is required to ensure that the filter media is of appropriate grain size and quality.
- Reed beds require a large amount of space, up to 5 m^2 per person, depending on conditions, and are therefore not always appropriate in urban areas.
- Odor caused by ponding on the surface, blockages in inlet pipe work and problems with drainage at the outlet can result in the development of septic conditions in the reed bed.
- A blocked or overloaded reed bed can cause the wastewater to rise above the surface, which may result in problems with mosquitoes or other insects.

Management arrangements

- Although the process is natural, constructed wetlands are complex systems that require specialist knowledge and technical expertise to ensure sustained performance.

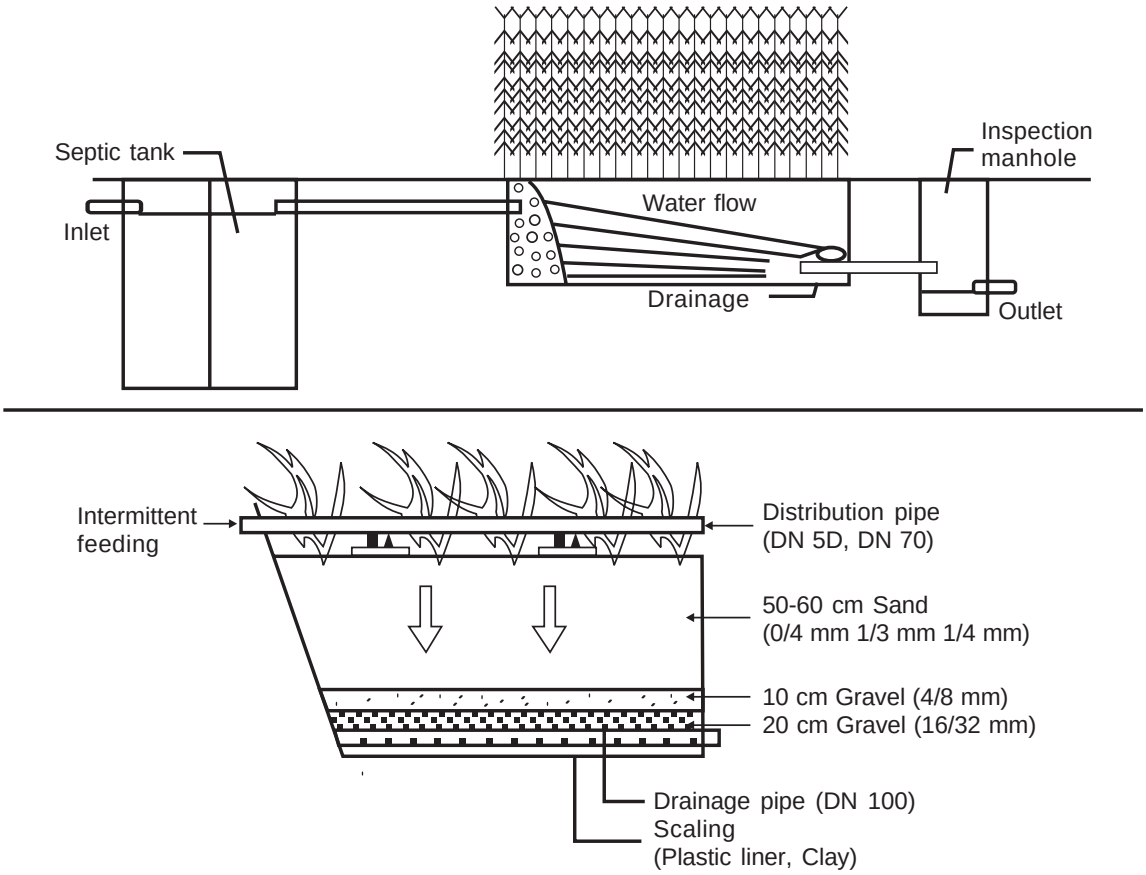
How much do they cost?

- *Capital costs*: Estimated cost at Rs 1,300/m^2 (US$30/$m^2$) for horizontal flow beds and Rs 2,100/m^2 (US$50/$m^{2)}$ for vertical flow beds, excluding land cost.
- *Operating costs*: Consists mainly of labor costs for reed cutting at intervals of three or four years.

Sources of further information

- Sasse, L. 1998. *DEWATS: Decentralized Wastewater Treatment Systems in Developing Countries*. Bremen Overseas Research and Development Association (BORDA), Bremen, Germany.
- US-EPA. 2000. *Manual Constructed Wetlands Treatment of Municipal Wastewaters*. Report EPA/625/R-99/010. United States Environmental Protection Agency, Office of Research and Development, Cincinnati, Ohio 45268.

