

# **INTEGRATED DRAIN MANAGEMENT CELL (IDMC)**

**NGT MATTER (OA NO.06/2012)**

**First Status Report of  
Integrated Drain  
Management Cell (IDMC)  
OA NO. 06/2012  
In the matter of  
Manoj Mishra  
Vs  
UOI & ORS**

# First Status Report of Integrated Drain Management Cell (IDMC)

NGT MATTER (OA NO.06/2012)

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## **STATUS REPORT OF INTEGRATED DRAIN MANAGEMENT CELL**

### **BRIEF HISTORY:**

In the matter of Manoj Mishra Vs UOI and Others (OA NO.06/2012) following order has been issued by Hon'ble NGT on dated 05.03.2020:

1. Delhi government may set up within two weeks from today i.e. on 05.03.2020 an "Integrated Drain Management Cell" under Chief Secretary for remediation and management of all drains of Delhi with representatives of all agencies/ department/ Urban Local Departments owning such drains not below the level of Chief Engineer dealing with the management of Drains to the IDMC. CEO, DJB will be the Ex-officio Member Secretary of the IDMC. The IDMC may meet at least once in a week to start with constitution of IDMC will not affect ownership of drains. IDMC may send its reports to this Tribunal every two months by e-mail at [judicial-ngt@gov.in](mailto:judicial-ngt@gov.in).

2. CPCB may revise its report on “Alternate Technologies for Management of waste Water in Drains” in the light of comments of YMC dated 17.02.2020 and forward the same to the Ministry of Urban Development., Jal Shakti, Govt. of India, NMCG, Govt of Delhi, Haryana and UP within one week from today for further necessary action on their part for making policy which may be finalised within one month from today. CPCB may file a compliance report after collecting status of compliance from the said authorities by email at [judicial-ngt@gov.in](mailto:judicial-ngt@gov.in) before the next date. Revised CPCB report may be placed on its website and also circulated to all state/UTs and PCBs/PCCs
3. IDMC may prepare and execute an action plan on the subject of “Alternate Technologies for Management of waste Water in Drains” after appropriate techno-economic evaluation at its end in the light of reports of the CPCB referred to by YMC in its recommendations dated 20.01.2020 and 17.02.2020 or any other relevant inputs on the subject within three weeks

from its constitution which may be ensured by Chief Secretary Delhi. It is made clear that this directing does not in any manner obviate the need to comply with the earlier direction of this Tribunal and the timelines already laid down. It is made further clear that Tribunal has not expressed any opinion about viability or desirability of any particular process or technology indicated in the report or otherwise. Only object of direction of this Tribunal is reduction and abatement of pollution load by using the best possible option.

4. As per the order of Hon'ble NGT dated 05.03.2020 in the matter of Manoj Mishra vs UOI and Ors (OA no.06/2012) a 30 member Committee has been constituted vide order dated 17.03.2020 under the Chairmanship of Chief Secretary Delhi by Ministry of Urban Development, Govt of NCT Delhi with CEO,DJB as Member secretary and all Drain Owning Agencies(DOA)( **Annexure "A"**).

5. First meeting of IDMC was earlier scheduled in the month of March but could not be held due to COVID-19 Pandemic in India, as there has been Nationwide Lockdown since 24.03.2020. Finally 1st meeting of IDMC under the Chairmanship of Chief Secretary Delhi was held on 05.05.2020 through Video Conferencing, which was attended by the officers concerned. Copies of the extant orders of Hon'ble NGT, Central Pollution Control Board (CPCB) Report, Power point Presentation and other relevant documents were sent through email/ WhatsApp prior to the meeting to all the Members of "Integrated Drain Management Cell" (IDMC). In this meeting all Drain owning Agencies (DoA) were requested to nominate Nodal Officers. All the DoA /Departments have nominated their Nodal officers. List of Nodal officers appointed by various drain owning agencies is enclosed as **Annexure "B"**.

6. As per directions of Hon'ble NGT, CPCB has suggested a basket of Alternate Technologies for management of waste water of drain in their report, such as Phyto-remediation, Constructed Wetlands(CWs), Microbials, Bioremediation, Ex-Situ Remediation Technique, Waste stabilization Ponds and Mechanically aerated Lagoons etc. Also categorization of drains has been carried out on the basis of discharge in the drains, their width, depth of water and pollution. Accordingly different Model- Treatment Schemes are suggested in CPCB report, which were to be examined and Action Plan was required to prepare subject to proper techno-economical evaluation by the Drain Owning Agencies. (CPCB report is being attached as **Annexure "C"**). All the agencies were asked to submit Action Plan by 26.05.2020.
7. So far five meetings of IDMC were conducted and all through Video Conferencing. Minutes of the Meeting of all the five meetings are annexed. (**Annexure "D" to "H"**).

8. Status of Action Plan for management of waste water in drains as per “Alternate Technologies” suggested by CPCB, which is to be prepared and executed by respective Drain-owning Agencies is as follows:

**a) Public Works Department(PWD)**

- i) Total Drain length:** Total Drain length under the jurisdiction of PWD is **2064.80Km**.
- ii) Appointment of Consultant:** PWD is in the process of appointment of IIT Delhi/DTU as Consultant.
- iii) Status of Consultancy Report / Action Plan and Timeline:** Action plan will be submitted after appointment of Consultant and receipt of consultancy report.
- iv) Constraints:** As per prevailing guidelines of Finance Department, GNCTD, due to COVID 19 and lack of funds, NO NEW PROJECT can be sanctioned till March 2021. It is informed by PWD that efforts are being made for getting Consultancy Report in phased manner so that some

progress can be achieved in compliance of directions of Hon'ble NGT.

- v) **Present Status:** Proposal of construction Bio-remediation plant at two locations at Chhattarpur & Chatrasal Stadium for 2.5MLD and 1-1.5MLD respectively, is being taken up by PWD but due to some technical reasons, the work is held up as field visits of expert team are not possible due to COVID-19. It was informed that work of construction of Bio-remediation plant at two locations shall be taken up and is likely to be completed by Dec- 2021. Present status of PWD is enclosed as **Annexure "I"**.

b) **Irrigation & Flood Control Department ( I&FC)**

- i) **Total Drain length:** Total Drain length under the jurisdiction of I&FC is **426.55Km**.
- ii) **Appointment of Consultant /Consultancy Report:** It was informed by I&FC that as per the reports of NEERI and other Consultants engaged earlier by them, Bio-remediation/ Phyto-remediation was not found techno-

economically feasible in any of the 57 drains under the jurisdiction of I&FC.

- iii) **Present Status:** To examine the feasibility afresh, efforts are again being made to re-engage NEERI for studying the other Alternate Technologies as suggested by CPCB for the 57 drains. The details are enclosed as **Annexure “J”**.

c) **New Delhi Municipal Council (NDMC)**

- i) **Total Drain length:** Total Drain length under the jurisdiction of NDMC is **335.29Km**.
- ii) **Status of Consultancy Report, Action Plan and Timeline:** Out of 335.29 Km of drain, NDMC has submitted that Bio-remediation in Kushak Nallah is being carried out since 2008-09. The testing of the samples is being done and parameters like BOD, TSS, COD etc are being regularly monitored. Further, NDMC has informed that for balance length of drains in NDMC area, no action plan is required as the entire length of drains except

Kushak Drain is covered. Action Plan of New Delhi Municipal Council is enclosed as **Annexure “K”**.

**d) South Delhi Municipal Corporation (South DMC)**

- i) Total Drain length:** Total Drain length under the jurisdiction of SDMC is **258.78Km**.
- ii) Appointment of Consultant:** IIT Delhi has been appointed as Consultant.
- iii) Status of Consultancy Report/Action Plan and Timeline:** IIT Delhi has submitted the Consultancy Report with Action Plan for treatment of waste water in drains. SDMC has intimated that estimates are being prepared for its implementation and timeline will be submitted on the basis of availability of funds.
- iv) Constraints:** Severe shortage of funds due to prevailing COVID-19 pandemic is delaying the execution of Action Plan. Assistance of DPCC is being sought for getting funds through EPF under CPCB.

v) **Achievement/Consultancy Report:** Action Plan of SDMC is prepared and is enclosed as **Annexure “L”**.

e) **East Delhi Municipal Corporation (EAST DMC)**

i) **Total Drain length:** Total Drain length under the jurisdiction of EDMC is **140.63Km**.

ii) **Appointment of Consultant:** East DMC has prepared Detailed Project Report (DPR) in-house and Action plan for 132 km has been submitted. As per East DMC, the drain length under their jurisdiction is about 132 KM only, instead of 140 KM as reported by Monitoring Committee.

iii) **Status of Consultancy Report /Action Plan and Timeline:** DPR has been prepared in-house and partly with GOI funded scheme. Action plan has been submitted with 18 months time period subject to availability of Funds.

iv) **Constraints:** It is apprised by EDMC that they are facing acute financial constraints, so funds for this project needs to be arranged either through Government Grants or Environmental compensation funds (EPF) under CPCB.

About 18 months are required for implementation of proposed action plan.

v) **Achievement:** Action Plan of East DMC is prepared and is enclosed as **Annexure “N”**.

f) **North Delhi Municipal Corporation (North DMC)**

i) **Total Drain length:** Total Drain length under the jurisdiction of North DMC is **122.46Km**.

ii) **Appointment of Consultant:** IIT Delhi has been appointed as Consultant for Bio-remediation/ Phyto-remediation of drains discharge as per Alternate Technologies suggested by CPCB.

iii) **Status of Consultancy Report /Action Plan and Timeline:** Action plan will be prepared after receipt of consultancy report. The Present status in this regard is enclosed as **Annexure “O”**.

g) **Delhi Development Authority (DDA)**

i) **Total Drain length:** Total Drain length under the jurisdiction of DDA is **251.30Km**.

- ii) **Appointment of Consultant / Status of Consultancy Report /Action Plan:** DDA is in the process of appointment of IIT Delhi as Consultant for Bio-remediation/Phyto-remediation of drains as per Alternative Technologies suggested by CPCB and their report is expected within 6 weeks.
- iii) **Constraints:** Action plan linked with drain length under each STP / Wetland treatment process is yet to be submitted by DDA for the total length of 251 KM.
- iv) **Present Status / Achievement:** DDA is constructing 09 wetlands on 09 Drains between DND flyover to Dhobi Ghat Jamia Nagar and likely to be completed by Oct 2020 .There is also proposal of Construction of 04 STPs of capacity 9.5MLD,7MLD,5MLD and 05 MLD respectively which includes TD-2 and TD-5 two major drains in Dwarka area, for which tender have been already invited and work is likely to be completed in two years. The present status of DDA is enclosed as **Annexure “M”**.