Figure 16: Wastewater Treatment Process



Source: Philippines Sanitation Sourcebook and Decision Aid, WSP-EAP.

Wastewater and Fecal Sludge Treatment: Waste Stabilization Ponds

What are they?

There are three basic types of waste stabilization ponds and these are normally connected in series to provide a two- or three-stage treatment process. They are:

- **Anaerobic ponds:** Comparatively small and deep (3–4 m) as there is no need for aeration. They receive raw sewage which is treated by anaerobic bacteria, while sludge that builds up in the bottom of the pond is digested by anaerobic micro-organisms.
- **Facultative ponds:** Shallower (1.5–2 m) with a larger surface area than anaerobic ponds. They consist of an aerobic zone close to the surface and a deeper, anaerobic zone.
- **Maturation ponds:** Shallow (1–1.2 m) with a large surface area to enable light penetration. They receive treated effluent from the facultative pond and provide tertiary treatment to remove turbidity, pathogens, and nutrients.

Where are they applicable?

- Waste stabilization ponds are appropriate for medium- to low-density settlements with sufficient free space, but should not be located very close to houses due to possible odor.
- They offer a robust treatment process that can deal with a wide variety of wastewaters of varying types and concentrations.
- Ponds are particularly appropriate where pathogen removal is an important objective of treatment.
- Waste stabilization ponds may be combined with aquaculture systems (duckweed, water hyacinth or fish production).

Mode of operation

- Treatment efficiency of high-loaded ponds with long retention times ranges from 70–95 percent BOD removal (COD removal: 65 percent to 90 percent) depending on biodegradability of the wastewater.
- Treatment efficiency increases with retention time but the number of ponds is not of major significance (splitting one pond into two ponds may increase performance by approximately 10 percent).
- Pond systems continue to operate well when overloaded beyond their theoretical design loads, but they will invariably fail if they are not maintained.
- Treatment in anaerobic and facultative ponds is based on microbial activity and settlement of suspended solids and sludge, while in maturation ponds it is achieved by solar radiation, predation by zooplankton, and the acidity created by photosynthesis.

Operation and maintenance requirements

- The commissioning of facultative ponds involves the development of algal culture and a heavily loaded anaerobic pond may release a bad odor until a layer of scum seals the surface.
- Routine operation and maintenance is easy but arrangements must be made for sludge removal. This is often done by emptying ponds and manually digging out the sludge. Alternatively, sludge can be removed under hydrostatic pressure using pumps mounted on rafts.
- Spraying to prevent fly breeding may be required at various times of the year.

Additional treatment requirements

- The three-stage process is a complete treatment system. The only additional requirement is for sludge treatment after its removal from ponds.

Limitations and risks

- Ponds require a lot of land, at least 5 m^2 per person.
- Underdesign, hydraulic short-circuiting, and poor operation and maintenance can all reduce performance.
- Possible problems related to odor and insects if the ponds are not managed properly, or are overloaded.

Management arrangements

- Performance and operation and maintenance practices need supervision and monitoring.

How much do they cost?

- *Capital costs:* Rs 1.5 million/MLD capacity (US$36,500/MLD).

Sources of further information

- Mara, D. D. 1997. *Design Manual for Waste Stabilization Ponds in India*. Lagoon Technology International, Leeds, United Kingdom (www.leeds.ac.uk/civil/ceri/water/tphe/publicat/pdm/india.html).
- Arthur, J. P. 1983. 'Notes on the Design and Operation of Waste Stabilization Ponds in Warm Climates of Developing Countries'. Technical Paper, n. 7, Washington, D. C.
- Pescod, M. B. 1992. *Wastewater Treatment and Use in Agriculture***.** Food and Agriculture Organization (FAO) Irrigation and Drainage Paper 47. United Nations (www.fao.org/docrep/T0551E/t0551e05.htm).
- www.irc.nl/page/14622 IRC. 2004. 'Waste Stabilization Ponds'.

Wastewater and Fecal Sludge Treatment: Activated Sludge Process

What is it?

- This process involves rapid mixing and aeration of the wastewater, either by mechanical surface aerators or a submerged compressed air system, to create optimal conditions for treatment.
- The aeration basin is followed by a secondary clarifier (settling tank) designed to remove suspended micro-organisms (flocs) prior to discharge. Active biomass is returned to the aeration tank.

Where is it applicable?

- Widely used for the treatment of municipal wastewater from medium to large towns where land is scarce and power is reliable.

Mode of operation

- Vigorous aeration elevates dissolved oxygen to create optimum conditions for aerobic bacterial growth. The bacterial population is maintained in suspension and grows rapidly, consuming large quantities of organic matter.
- A fraction of the settled microbial sludge is pumped back from the secondary clarifier to maintain an active population of micro-organisms and an adequate supply of biological solids for the adsorption of organic material.
- Provided the reactor is well operated, a very good removal of BOD and suspended solids can be achieved, though pathogen removal is low.
- Performance is critically dependent on the performance of secondary clarifier and the sludge settling characteristics.
- Sludge production depends on the sludge retention time in the reactor (an extended aeration process can reduce the quantity of sludge produced). Excess sludge is removed from the secondary clarifier and pumped to a separate sludge-handling process.

Operation and maintenance requirements

- A continuous supply of oxygen and sludge is essential; hence maintenance of the aeration equipment and sludge pump is important.
- Careful monitoring and control of concentrations of suspended sludge solids and dissolved oxygen levels in the aeration tank is required.

Additional treatment requirements

- *Pretreatment*: There is usually a need for primary sedimentation, but in many cases it is omitted, with only preliminary screening provided.

- *Posttreatment*: The treated effluent from the secondary clarifier may require additional treatment depending on the discharge requirements.
- *Sludge production and treatment*: Provision must be made to digest, dewater, and dispose of excess sludge.

Limitations and risks

- High energy consumption results in high recurring costs.
- Performance is adversely affected due to interruptions in power supply, even for short periods of time, due to impacts on aeration process and sludge recirculation.
- Foaming, particularly in the winter, may adversely affect the oxygen transfer, and hence performance.
- Mixing of industrial effluent with domestic wastewater can lead to toxicity and major malfunctioning.

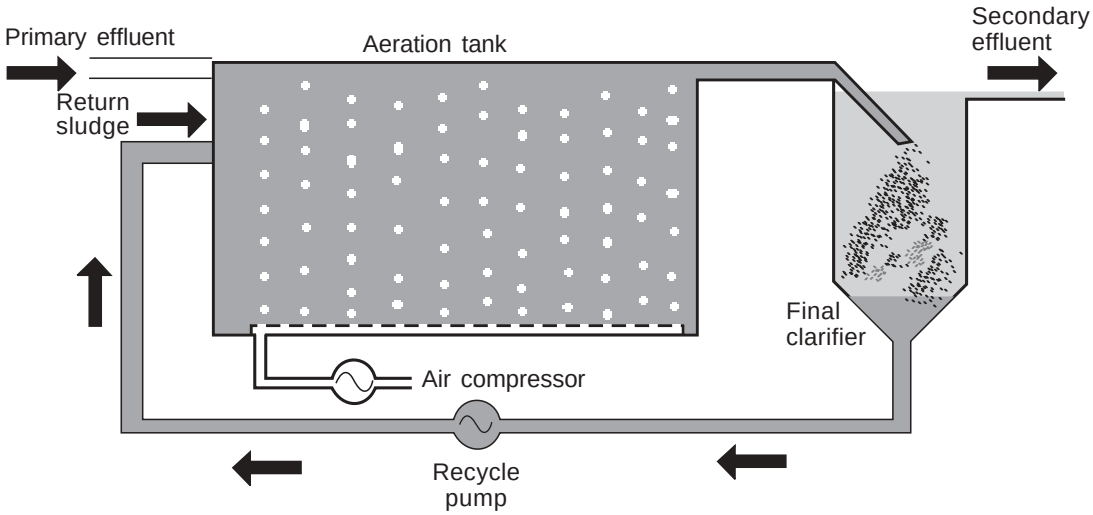
Management arrangements

- The activated sludge process is technically complex and requires a highly competent and trained supervisor and workforce to be able to operate the system effectively.

How much does it cost?

- Smaller capacity plants tend to incur relatively high costs per volume of treated wastewater.
- *Capital costs*: In the range of Rs 4.2–4.8 million/MLD (US$0.10–0.12 million/MLD). Approximately 55 percent cost is for civil works and remaining 45 percent is for electrical and mechanical works.
- *Operating costs*: In the range of Rs 0.43–0.52 million/year/MLD (US$10,500–12,600/year/MLD).

Figure 17: Activated Sludge Process



Wastewater Treatment: Biological Trickling Filter

What is it?

- An 'attached-growth' system comprising a circular tank filled with a bed of crushed aggregate, cylindrical plastic or foam blocks. Wastewater trickles vertically through the filter and the biomass growing on the media removes organic matter under aerobic conditions.

Where is it applicable?

- Can be used as a standalone treatment or a preliminary treatment for high strength wastewater in combination with activated sludge process or as a posttreatment operation for UASB effluent.
- Land requirement: Between 0.28 to 0.65 hectare/MLD.