**h) Delhi State Industrial Infrastructure Development Corporation (DSIIDC)**

**i) Total Drain length:** Total Drain length under the jurisdiction of DSIIDC is **98.12Km**.

**ii) Appointment of Consultant:** NEERI has been appointed as Consultant.

**iii) Status of Consultancy Report /Action Plan and Timeline:** It was informed by DSIIDC that trapping of drains under command area of 17 industrial areas under 13 CETPs is expected to be carried out as per following schedule :-

1. NEERI report by 30 Sep-2020.
2. Trapping of drains within 4 to 6 months after receipt of NEERI Report
3. Up gradation of STPs shall be taken up subsequently.

For balance 11 industrial areas, NEERI is expected to submit the report by Dec - 2020.

**iv Present Status:** It is enclosed as **Annexure “P”**

**i) Delhi Cantonment Board (DCB)**

**i) Total Drain Length:** Total length under the jurisdiction of DCB is 39.68Km

**ii) Status of Consultancy Report / Action Plan and Timeline:** Action Plan and DPR has been prepared and they are implementing the Action plan.

**iii) Achievement:** Action Plan has been submitted and DCB is in the process of its implementation, which is enclosed as **Annexure “Q”**

**j) National Thermal Power Corporation Limited (NTPC)**

**i) Total Drain Length:** Total length under the jurisdiction of NTPC is 3.11 Km.

**ii) Status of Consultancy Report, Action Plan and Timeline:** NTPC informed that Power Plant of Badarpur is closed since Oct-2018 and most of the drains are dry now. NTPC is planning to develop one of the biggest Eco Park in India, in a area of about 884 acres of land. Only Jaitpur drain is passing through NTPC land which carrying

discharge from Delhi area and they are taking necessary action for the treatment of the drain along with its beautification of Jaitpur drain.

**iii) Present Status:** NTPC is yet to submit detailed Action Plan of the drains.

Government of NCT of Delhi  
Department of Urban Development  
10<sup>th</sup> Level C-Wing, Delhi Sachivalaya  
I.P. Estate, New Delhi - 110002  
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Office of C.E. (Dr.) Proj  
Diary No. 685  
Dated 20/3/20

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Dated:- 17/03/2020

**ORDER**

Hon'ble NGT vide order dated 05.03.2020 O.A No. 06/2012 in the matter of Manoj Mishra Vs. Union of India & Ors has directed the Government of NCT of Delhi.

"Delhi Government may set up within two weeks from today an 'Integrated Drain Management Cell' (IDMC) under the Chief Secretary for remediation and management of all drains of Delhi with representatives of all agencies/departments/Urban Local Departments owning such drains, not below the level of Chief Engineer dealing with the management of drains to the IDMC. The CEO, DJB will be the ex-officio Member Secretary of the IDMC. The IDMC may meet atleast once in a week, to start with. Constitution of IDMC will not affect ownership of the drains. IDMC may send its reports to this Tribunal every two months by e-mail at [judicial-ngt@gov.in](mailto:judicial-ngt@gov.in)"

Accordingly, Competent Authority, GNCT of Delhi has been pleased to constitute a committee in the following manner:-

- |  |                         |
|--|-------------------------|
| 1. Chief Secretary, GNCTD                              | Chairman                |
| 2. Pr. Secretary, UD                                   | Member                  |
| 3. Pr. Secretary, Revenue                              | Member                  |
| 4. Pr. Secretary, Environment                          | Member                  |
| 5. Pr. Secretary, PWD                                  | Member                  |
| 6. Vice Chairman, DDA                                  | Member                  |
| 7. Chairperson, NDMC                                   | Member                  |
| 8. Secretary (I&FC)                                    | Member                  |
| 9. CEO, DUSIB  | Member                  |
| 10. Managing Director, DSIIDC                          | Member                  |
| 11. Commissioner, South DMC                            | Member                  |
| 12. Commissioner, East DMC                             | Member                  |
| 13. Commissioner, North DMC                            | Member                  |
| 14. Chief Executive Officer, Delhi Jal Board           | <b>Member Secretary</b> |
| 15. CEO, Delhi Cantonment Board                        | Member                  |
| 16. Sh. R.S.Negi, Member Drainage, DJB                 | Member                  |
| 17. Sh. Shalab Kumar, Member Water, DJB                | Member                  |
| 18. Sh. O.P.Srivastva, Chief Engineer (I&FC).          | Member                  |
| 19. Sh. Navrang Singh, Chief Engineer, North DMC       | Member                  |
| 20. Sh. Rakesh Kumar Aluwadi, Chief Engineer, East DMC | Member                  |
| 21. Sh. Dalip Ramnani, Chief Engineer, South DMC       | Member                  |

17/3/2020

22. Sh. Sanjay Jain, Engineer in Chief, South DMC	Member
23. Sh. Mathura Prasad, Chief Engineer, PWD	Member
24. Sh. Sanjay Gupta, Chief Engineer, NDMC	Member
25. Sh. Anurag, Chief Engineer, CPWD	Member
26. Sh. S.K.Arya, Chief Engineer, DDA	Member
27. Sh. D.S. Khatri, Consultant, Delhi Cantonment Board	Member
28. Sh. Mukesh Gupta, Chief Engineer, DSIIDC	Member
29. Sh. D.K. Singh, Sr. Env. Engineer, DPCC	Member
30. Chief Engineer, DUSIB	Member

(I) The Member Secretary shall organise weekly meeting as per the Administrative requirement and will coordinate with other departments/ organisations.

(II) The Member Secretary will also comply with the direction and send status report etc to the NGT and Concerned Authorities in Government of India as well as in GNCTD.

(III) The order is issued with prior approval of the Competent Authority.

*KP* 17/03/2020

(KULDEEP PAKAD) IAS  
SPECIAL SECRETARY (UD)

All Concerned.

F.16(483)/UD/W/2015/Vol.-III/ 564-598

Dated:- 17/03/2020

Copy forwarded to the following for information and necessary action please:-

01. The Member, Yamuna Monitoring Committee.
02. SO to Chief Secretary, GNCT of Delhi.
03. PS to Pr. Secretary, Urban Development Department.
04. PS to Special Secretary (UD), Urban Development Department.
05. SO (Water)

*KP* 17/03/2020

(KULDEEP PAKAD) IAS  
SPECIAL SECRETARY (UD)

## ANNEXURE-B

### INTEGRATED DRAIN MANAGEMENT CELL

**In the matter of Manoj Mishra Vs.UOI &ORS( NGT OA  
NO.06/2012 order dated 05.03.2020)**

#### LIST OF NODAL OFFICERS OF IDMC

SL.NO.	Department	Name of Nodal Officer	Designation	Mobile No	Email id
1	PWD	Mathura Prasad	CE(North)	9818582453	cepwddelhimzm3@gmail.com
2	I&FC	O P Srivastava	CE	9899260883	ceiifcd@gmail.com
3	NDMC	Sanjay Gupta	CE	9818884167	<a href="mailto:ce.civil@ndmc.gov.in">ce.civil@ndmc.gov.in</a>
4	SDMC	Dalip Ramnani	CE(South Zone)	8588888222	cesouthsdmc@gmail.com
5	DDA	S K Arya	CE	9418105283	ceez@dda.org.in
6	EDMC	PK Khandelwal	CE	9717788004	<a href="mailto:pradeepcemcd@gmail.com">pradeepcemcd@gmail.com</a> deepkhandelwal100@gmail.com
7	North DMC	Naurang Singh	CE	9717788779	ceivndmc@gmail.com
8	DSIIDC	Mukesh Gupta	CE	9996259028	ceiadsiidc@gmail.com
9	DCB	Rakesh Rana		7042491415	cbdelhi@dggest.org
9	DUSIB	SK Dania	CE	9717999290	ce1.dusib@gmail.com
10	CPWD	Anurag Garg	CE	9717653300	ce_ndz2@nic.in
11	DPCC	Nandita Moitra	Lab Incharge (Water)	9717593521	nandita_moitra@rediffmail.com
12	DJB	Ajay Gupta	CE	9650291023	cedrpr3@gmail.com

# ALTERNATIVE TREATMENT TECHNOLOGIES FOR WASTEWATER TREATMENT IN DRAINS

**In Compliance to Direction of Hon'ble NGT in the Matter of OA No. 06/2012  
Titled Manoj Mishra Vs Union of India & ORS**



**February, 2020**

**CENTRAL POLLUTION CONTROL BOARD, DELHI**

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## **LIST OF ABBREVIATIONS**

BOD- Biological oxygen demand  
COD – Chemical oxygen Demand  
CPCB – Central Pollution Control Board  
CW- Constructed wetland  
DO – Dissolved oxygen  
EL – Elevation  
EM – Electromagnetic  
ICT- Institute of Chemical Technology  
IIT- Indian Institute of Technology  
MLD- Million liter per day  
MSL- Mean sea level  
N – Nitrogen  
NEERI- National Environmental Engineering Research Institute  
NGT – National Green Tribunal  
NH<sub>3</sub>-N – Ammonical Nitrogen  
NO<sub>3</sub>-N – Nitrate Nitrogen  
O&M - Operation & Maintenance  
OL- Organic load  
OLR – Organic loading rate  
P- Phosphorus  
PO<sub>4</sub>-P – Phosphate  
STP – Sewage Treatment plants  
TERI- The Energy and Resources Institute  
TSS – Total dissolved solids  
V – Volume  
WSP- Waste stabilization pond

**REPORT ON ALTERNATIVE TREATMENT TECHNOLOGIES FOR  
WASTEWATER TREATMENT OF DRAINS IN COMPLIANCE TO DIRECTION OF  
HON'BLE NGT IN THE MATTER OF OA NO. 06/2012 TITLED MANOJ MISHRA VS  
UNION OF INDIA & ORS.**

## **1. BACKGROUND**

The verbatim of Hon'ble National Green Tribunal in the matter of OA No. 06 of 2012 titled; Manoj Mishra Vs Union of India & Ors. vide order dated 22.01.2020 at para 25 is as follows:

*“Since the above report does not mention the generic and representative models which could be customised, adapted and adopted to the natural scenario including the drains in question, let CPCB furnish such a report containing at least ten generic and representative models which are techno-economically feasible and can be implemented after customization to the YMC by 07.02.2020 and the YMC may include the report with its comments in its report to be submitted to this Tribunal before the next date by e-mail at [judicial-ngt@gov.in](mailto:judicial-ngt@gov.in).*

*CPCB furnish a report in terms of Para 25 above to the YMC by 07.02.2020 and the YMC may include the report with its comments in its report to be submitted to this Tribunal before the next date by e-mail at [judicial-ngt@gov.in](mailto:judicial-ngt@gov.in).”*

A meeting was convened on 27.01.2020 to consult experts including representatives from NEERI, TERI, Delhi University and other stakeholders. During the meeting, apart from in-situ remediation, low cost decentralised treatment systems (waste stabilization pond, oxidation pond, anaerobic lagoon) were also discussed, which can be adopted as ex-situ treatment. Another meeting was convened on 29.01.2020 wherein consultation was held with experts from IIT-Roorkee, IIT-BHU and ICT - Mumbai.