Mode of operation

- A rotating arm distributes wastewater across the surface of the filter bed. Effluent is drained at the bottom.
- Micro-organisms growing on the media break down organic material to produce a consistent effluent quality and sludge with good settling characteristics.
- Bacteria use oxygen to convert ammonia in the effluent to nitrate and the BOD is reduced by 65–85 percent, nitrogen by 10–20 percent, and coliform bacteria by 60–90 percent.
- Recirculation of effluent may be required to avoid low flow conditions and reduce odor and flies.

Operation and maintenance requirements

- Relatively straightforward though hydraulic loading needs to be controlled to prevent the loss of biofilm. Clogging of screens must also be controlled.
- Maintenance of the turntable is required, as well as cleaning of stone filter media once in five or seven years or more.

Additional treatment requirements

- *Pretreatment*: Primary sedimentation is compulsory to avoid clogging of filter bed.
- *Posttreatment*: Effluent requires secondary clarification.
- *Sludge treatment*: Excess sludge production = 0.8 kg/kg of BOD removed. Thickening, digestion, and drying are required.

Limitations and risks

- Mechanical breakdown of the distribution arm is common; ponding resulting from blockages due to excess biofilm growth can also be a problem.
- High organic loadings can create anaerobic conditions on the filter, causing an odor problem.
- Filter flies (*Psychoda*) may proliferate due to inadequate filter media moisture.

Management arrangements

- Low-skilled manpower requirements under technical supervision.

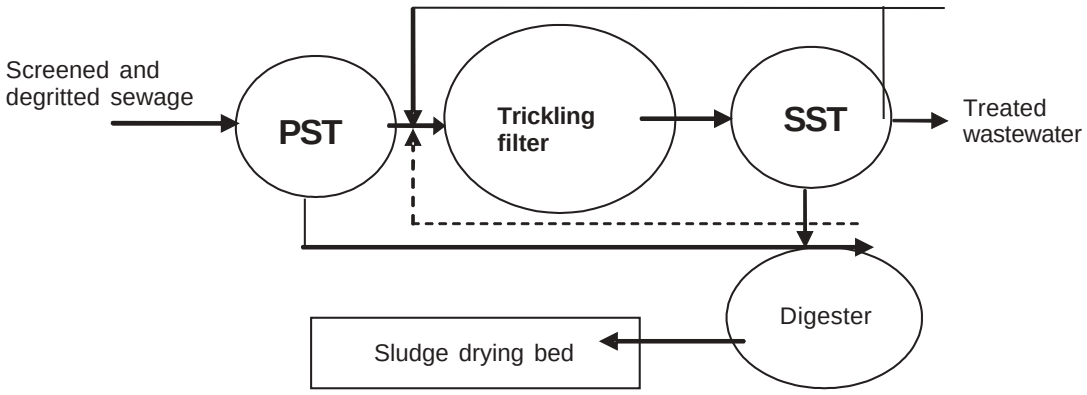
How much does it cost?

- *Capital costs*: Rs 13.2 million (US$0.32 million) per MLD capacity

Sources of further information

- Arceivala, Soli J. 1998. *Wastewater Treatment for Pollution Control, 2nd ed*. Tata McGraw-Hill Publishing Company Ltd.

Figure 18: Biological Trickling Filter



Wastewater Treatment: Fluidized Aerated Bed (FAB) Reactor

What is it?

- An aerobic process in which wastewater flows vertically upwards through a filter bed of lightweight inert media at a sufficient velocity to 'fluidize' the bed. A bacterial biofilm develops on the media particles and treats the wastewater as it passes through.

Where is it applicable?

- Good for treatment of small to medium flows in congested locations. Being a closed reactor, it is suitable for sensitive locations.

Mode of operation

- High BOD removal with effluent concentration under 10 mg /l and high suspended solids removal with effluent concentration under 20 mg/l.
- Fecal coliforms removal for a two-stage FAB.
- Electrical energy requirement rather low (between 99 to 170 kWh/MLD).

Additional treatment requirements

- Secondary settling, sludge removal, thickening, and drying. Digestion is not required as the sludge is stabilized.

Management arrangements

- Straightforward operation but requires a skilled workforce.

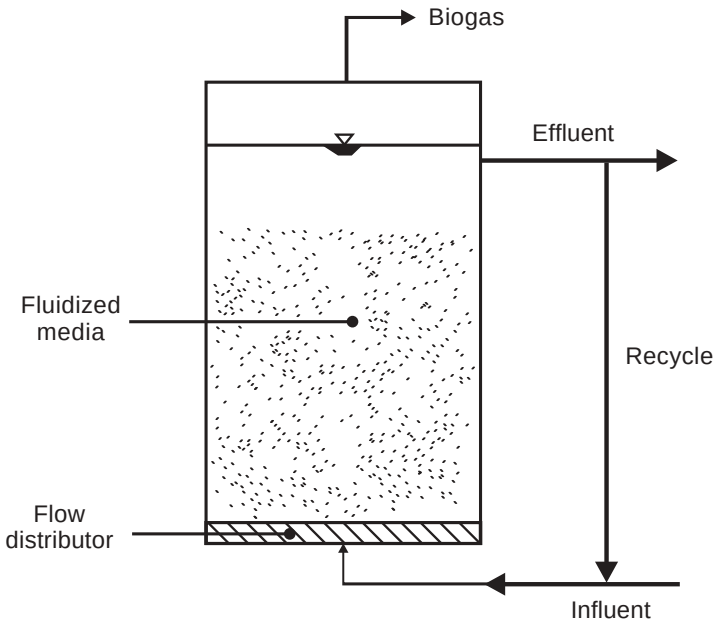
Limitations and risks

- Reliance on patented filter media.
- Choking of reactor by floating plastic matter and of outlet by fluidized media. Excess biomass growth or low hydraulic loads can result in blockages.
- Long shutdowns may lead to septic conditions, and restart may involve a long stabilization period.
- Uncertain durability of media under varying climatic conditions.

How much does it cost?

- *Capital costs*: Rs 5–200 million/MLD (US$0.12–4 million/MLD) for plants of 0.5–40 MLD capacity. Filter media accounts for roughly one-third of the cost.
- *Operating costs*: Rs 0.6–0.75 million/MLD/annum (US$14,000–18,000/MLD/annum).

Figure 19: Fluidized Aerated Bed (FAB) Reactor



Wastewater Treatment: Upflow Anaerobic Sludge Blanket (UASB)

What is it?

- Wastewater flows upwards through a blanket of flocculated biomass in a vertical reactor containing anaerobic bacteria which break down carbonaceous organic matter.

Where is it applicable?

- Best suited to higher strength wastewaters: blackwater and industrial wastewater, but can also treat lower strength domestic wastewater.
- Appropriate for medium-size wastewater treatment plants.
- UASBs need less land than aerobic systems but require follow-up treatment to achieve comparable performance in terms of COD/BOD removal.

Mode of operation

- The upward motion of gas bubbles produced during anaerobic digestion causes turbulence that enables mixing without mechanical assistance. Baffles at the top of the reactor allow gases to escape but prevent outflow of the sludge blanket.
- No external energy requirements in the reactor, thereby the process is not vulnerable to power cuts.
- Can bring down BOD of domestic wastewater to 70–100 mg/l and suspended solids as low as 50–100 mg/l, but removal of nitrogen and bacteria is poor.

Additional treatment requirements

- *Pretreatment*: Screening and degritting but no other form of primary treatment is required.
- *Posttreatment*: Like other anaerobic treatment technologies, UASBs only provide partial treatment and rarely meet discharge standards unless appropriate post-treatment is provided. As yet, only a waste stabilization pond system has been found to be an appropriate post treatment option.
- *Sludge production and treatment*: Relatively low sludge production with good dewatering characteristics. Requires thickening, drying, and safe disposal.

Operation and maintenance requirements

- Careful monitoring and control of the reactor sludge levels and sludge withdrawal.
- Frequent cleaning or desludging of distribution or division boxes and influent pipes.
- Removal of scum and floating material from the settling zone.
- Control of the flow rate is difficult for small units.
- Prevent mixing of industrial effluents with toxic elements and sulfates or sulfides.

Management arrangements

- Skilled supervision during start-up and for control of biomass levels in the reactor.

Limitations and risks

- Long start-up and high initial oxygen demand of effluent during this period may cause oxygen depletion in receiving water bodies.
- Sensitive to seasonal temperature variations and low removal efficiency in winter.
- Release of corrosive and odorous hydrogen sulfide and ammonia in the air.
- Sludge washout from the reactor can result in instability leading to deteriorations in treatment performance and very high BOD and total suspended solids in the effluent.

How much does it cost?

- *Capital costs:* Rs 2.4–3.5 million/MLD (US$58,500–85,000/MLD) depending on the capacity of the plant. Approximately 65 percent cost is of civil works and remaining 35 percent is for electrical and mechanical works.
- *Operating costs:* Rs 0.07–0.15 million/MLD/annum (US$1,700–3,600/MLD/annum) depending on plant capacity.