## **2. ADVANTAGES AND ECOLOGICAL SERVICES OF ALTERNATIVE BIOLOGICAL TREATMENT TECHNOLOGY**

In situ treatment methods such as constructed wetland system, phytoremediation, Eco Bio Block system, microbial bio remediation are most favorable methods for alternative biological treatment technology of drains. Although above treatment systems are temporary provision but it may be adopted for further polishing of STP effluent. Alternative biological treatment technologies are not only useful in improving water quality of drains / rivers but are also helpful in rejuvenation of the ecology of a river system. Benefits of alternative biological treatment technologies are highlighted below:

- Alternative biological treatment technology methods such as phytoremediation or wetland systems are efficient in terms of nutrient removal such as removal of nitrogen and phosphorous.

- All alternative biological treatment technologies are low in energy incentive and not only reduces carbon footprint thereby minimizing climate change impact but also contributes to carbon sequestration.
- Constructed Wetlands have highest microbial diversity that will biodegrade not only organic but all emergent pollutants including odor producing substances & gases, antibiotic, detergent, pharmaceutical products, etc.
- The technologies provide benefits like increase in the biodiversity and biomass production apart from habitat conservation.
- Constructed Wetlands may attract migratory birds, as well as provide aesthetic and recreational services to the public.
- Studies indicate that there is massive reduction in pathogenic microbes in alternative biological treatment technology as compared to conventional treatment.
- In-situ remediation technique does not require much energy, its maintenance cost is relatively low, it is easy to develop, operate and manage as compared to conventional technology. Besides high reduction efficiency of BOD, different alternative treatment technologies are efficient in increasing Dissolve Oxygen (DO) and reducing Fecal Coliform (FC) e.g. Phytoremediation technique can reduce FC by 50% and increase DO from 0 to 5 mg/l; Oxidation Pond can reduce FC by more than 95% and increase DO from 0 to 5mg/l; similarly, lagoons are efficient in reduction of FC by 50-70%.
- The cost of alternative biological treatment technology is extremely low.
- In-situ remediation is more efficient in restoring self-purification system of river and also immobilization of heavy metals.
- Constructed wetlands contribute to groundwater recharge as well as results in buffering of ambient temperature and odor.

### **3. WATERSHED PATTERN – STREAM ORDER**

Based on the drainage pattern, all drains traverse towards recipient water body located downstream of drains. Drains which directly discharge into recipient water bodies such as rivers, rivulets, ponds, lakes etc. are called as first order drain. Drains which join into first order drain are called as second order drains. Similarly, third and fourth order drains could be defined. The first and second order drains which confluence directly with River system are relatively larger with continuous flow.

Generally, drain emerging from urban centers/ rural habitats are third or fourth order drains which confluence into larger second or first order drains finally meeting into river/ pond/lakes.

Third and fourth order drains are rather narrow, very shallow, located at higher gradient, usually shorter in length and often covered / or passed beneath roads. Similarly, due to unplanned growth, untreated sewage/ industrial discharge into such drains, which ultimately meets first and second order drain (Figure – 1).

*This sort of order of drain is defined as classic stream order, also called [Hack's stream order](#). Drains usually carry wastewater from Urban/Rural centers called domestic sewage or effluent from Industrial activities and surface runoff including agricultural runoff.*

Therefore, drains could be broadly categorized as sewage drains carrying only sewage and mixed drains carrying sewage and industrial effluent.

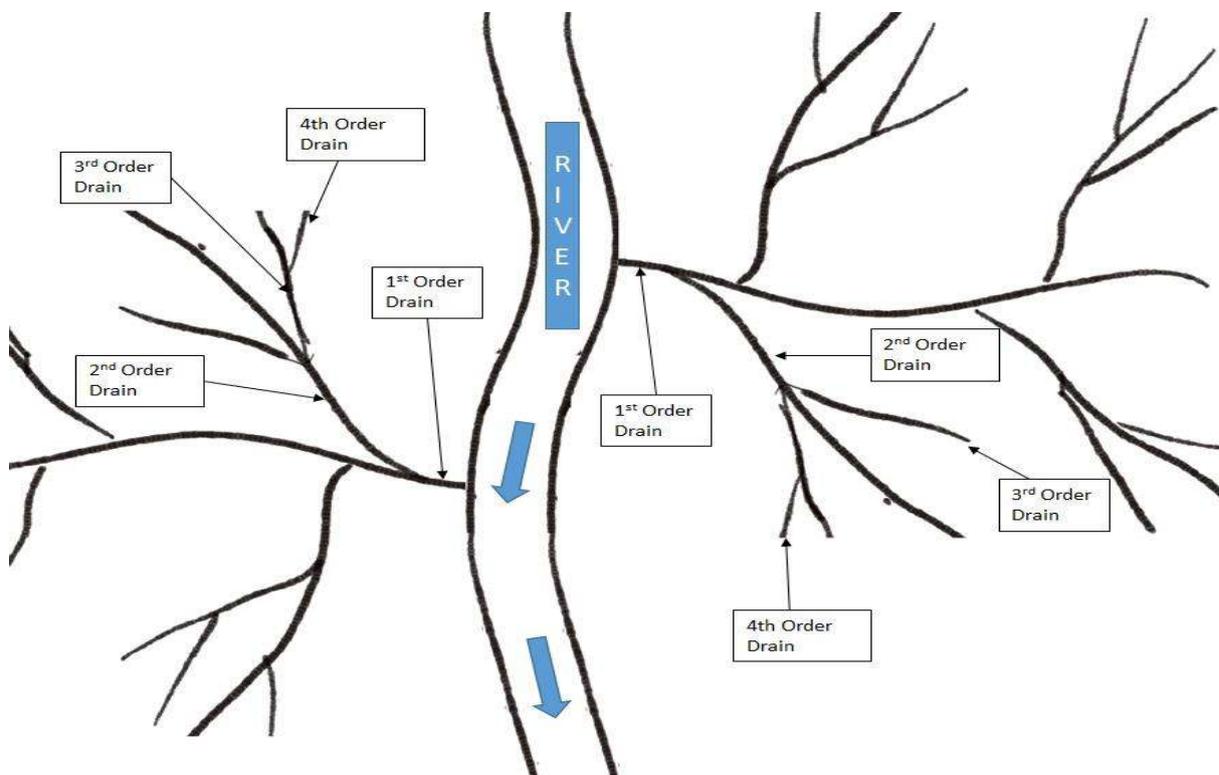


Figure 1 Drainage pattern of any city/town

Based on drain data available for River Ganga and its tributaries, categorization of drains has been made considering their hydrological characteristics namely, flow, pollution load and physical characteristics, which may influence selection of drain wastewater treatment technology.

Flow – Based on flow drain can be classified as,

- <20MLD – Minor Drain
- 20 – 50 MLD – Medium Drain
- >50 MLD – Major Drain

Pollution Load – Based on pollution load in terms of BOD concentration, drains can be classified as,

- <50 mg/l – Low Pollution Load
- 50-100 mg/l – Modern Pollution Load
- >100 mg/l – High Pollution Load

Width – Based on channel width, drains can be classified as,

- <3m – Narrow Drain
- 3 – 15m – Wide Drain
- >15m – Broad Drain

Drain could also be characterized based on the criteria such as drain traversing through hilly terrain, rocky terrain, plain, marshy area and draining into different recipient water body like river, lakes, pond and sea.

## **4. ALTERNATIVE TREATMENT TECHNOLOGIES**

### **4.1 IN-SITU BIOREMEDIATION TECHNIQUES**

*In-Situ* bioremediation techniques involve treatment at the site using aquatic plants and/or microbial remediation methods. *In-Situ* treatment systems can be commissioned in lower time duration (few months only), is easy to operate, and requires less energy as compared to conventional treatment technologies. *In-situ* treatment, depending on effluent characteristics, site conditions, and type of treatment systems, may either provide desired quality of treated effluent or act as supplementary to conventional treatment technologies. In any case, wherever feasible, it can be used as an interim remedial measure and help in reducing pollution load or polishing of treated effluent from Sewage Treatment Plants. The common *in-situ* treatment systems are Microbial Bioremediation, Phytoremediation, Constructed Wetland System and Root Zone Treatment. Adequate space and appropriate flow are general requirements for adoption of these technologies. Details of above mentioned *In-situ* bioremediation techniques indicating methodology, parameters for the feasibility assessment, existing experiences, etc. are as follow:

#### **4.1.1 Phytoremediation**

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. Phytoremediation involves the removal of organic compounds and nutrients from wastewater through bio-sorption/uptake by pollution-tolerant aquatic plants (such as algae, water hyacinth, duckweeds, etc.) growing in the wastewater. Quite often such plants grow along the littoral zones on either side of the drain.

#### **4.1.2 Constructed Wetlands (CWs)**

CWS also uses principle of Phytoremediation techniques. It integrates microbial bioremediation, phytoremediation and root-zone treatment in addition to providing the benefits of oxidation pond and physical filters.

Constructed wetlands (CWs) are scientifically proven and widely adopted across the world as alternative and complementary technology to conventional technologies for sewage treatment. A well-designed constructed wetland system will work on the same principle as that of STP but with greater microbial diversity associated with diverse plant

species that effectively biodegrade organics and other pollutants in sewage and without energy.

A constructed wetland is highly versatile and can be designed for drains that have different topography hydraulics and physical characteristics of the drain (width, length, height). A constructed wetland system can be used as primary/ secondary/ tertiary treatment and with continuous flow. Figure 2 depicts schematic flow diagram of a Constructed Wetland System.