Practical experiences

- 14 MLD domestic wastewater treatment plant in Mirzapur.
- 36 MLD tannery wastewater treatment plant in Kanpur.
- In India**,** see: Tare, Vinod, and Asit Nema**.** April 2006. *Sewage Treatment through UASB Technology—Expectations and Reality*. 22nd National Convention on Environmental Engineering, Institution of Public Health Engineering and IT-BHU, Varanasi, India.
- Elsewhere: There has been considerable interest in the UASB as an appropriate form of wastewater treatment in other developing countries, notably Brazil.

References and sources of further information

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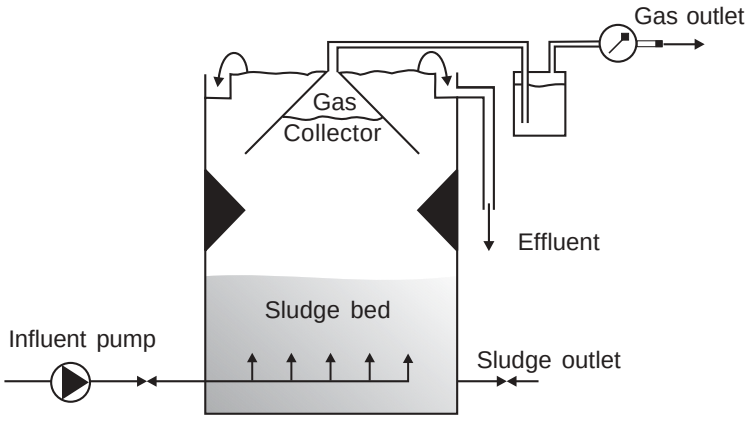
Figure 20: Upflow Anaerobic Sludge Blanket (UASB)



Source: Integrated Approach and Replicability. March 1994. Indo-Dutch Environmental and Sanitary Engineering Project, Kanpur-Mirzapur.

Wastewater Treatment: Upflow Anaerobic Filter

Also known as fixed bed or fixed film reactor.

What is it?

- Anaerobic filters provide additional treatment by bringing wastewater into contact with active bacteria attached to media as the wastewater flows upwards through the filter. Filter material, such as gravel, rocks, cinder or specially formed plastic pieces provide additional surface area for bacteria to form a slime.

Where is it applicable?

- Appropriate for treating effluent from septic tanks (individual or shared/communal) in areas where infiltration is not possible due to low soil permeability, high water table and/or lack of space.

Mode of operation

- There is no physical straining of particulates; nonsettleable and dissolved solids are removed through close contact with a surplus of active bacterial mass.
- May be operated as downflow or upflow systems. Upflow is generally preferred as there is less risk of washing out active bacteria, but cleaning of the filter is easier with the downflow system.
- Treatment quality (when combined with pretreatment) can be as high as 80 percent BOD removal.

Operation and maintenance

- Active sludge (for example, from septic tanks) should be added to the filter before starting continuous operation.
- The bacterial film gradually thickens and must eventually be removed. This is usually done by back-washing with wastewater.

Additional treatment requirements

- The filter should be preceded by a septic tank.

Limitations and risks

- Lack of attention to maintenance results in blockage of the filter. In addition, the perforations of the distribution pipe at the bottom of the filter get clogged easily.
- On average, 25–30 percent of the total filter mass may be inactive due to clogging. While a cinder or rock filter may not block completely, reduced treatment efficiency is indicative of clogging in some parts.

- A sand or gravel filter may block completely due to smaller pore size resulting in backup of wastewater into the septic tank.

Management arrangements

- Responsibility will normally lie with the manager of the property served.

How much does it cost?

- No data available.

Practical experience

- Research in Thailand found that operational problems with household septic tanks and upflow anaerobic filters resulted from the perforations in the distribution pipe clogging easily.

References and sources of further information

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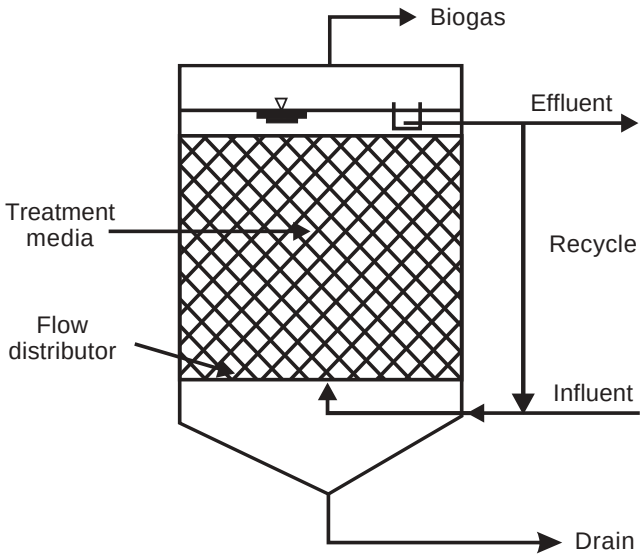
- Sagar, G. 1983. 'A Dwarf Septic Tank Developed in India'. *Waterlines*, Vol 2 (1). July 1983.