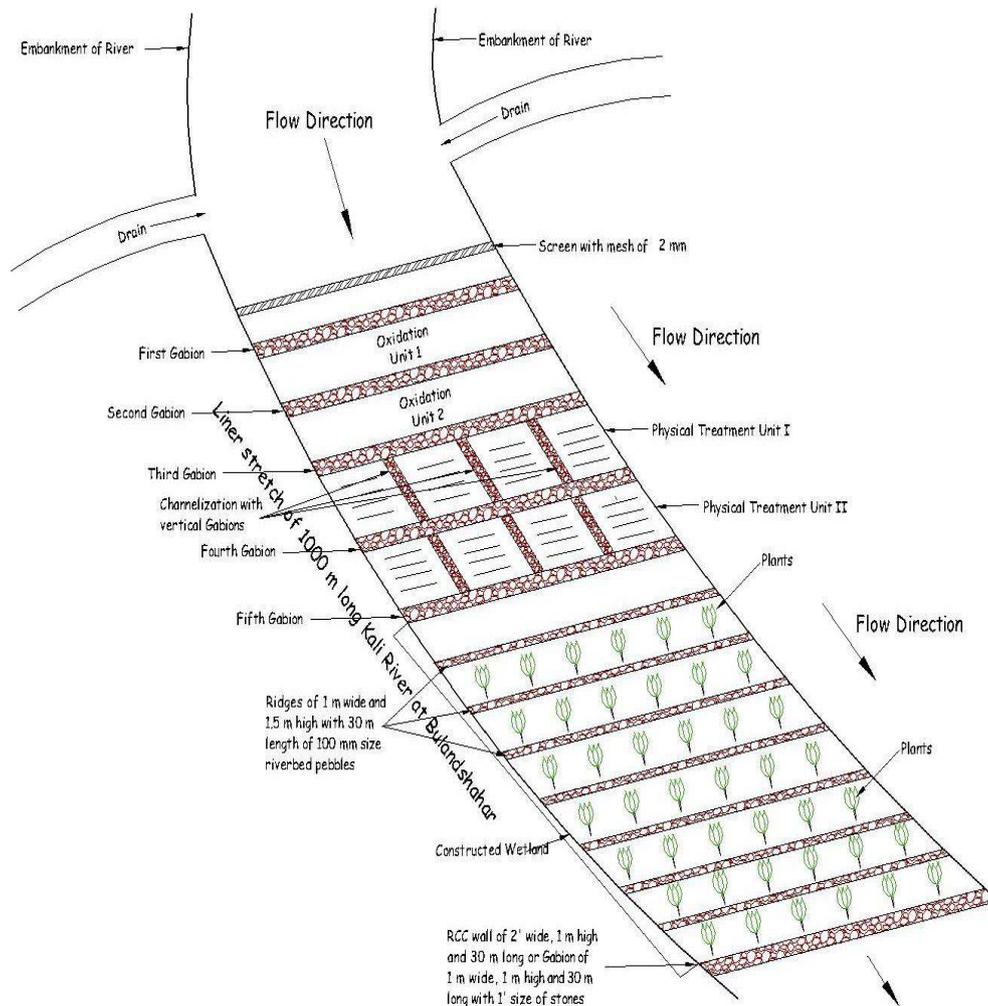


Figure 2 Schematic Diagram of Constructed Wetland Systems

A typical CW system should have the following components:

- i. An aerobic oxidation pond with depth of water ranging from < 1m to 5m; water may be retained for at least 8-10 hours and consequently there may be slight rise in the water level (up to 30cm) from the normal water level in the drain.
  - (a) there may be a screen (iron mash having 4-10 mm aperture) before the oxidation pond to remove solid waste and another screen (2-4 mm aperture) before water

- enters into two physical filter tanks / chambers/ zones/ channels from oxidation pond.
- ii. Three physical filter tanks/ chambers/ channels/ zones are ideal for efficient functioning; the physical filter chambers are separated by gabions of boulders of different sizes and embedded in iron mesh.
    - (a) the first chamber/ channel/ zone is separated from the second chamber by a gabion made of boulders of 2' within the chamber channel and there will be 3 ridges made of stones/ pebbles of 200 to 250 mm.
    - (b) The second chamber is separated from third chamber by a gabion made of boulders of 1' size with 3-4 ridges of pebbles of 180 mm.
    - (c) The third chamber is separated from the constructed wetland by gabion made of boulders of 1' size with 3 to 4 ridges of river bed pebbles of 150 -120 mm.
  - iii. Constructed wetland having 5-10 furrows of 1 to 4 m width separated by ridges of 1 m high, 0.5m wide and composed of river bed pebbles of 80-50 mm size.
  - iv. Cascade outlet is made of boulders, stones and pebbles with gentle slope from the overflow of the constructed wetlands. Water coming out from the cascade can be recycled /stored in stagnant water bodies / wetland or channelized into the downstream of the drain or river.

**Note:**

- i. The height of gabions should be 1.0 m 1.5 m high and usually above the water level in the channels/ chambers/ ponds/ zones.
- ii. The typical CW system outlined above is for in situ biological remediation where the sides of the chambers/ ponds/ channels / zones are the embankments of the drains.
- iii. For ex-situ biological remediation, the four sides of chambers/ponds/ tanks should be made of stone meshed walls of 1.5 -2 m high and 0.5 m – 1 m wide and all the components should be contiguous with gradient so that water flows on its own. If a gradient does not exist, a gradient channel has to be constructed.

**4.1.3 Microbial Bioremediation**

Microbial bioremediation involves periodic or continuous dosing of special waste-treating microbes, fungi and /or plants and their products (such as enzymes) in adequate quantity to the wastewater mass. The effectiveness of bioremediation depends on both the wastewater characteristics, the microorganisms and products that are used for dosing, the dosing amount, frequency of dosing and the environmental conditions.

Microbial bioremediation could be intrinsic (within the drain using natural consortia of microorganisms) or in vitro (using an engineered treatment system).

Microorganisms are used to treat mainly the organic matter; small quantity of inorganic materials and metals are also consumed as nutrients. Direct use of enzymes is done in biochemical treatment. It may be noted that aerobic microbes need less time, whereas anaerobic microbes need more time to degrade the waste.

Flow and retention time: This type of bioremediation requires retention time of 20 -30 hours, therefore may be suitable for drains with low flow.

Output of the process could vary where flow rates are variable and high, which could partly be due to rapid wash out of the material dosed from drains during high flow pulses. Drains often need interventions to slow down the flow rates. Also, the process being inherently slow will achieve good performance in larger span of time.

Domestic wastewater also gets mixed with the effluents from industries which invariably carry inorganic pollutants thereby impacting the microbial load. While there have been claims of successful treatment of municipal wastewater by bioremediation with various microorganisms and inoculums, these claims require re-verification for a sustained period.

The system requires a kind of bio-reactor to meet the retention time and as such it requires a large area /stretch to provide the requisite retention time and the microbial diversity is limited and is composed of consortia of known microbes. There is recurring cost for maintaining microbial consortia as bio-media has to be added in running stream at regular intervals.

Further, the successful use of this bioremediation technique for in-situ treatment of wastewater-carrying drains, would necessitate periodic removal of bio-sludge generated over time from the drains to avoid choking of the drains and/or addition of pollution load on the receiving water body by transporting the sludge generated.

There is a requirement for well-defined specifications in case of this type of bioremediation since the microbial composition and doses are usually trade secrets and claims are unverifiable and comparable.

Current application of microbial bioremediation carried out by NMCG in 144 drains depicts better results in drains having flow less than 10 MLD. Therefore, such intervention can be applied in low hydraulic load and its expected outcome shall be within 50 %.

## **4.2 Ex-Situ Remediation Techniques**

Ex-situ remediation technique includes constructed wetland, waste stabilization pond, aerated lagoon and oxidation pond. Design and performance details are attached as Annexure-I. Details of ex-situ techniques are given below:

### **4.2.1 Waste stabilization pond**

Waste or Wastewater Stabilization Ponds (WSPs) are large, man-made water bodies in which Blackwater, greywater or faecal sludge are treated by natural occurring processes and the influence of solar light, wind, microorganisms and algae. The ponds can be used individually, or linked in a series for improved treatment. There are three types of ponds,

- (1) anaerobic,
- (2) facultative and
- (3) aerobic (maturation),

each with different treatment and design characteristics. WSPs are low-cost for O&M and BOD and pathogen removal is high. However, large surface areas and expert design

are required. Effluent contains nutrients (e.g. N and P) and is therefore appropriate for reuse in agriculture, but not for direct discharge in surface waters.

#### 4.2.2 Mechanically Aerated Lagoon

Mechanically aerated lagoons are earthen basins generally 2.5 to 5m deep, provided with mechanical aerators installed on floats or fixed columns. Raw sewage is fed from one end into lagoon (after screening) and it leaves from the other end after desired period of aeration. Aerated lagoons are smaller in size (less than 10-20%) compared to waste stabilization ponds. Three types of aerated lagoons can be distinguished as mentioned below:

##### 1. Facultative aerated Lagoons

Facultative aerated lagoons consist of a shallow basin in which settleable solids introduced by the wastewater settle to the bottom to form a sludge layer that decomposes anaerobically. Biodegradable organic materials that do not settle are degraded aerobically. The term facultative aerated describes the aerobic-anaerobic nature of the lagoon - an anaerobic bottom region covered by an aerobic top layer. Process of oxygenation is enhanced through floating aerators in upper section of lagoon. Lower section of lagoon maintains anaerobic conditions. The power input per unit volume is only sufficient for diffusing required amount of oxygen into liquid, but not sufficient for maintaining all the solids in suspension (Figure – 3).

Consequently, some of the suspended solids entering the Lagoon and some of the new solids produced in the lagoon as a result of substrate removal tend to settle down and undergo anaerobic decomposition at the bottom. They are capable of giving 70-90% BOD removal from domestic sewage.

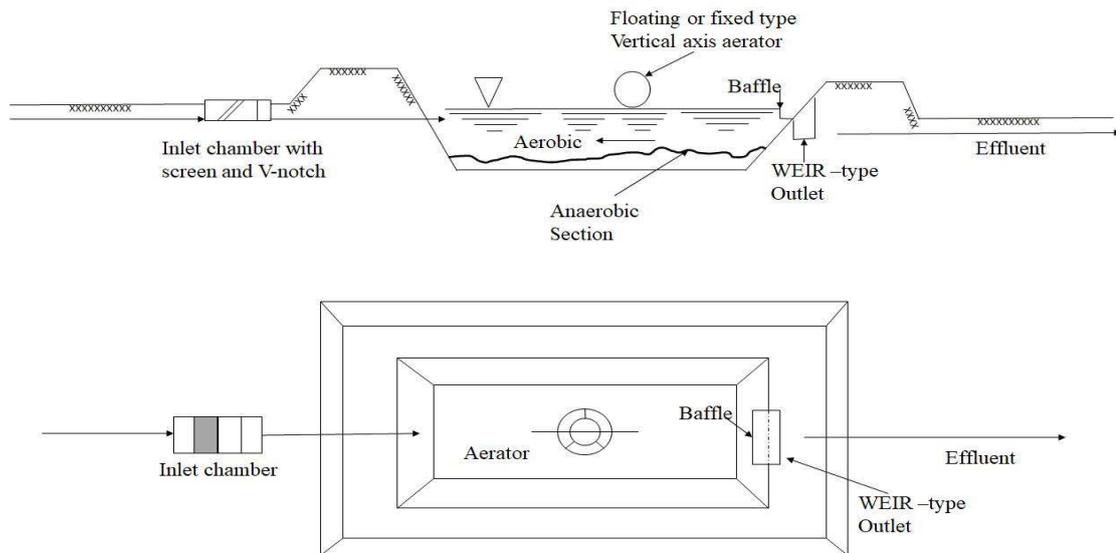


Figure 3: Mechanical aerated facultative lagoon

## 2. Aerobic flow-through Lagoons

Aerobic flow-through lagoons use aerators to mix the effluent in the pond and add oxygen to the wastewater. In aerobic flow through lagoons, oxygen transfer is maintained throughout the depth of the lagoon. The power level is high enough not only to diffuse adequate oxygen into the liquid but also to keep all solids in suspension as in an activated sludge aeration tank (Figure – 4). Additional treatment (such as stabilization pond) is necessary if better BOD and solid removal is desired.

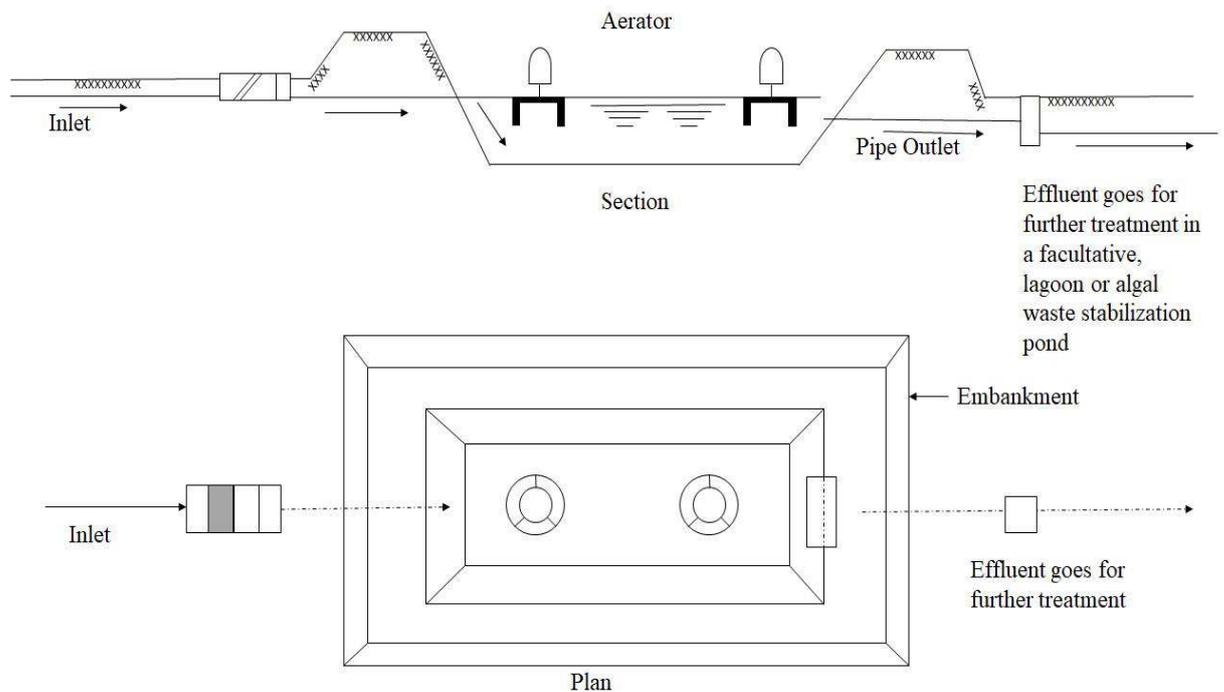


Figure 4 Mechanical aerated flow through type lagoon

## 3. Aerobic lagoons with recycling of solids

In aerobic lagoons, oxygenation of effluent and retention of recyclable solids is carried out. In these lagoons, power input level is sufficient to meet the oxygen requirement as well as to keep all solids in suspension. The efficiency of BOD removal in these types of lagoons can be as high as 95-98%, and nitrification can also be achieved (Figure – 5).

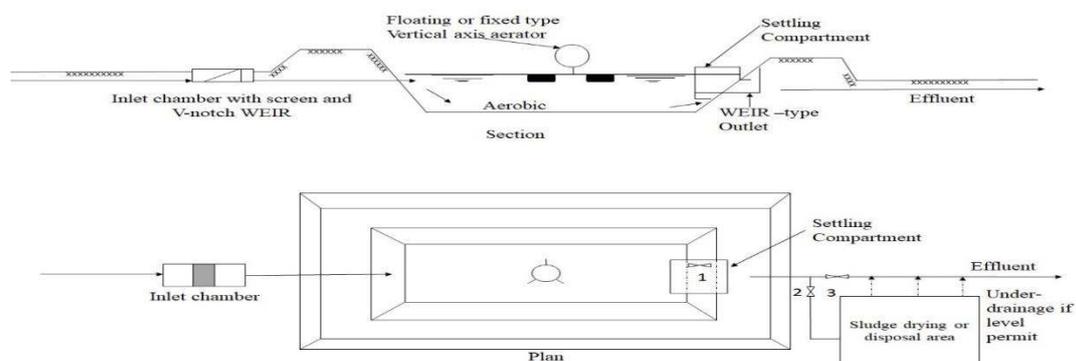


Figure 5: Typical mechanical aerated lagoon system

## 5. CRITERIA FOR SELECTION OF ALTERNATIVE TREATMENT TECHNOLOGIES FOR REJUVENATION OF DRAINS

The effective biological *in-situ* treatment system should need the following requirements:

- i) *In situ* treatment should be different from conventional centralized or decentralized treatment system.
- ii) It should be a rapid system having commissioning time of less than six to twelve months.
- iii) The *in situ* treatment system should have the ability to treat the sewage in a continuous manner throughout the year.
- iv) The treatment system must have a well-defined inlet and outlet along with minimum modification in natural drain structure.
- v) The treatment system should work on zero/negligible power consumption.
- vi) The treatment system should have a designed life and minimum operational constraints.
- vii) It should not have high capital cost and recurring cost as compared with conventional *ex situ* treatment technology currently in practice.
- viii) The design life should be up to 15 years at optimum operation condition.
- ix) In case of drains having flow >20 MLD, the system may be developed in modular form having 2-3 blocks of treatment within one treatment stretch.
- x) The treatment system must be capable of degrading/reducing the soluble and insoluble organic materials.
- xi) Removal efficiency of soluble BOD at the final designated outlet should not be less than 60% in terms of organic load reduction with treated wastewater quality at designated outlet of pH 6.5-8.5, DO  $\geq 5$ mg/l and BOD  $\leq 20$  mg/l, whichever is stringent.
- xii) *In-situ* treatment shall be accompanied with pre-treatment/ physical solid liquid separation as drains carry large quantity of solid waste.
- xiii) The generated sludge must be quantified and cleaned based on requirement preferentially at every 15 days within the defined stretch. If required, dredging should be done to maintain the depth.
- xiv) The system must not hinder the flow and not result in ponding at the upstream site of the drain.
- xv) Flow measuring device (such as V-notch, EM meter etc.) may be installed at the inlet/outlet of the treatment stretch so as to control the treatment based on flow and assessment of daily treated volume.
- xvi) Treatment system shall be installed at such a location/manner and for such volume of drains that the treated effluent quality at defined outlet shall be maintained throughout the entire downstream stretch of the drain till confluence with the river. If required, treatment system could be set up in series in entire drain stretch.
- xvii) Treatment system shall be set up for inlet wastewater quality of BOD  $\geq 40$ mg/l.

## 6. SCHEMES/MODELS FOR DIFFERENT ORDERS OF DRAIN

Categorization of drains are made based on the experience of drain monitoring in Ganga Catchment. Schemes/ Models defined for treatment are generic and suggestive in nature and any application of such model requires specific design as per site requirements. The land requirements mentioned are indicative and it shall be worked out as per the design criteria. Summary of different treatment schemes is shown in table 1

### 6.1 Model 1: Minor sewage drain with moderate pollution load & broader channel

#### a) Drain hydrological characteristics:

##### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter  
 Depth of Flowing Water : 1 - 3 Meter

##### ➤ Organic Loading

BOD : < 100 mg/l

##### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation ponds/ Facultative pond (1-2 no.) + Physical Treatment unit + wetland/phytoremediation or waste stabilization pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure 6). In *in-situ* treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

#### e) Schematic diagram:

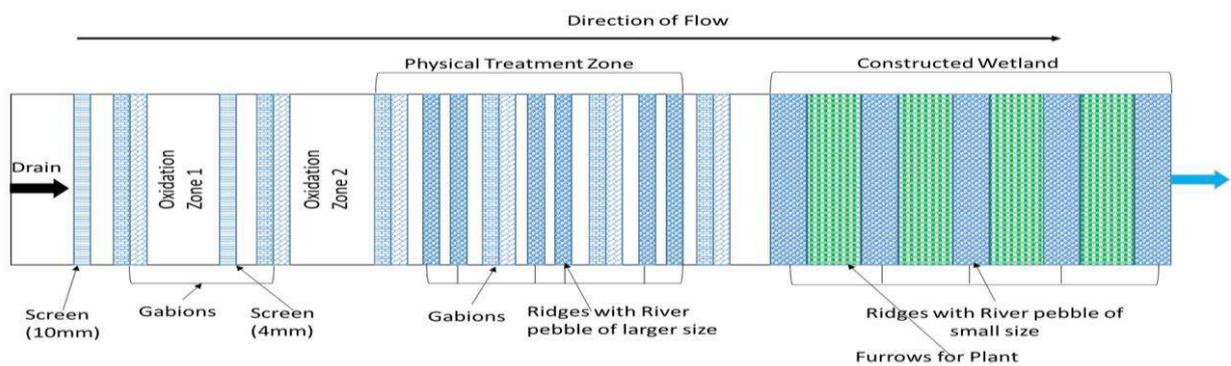


Figure 6 Schematic layout of *in-situ* Biological Remediation

## 6.2 Model 2: Minor sewage drain with moderate pollution load & wide channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : 3-15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : < 100 mg/l

#### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation ponds/ Facultative pond (1-2 no.) + Physical Treatment unit + wetland/phytoremediation or waste stabilization pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with wide channel suitable for in-situ construction. This type of model is suitable for 2<sup>nd</sup> and 3<sup>rd</sup> order drains. For hilly areas, such system has to be developed in the marshy depressions/valleys. In other words, it will be developed at the confluence of the drain with depression /low lying area in the valley.

d) **Design aspect:** Depending on the space availability and the flow rates of the 2<sup>nd</sup> and 3<sup>rd</sup> order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised In-situ/ Ex-situ based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 7).