Figure 21: Upflow Anaerobic Filter



Wastewater Treatment: Duckweed Ponds

What is it?

- Duckweed (*Lemnaceae*) is a small, floating, and fast growing aquatic plant that grows vigorously in pretreated wastewater to produce a protein-rich biomass.
- Duckweed-based pond systems take nutrients from wastewater and produce a highly nutritious feed for fish, poultry or livestock. Fish yields may be two to three times higher than in conventional ponds.

Where is it applicable?

- Appropriate for treating low strength domestic wastewater or as a polishing treatment after primary sedimentation.
- Requires a considerable amount of land (5–10 m^2 per person for 7- or 20-day retention period).
- Best suited for rural and semiurban settlements.

Mode of operation

- Duckweed-based systems are a modification of conventional lagoon technology with the pond functioning as a facultative lagoon. Deeper layers are anaerobic.
- Duckweed grows rapidly and is harvested for use as a mulch or natural soil enricher. Harvesting promotes growth and removal of nutrients and dissolved carbon from the wastewater.
- Algal growth is suppressed by duckweed due to competition for sunlight and nutrients and possibly secretion of organic substances.
- Duckweed suppresses mosquito breeding by forming a mat over the water surface.

Operation and maintenance requirements

- Relatively simple maintenance: Frequent duckweed harvesting from the surface to ensure productivity, prevention of other vegetative growth, and control of wave action using bamboo or similar vegetation.
- The pond needs desludging every two or three years.

Additional infrastructure or treatment requirements

- Pretreatment required if used as part of a wastewater treatment process. This often takes the form of a waste stabilization pond but other forms of treatment can be used.

Limitations and risks

- Low pathogen removal due to reduced light penetration.
- Duckweed dies in cold weather.

- If flows are not adequately controlled, duckweed can flow out with the effluent. Treatment capacity may be lost during floods.

Management arrangements

- Technical and commercial skills are needed for the production, marketing, and sale of dried duckweed for animal or fish feed if this is to succeed as a microenterprise.

How much does it cost?

- *Capital costs*: Of the same order as waste stabilization ponds with the additional cost of floating cell material (to control flows). Estimated at Rs 1.9 million/MLD (US$46,000/MLD) capacity.
- *Operating costs*: Rs 0.18 million/MLD/year (US$4,000/MLD/year).

Links to other technologies

- Waste stabilization ponds.

Examples of application

- Duckweed ponds have been piloted on a limited scale in Delhi, Haryana, West Bengal, and Orissa in both rural and urban locations. They have also been used in Bangladesh.

References and sources of further information

- Gijzen, H. J., and M. Ikramullah. 1999. *Pre-Feasibility Study of Duckweed-Based Wastewater Treatment and Resource Recovery in Bangladesh*. World Bank.
- Iqbal, S. 1999. *Duckweed Aquaculture Potentials, Possibilities and Limitations for Combined Wastewater Treatment and Animal Feed Production in Developing Countries*. SANDEC Report No. 6/99. EAWAG, Switzerland.

Glossary

Activated sludge: An aerobic treatment process in which oxygen and micro-organism concentrations in wastewater are artificially elevated to facilitate rapid digestion of biodegradable organic matter.

Aerated pond or lagoon: A natural or artificial wastewater treatment pond in which mechanical or diffused air aeration is used to supplement the natural reoxygenation processes.

Aerobic treatment: Treatment of wastewater with the help of micro-organisms that rely on oxygen.

Anaerobic digestion: Decomposition of organic material by anaerobic bacteria in the absence of air.

Anaerobic lagoon: A system for treatment of high-strength wastewater and sludge that involves retention under anaerobic conditions.

Biochemical oxygen demand: A measure of the organic pollutant strength of wastewater.

Biosolids: See **Sewage sludge**.

Blackwater: Wastewater discharge from toilets.

Bucket latrine: A traditional but unhygienic form of sanitation in which feces is deposited into a bucket which is collected regularly (usually at night) and taken away (usually by ‘sweepers’).

Composting latrine: A latrine designed to receive both feces and waste vegetable matter with the aim of reducing moisture content and achieving a carbon-to-nitrogen ratio that promotes rapid decomposition.

Dry latrines: All forms of latrines that do not require water for flushing.