### e) Schematic diagram:

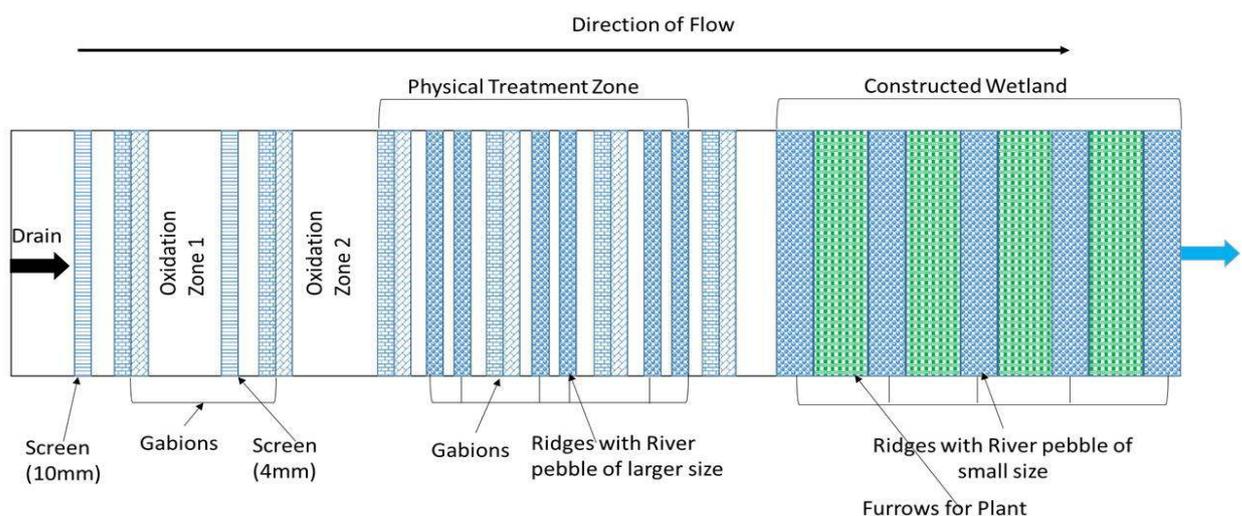


Figure 7 Schematic layout of *in-situ* Biological Remediation

### 6.3 Model 3: Minor sewage drain with moderate pollution load & narrow channel

#### a) Drain hydrological characteristics:

##### ➤ Physical Characteristics of Drainage System

Width of Drain : < 3 Meter  
Depth of Flowing Water : 1 - 3 Meter

##### ➤ Organic Loading

BOD : < 100 mg/l

##### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation ponds/ Facultative pond (1-2 no.) + Physical Treatment unit + wetland/phytoremediation or waste stabilization pond or Ex-Situ Activated Sludge Method

c) **Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with channel width of less than 3m. This type of model is suitable for 3<sup>rd</sup> or higher order drains. For hilly areas, such system has to developed in the marshy depressions/valleys. In other words, it will be developed at the confluence of the drain with depression /low lying area in the valley.

d) **Design aspect:** Due to less flow width, In- situ treatment is generally not feasible in these categories of drains. Ex situ model may be best suitable for providing sufficient hydraulic retention time in oxidation pond + wetland system or Waste Stabilization Pond as per the space available. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 8).

#### e) Schematic diagram:

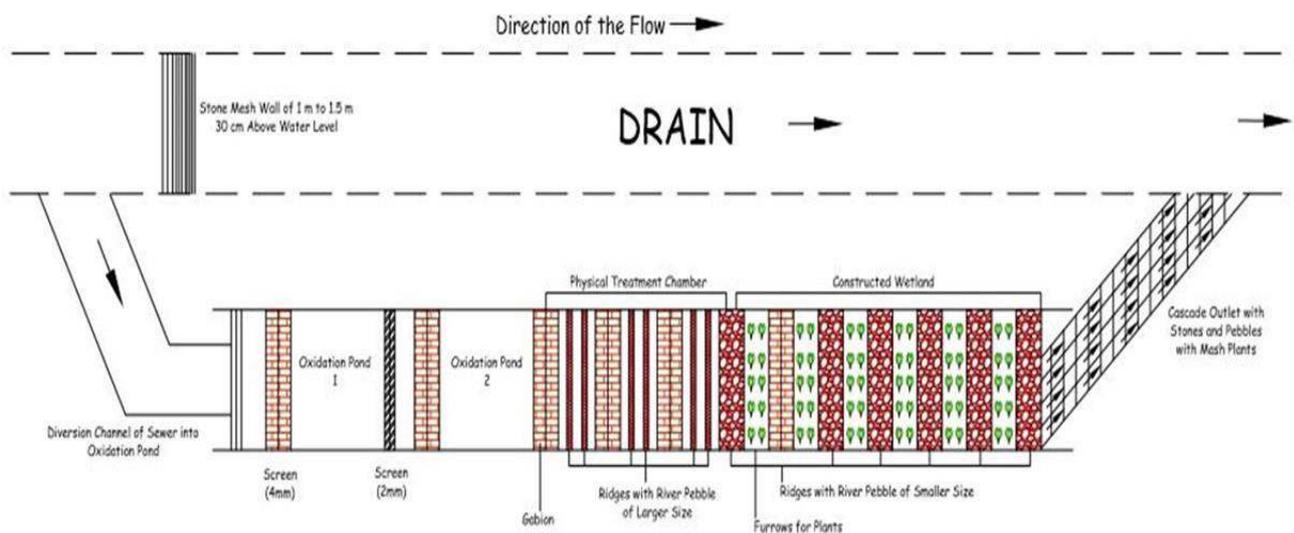


Figure 8 Schematic layout of *ex-situ* Biological Remediation

## 6.4 Model 4: Minor sewage drain with high pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 0.5 - 2 Meter

#### ➤ Organic Loading

BOD : >100 mg/l

#### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation pond + Physical Treatment unit + constructed wetland system or Waste Stabilization Pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying high pollution load (untreated sewage + industrial effluent) with channel width more than 15 m. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 9). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

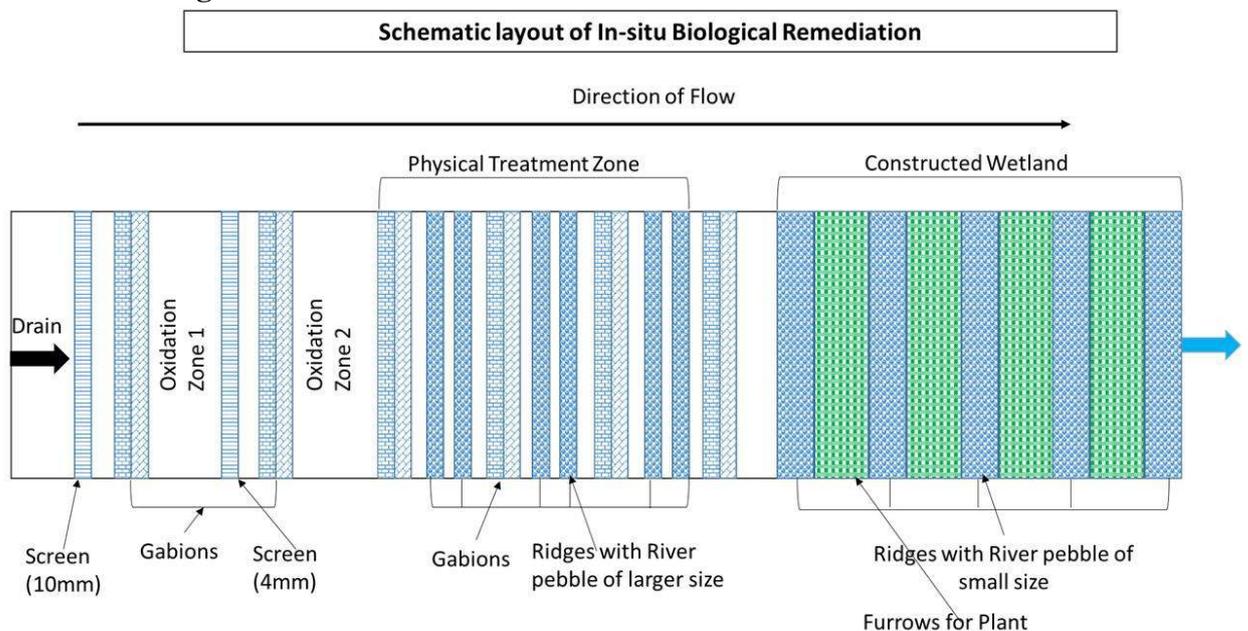


Figure 9: Schematic layout of *in-situ* Biological Remediation.

## 6.5 Model 5: Minor sewage drain with high pollution load & wide channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : 3- 15 Meter

Depth of Flowing Water : 0.5 - 2 Meter

#### ➤ Organic Loading

BOD : >100 mg/l

#### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation pond + Physical Treatment unit + constructed wetland system or Waste Stabilization Pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying high pollution load (untreated sewage + industrial effluent) with channel width 3-15 m. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 2<sup>nd</sup> and 3<sup>rd</sup> order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised In-situ/ Ex-situ based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure 10).

### e) Schematic diagram:

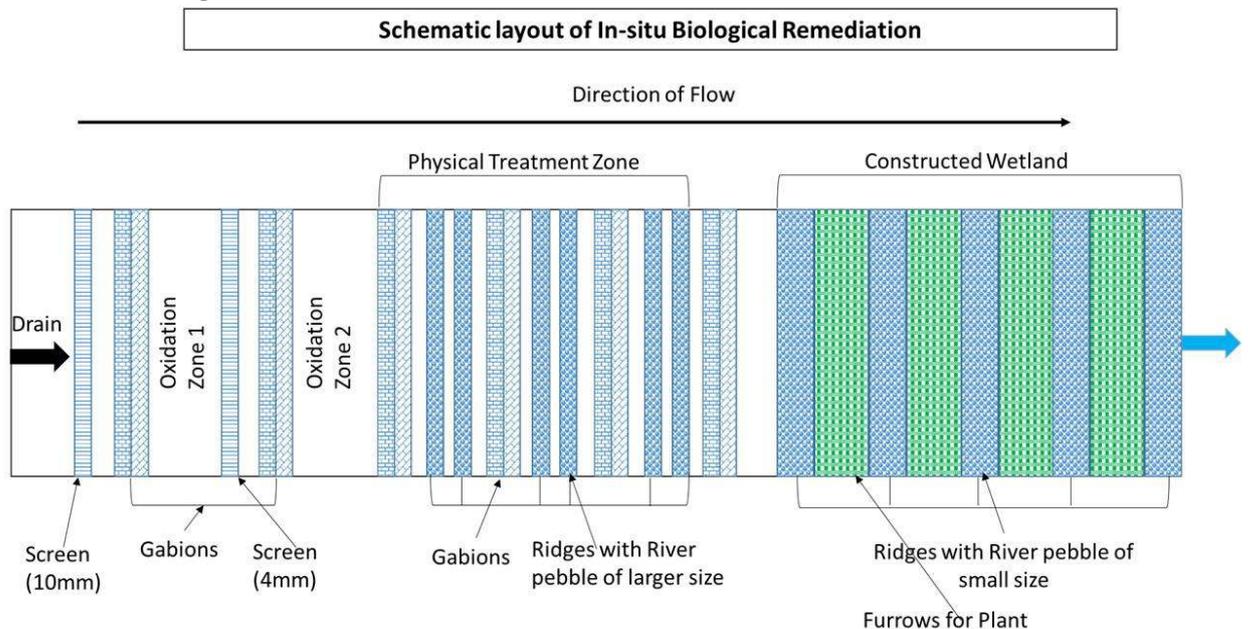


Figure 50 Schematic layout of *in-situ* Biological Remediation.

## 6.6 Model 6: Minor sewage drain with high pollution load & narrow channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : < 3 Meter  
Depth of Flowing Water : 0.5 - 2 Meter

#### ➤ Organic Loading

BOD : >100 mg/l

#### ➤ Hydraulic Loading

Flow : < 20 MLD

b) **Treatment scheme:** Oxidation pond + wetland system or Waste Stabilization Pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying only low pollution load untreated sewage with channel width of less than 3m. This type of model is suitable for 3<sup>rd</sup> or higher order drains.

d) **Design aspect:** Due to less flow width, In- situ treatment is generally not feasible in these categories of drains. Ex situ model may be best suitable for providing sufficient hydraulic retention time in oxidation pond + wetland system or Waste Stabilization Pond as per the space available. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 11).

### e) Schematic diagram:

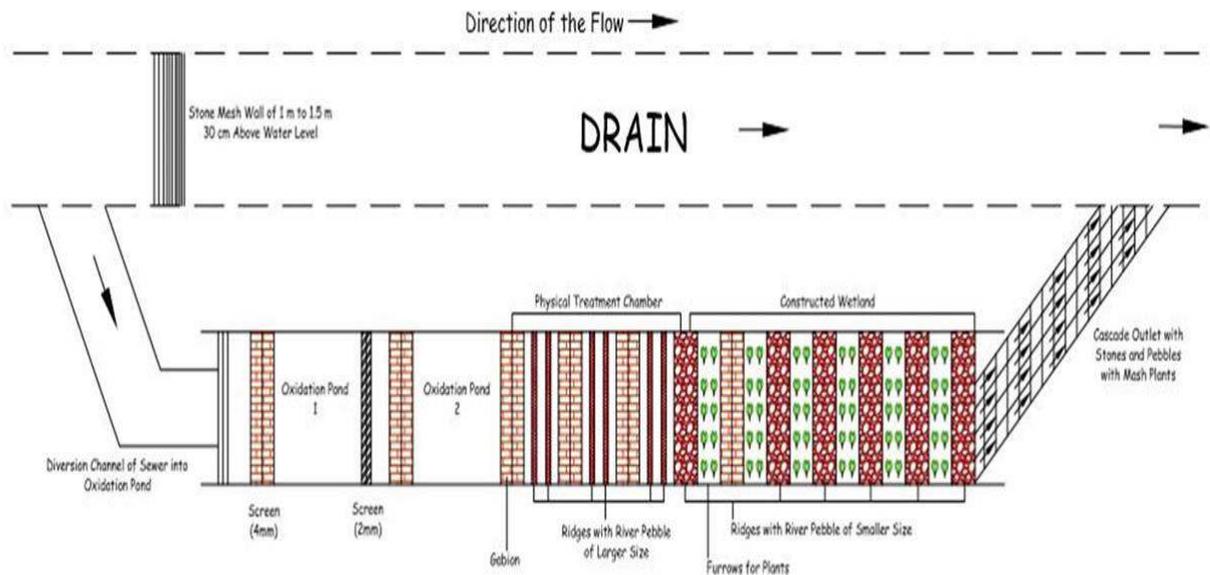


Figure 11: Schematic layout of *ex-situ* Biological Remediation.

## 6.7 Model 7: Medium sewage drain with low pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : < 50 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + wetland/phytoremediation or Oxidation pond + Physical Treatment unit + Constructed wetland or waste stabilisation pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying only low pollution load sewage with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 12). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

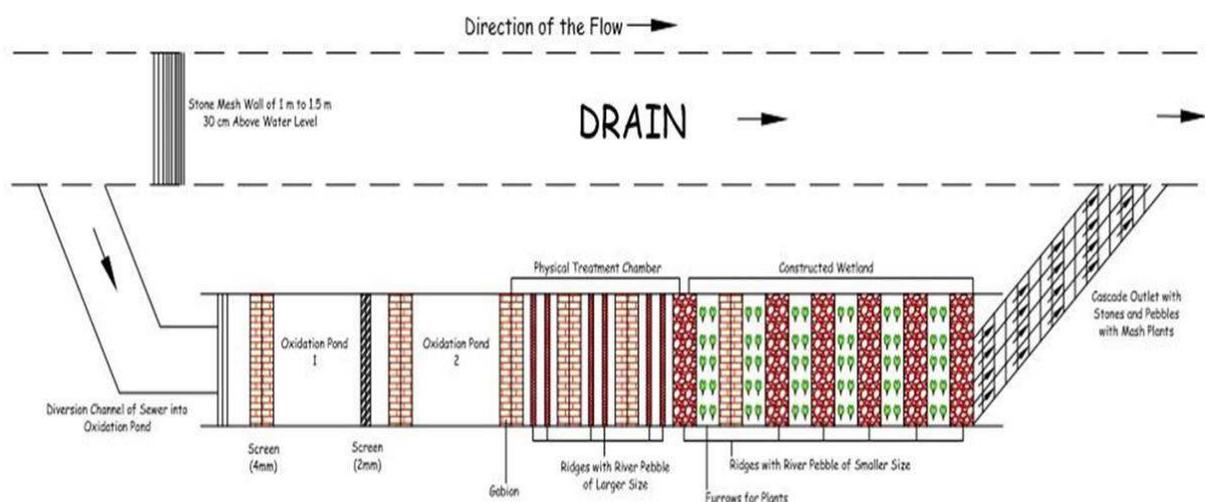


Figure 62 Schematic layout of *ex-situ* Biological Remediation

## 6.8 Model 8: Medium sewage drain with low pollution load & wide channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : 3- 15 Meter

Depth of Flowing Water : 1 - 2 Meter

#### ➤ Organic Loading

BOD : < 50 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + wetland/phytoremediation or Oxidation pond + Physical Treatment unit + Constructed wetland or waste stabilisation pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying only low pollution load untreated sewage with channel width of 3-15m. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 2<sup>nd</sup> and 3<sup>rd</sup> order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised as In-situ/ Ex-situ based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 13).

### e) Schematic diagram:

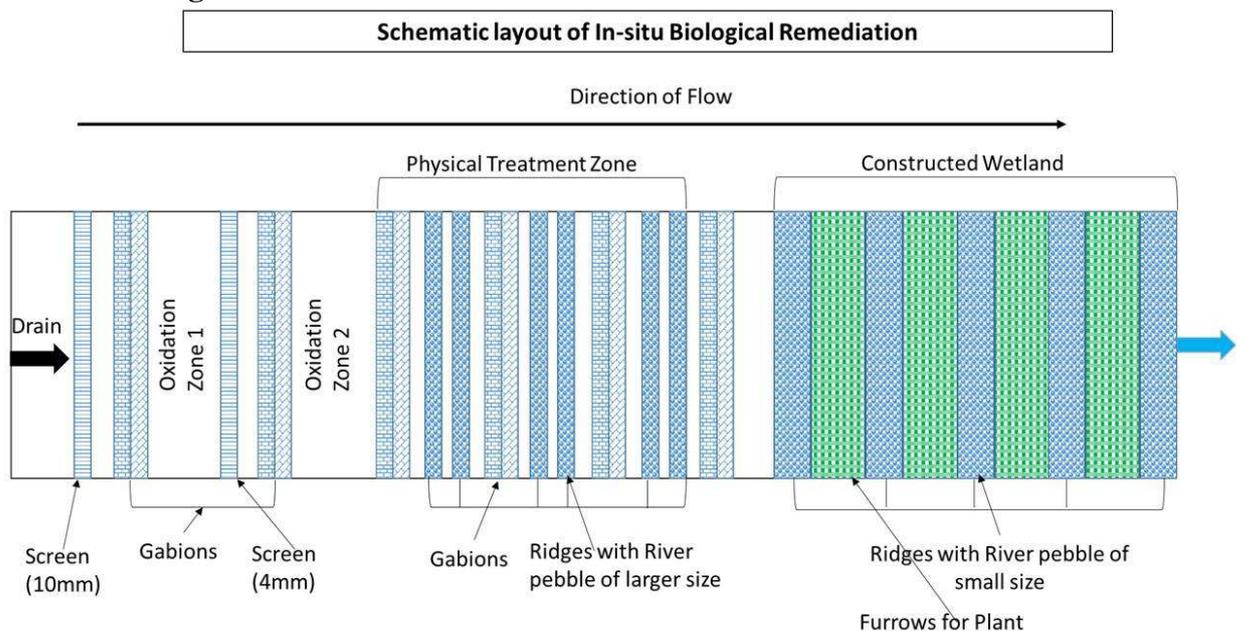


Figure 13 Schematic layout of *in-situ* Biological Remediation.