Desludging: Removal of sludge or settled solid matter from treatment tanks such as septic/Imhoff tank, interceptor tank or sedimentation tanks.

Disposal: Discharge, deposition or dumping of any liquid or solid waste onto land or water so that it may enter the environment.

Domestic sewage: All forms of wastewater derived from residential properties, as well as blackwater and greywater from commercial and institutions buildings.

Dry sanitation: Disposal of human excreta without the use of water for flushing or anal cleansing.

Ecological sanitation (ecosan): A form of dry sanitation that involves separation of feces and urine in order to facilitate recycling of nutrients in local agricultural systems.

Effluent: Any form of wastewater or liquid waste that flows from an operation or activity.

Excreta: Feces and urine.

Fecal sludge: The undigested sludge that is collected from pit latrines and leach pits.

Greywater (also known as sullage): Wastewater produced by washing and bathing activities.

Lagoon: See technology data sheet on 'Wastewater and Fecal Sludge Treatment: Waste Stabilization Ponds' (page 104).

Leachfield: A trench filled with sand, soil, gravel and brickbats for disposal of septic tank overflow into the surrounding soil.

Leach pit (sometimes known as a cesspit): An underground tank that is used where there is no sewer and household wastewaters are drained into them to permit leaching of the liquid into the surrounding soil.

Night soil: Human excreta, with or without anal cleansing material, which are deposited into a bucket or other receptacle for manual removal.

On-plot sanitation: A sanitation system that is wholly contained within the plot occupied by a private dwelling and its immediate surroundings. Commonly, on-plot sanitation is equivalent to ‘household latrine’, but may also include facilities shared by several households living together on the same plot.

On-plot facilities: The components of a sanitation system located within a householder’s plot.

Off-site sanitation: A system of sanitation that involves collection and transportation of waste (wastewater either by sewerage or septage/fecal sludge by vacuum truck) to a location away from the immediate locality.

Pathogens: Micro-organisms such as bacteria, viruses and protozoa that cause disease.

Percolation rate: The rate at which liquids move through soil.

Pit latrine: A form of on-plot sanitation with a pit for accumulation and decomposition of excreta from which liquid infiltrates into the surrounding soil.

Pour flush toilet: A type of latrine where a water seal trap is used to prevent smells and to reduce insects.

Sanitation: Interventions (usually construction of facilities such as latrines) that improve the management of excreta and promote sanitary (healthy) conditions.

Septage: Mixture of wastewater and sludge removed from a septic tank during cleaning operations.

Septic tank: A form of on-plot sanitation for the anaerobic treatment of sewage/ blackwater.

Sewage: A mixture of wastewater from all urban activities from residential, commercial properties. It may also contain a component of industrial wastewater.

Sewer: A conduit, usually a pipe, which is used to collect and convey wastewater away from its point of production to its point of disposal.

Sewage sludge (sometimes referred to as biosolids): A semisolid residue generated during the treatment of domestic sewage including both solids removed by sedimentation and biological sludge produced by biological treatment.

Sewerage: A network of interconnected sewers in an area, district or town.

Soak pit/Soakaway: A pit, typically after a septic tank from where wastewater slowly seeps into the ground through perforated sides and bottom.

Sullage (also known as greywater): Wastewater from bathing, laundry, preparation of food, cooking, and other personal and domestic activities.

Superstructure: Screen or building enclosing a latrine to provide privacy and protection for users.

Suction truck: A vehicle used for mechanized sludge removal from septic tanks and lined latrine pits.

Ventilated improved pit latrine (VIP): A dry latrine system, with a dark interior and a screened vent pipe to reduce odor and fly problems.

Vent pipe: A pipe that facilitates the escape of gases and odors from a latrine or septic tank.

Wastewater: Liquid wastes from households or commercial or industrial operations, along with any surface water/storm water.

Wastewater treatment: A combination of physical, chemical, and biological processes to remove suspended solids, dissolved pollutants, and pathogens and render the water harmless to the environment.

Water closet: A pan, incorporating a water seal, in which excreta are deposited before being flushed away using water.

Water seal: Water held in a U-shaped pipe or hemispherical bowl connecting a pan to a pipe, channel or pit to prevent the escape of gases and insects from the sewer or pit.

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ACKNOWLEDGMENTS
The Guidance Note has been peer reviewed by Dr. R. Sethuraman (CPHEEO), Eduardo A. Perez, Kevin Tayler, Pravin More, Martin Gauss

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Edited by: Anjali Sen Gupta
Pictures by: Sajid Darokhan, C. Ajith Kumar, WSP-SA/Guy Stubbs
Designed and Printed by: Roots Advertising Services Pvt Ltd

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September 2008

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