## 6.9 Model 9: Medium sewage drain with moderate pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : < 100 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + wetland/phytoremediation or Oxidation pond + Physical Treatment unit + Constructed wetland or waste stabilisation pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure 14). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

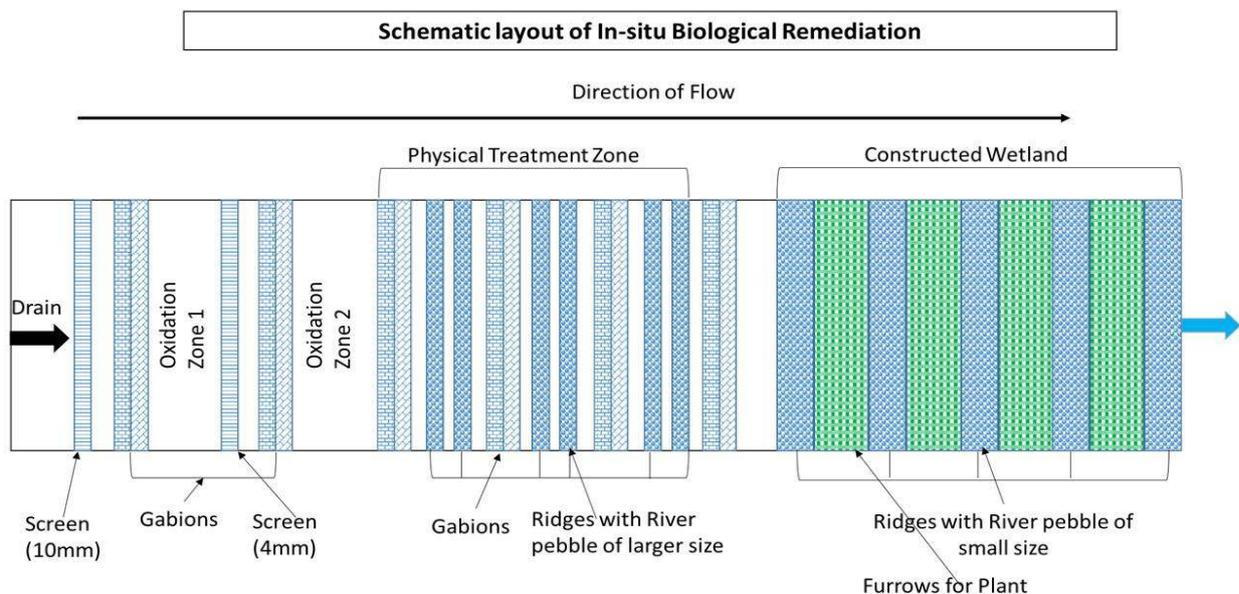


Figure 14: Schematic layout of *in-situ* Biological Remediation.

## 6.10 Model 10: Medium sewage drain with moderate pollution load & wide channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : 3- 15 Meter

Depth of Flowing Water : 1 - 2 Meter

#### ➤ Organic Loading

BOD : < 100 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + wetland/phytoremediation or Oxidation pond (2 no.) + Physical Treatment unit -2 no.) + Constructed wetland or waste stabilisation pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load untreated sewage with channel width of 3-15m. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 2<sup>nd</sup> and 3<sup>rd</sup> order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised as *In-situ/ Ex-situ* based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 15).

### e) Schematic diagram:

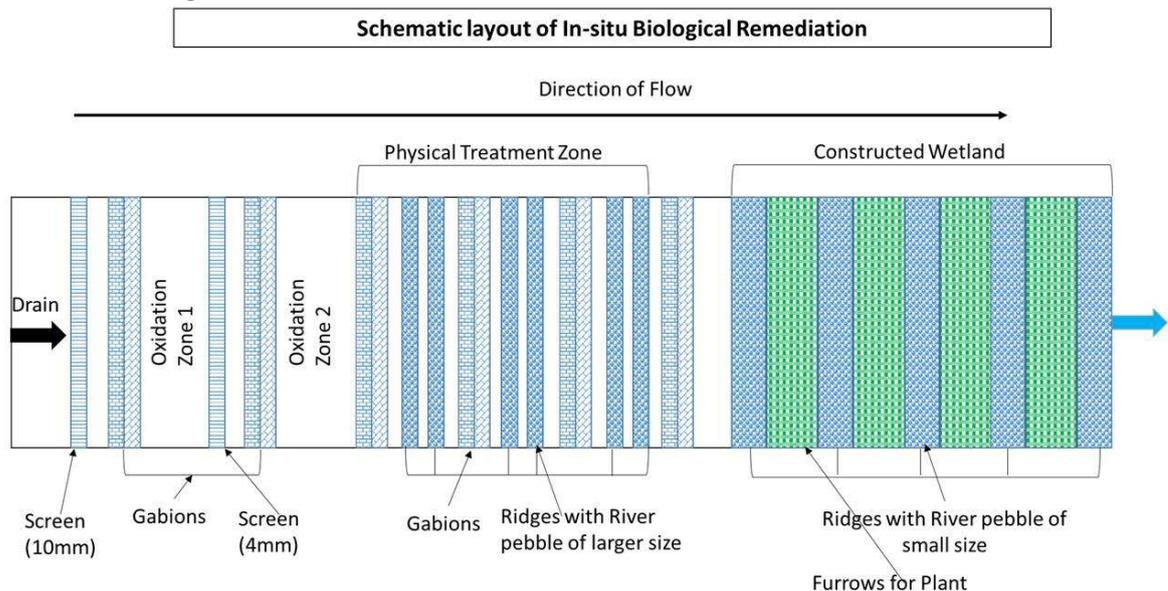


Figure 15: Schematic layout of *in-situ* Biological Remediation.

## 6.11 Model 11: Medium sewage drain with high pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : > 100 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + wetland/phytoremediation or Oxidation pond + Physical Treatment unit + Constructed wetland or waste stabilisation pond

c) **Applicability:** This type of treatment scheme is suitable for drains carrying high pollution load (untreated sewage + industrial effluent) with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure 16). In *in-situ* treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

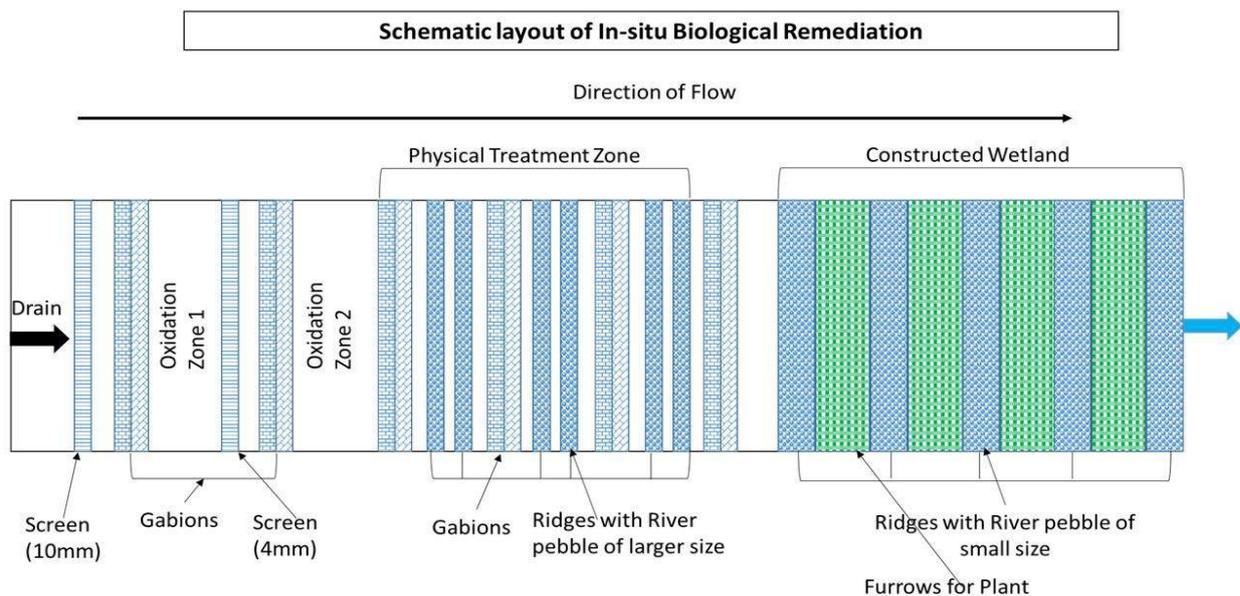


Figure 76: Schematic layout of *in-situ* Biological Remediation.

## 6.12 Model 12: Medium sewage drain with very high pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : > 200 mg/l

#### ➤ Hydraulic Loading

Flow : < 50 MLD

b) **Treatment scheme:** Pond with mud ball technology + Facultative ponds (1-2 no.) + Lagoon + oxidation pond + Lagoon+ wetland or Oxidation pond + Physical Treatment unit + Constructed wetland

c) **Applicability:** This type of treatment scheme is suitable for drains carrying high pollution load (untreated sewage + industrial effluent) with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 17). In *in-situ* treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

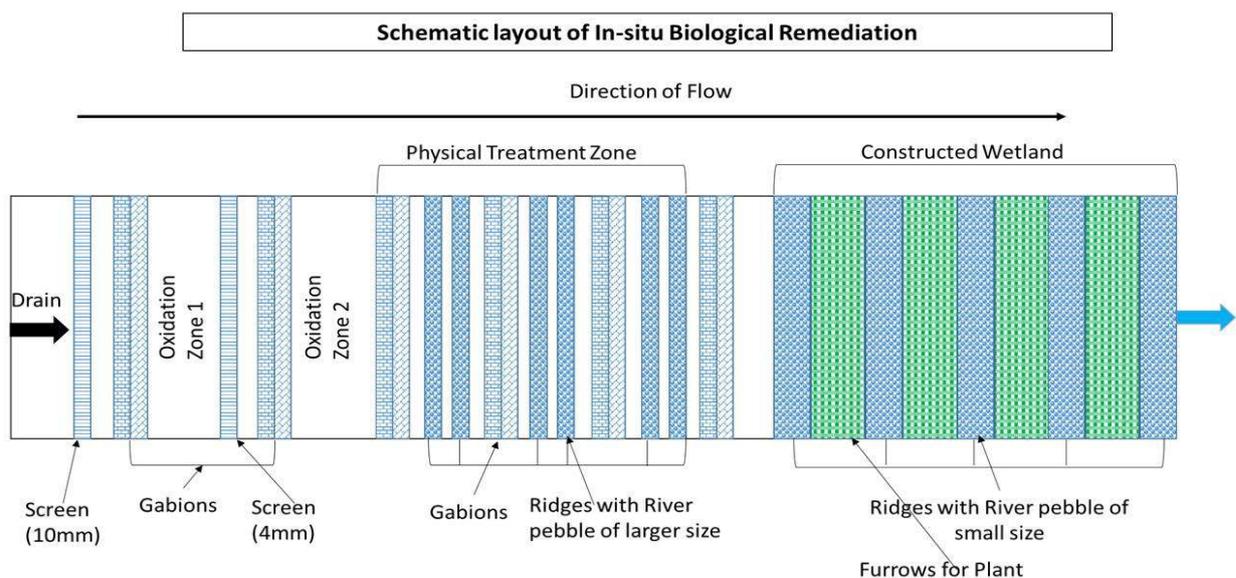


Figure 8 Schematic layout of *in-situ* Biological Remediation.

### 6.13 Model 13: Major sewage drain with low high pollution load & broader channel

#### a) Drain hydrological characteristics:

➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

➤ Organic Loading

BOD : < 50 mg/l

➤ Hydraulic Loading

Flow : 50 -100 MLD

b) **Treatment scheme:** Facultative ponds (1-2 no.) + Lagoon + oxidation pond + Lagoon+ wetland or Oxidation pond + Physical Treatment unit + Constructed wetland

c) **Applicability:** This type of treatment scheme is suitable for drains carrying low pollution load (untreated sewage only) with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure 18). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

#### e) Schematic diagram:

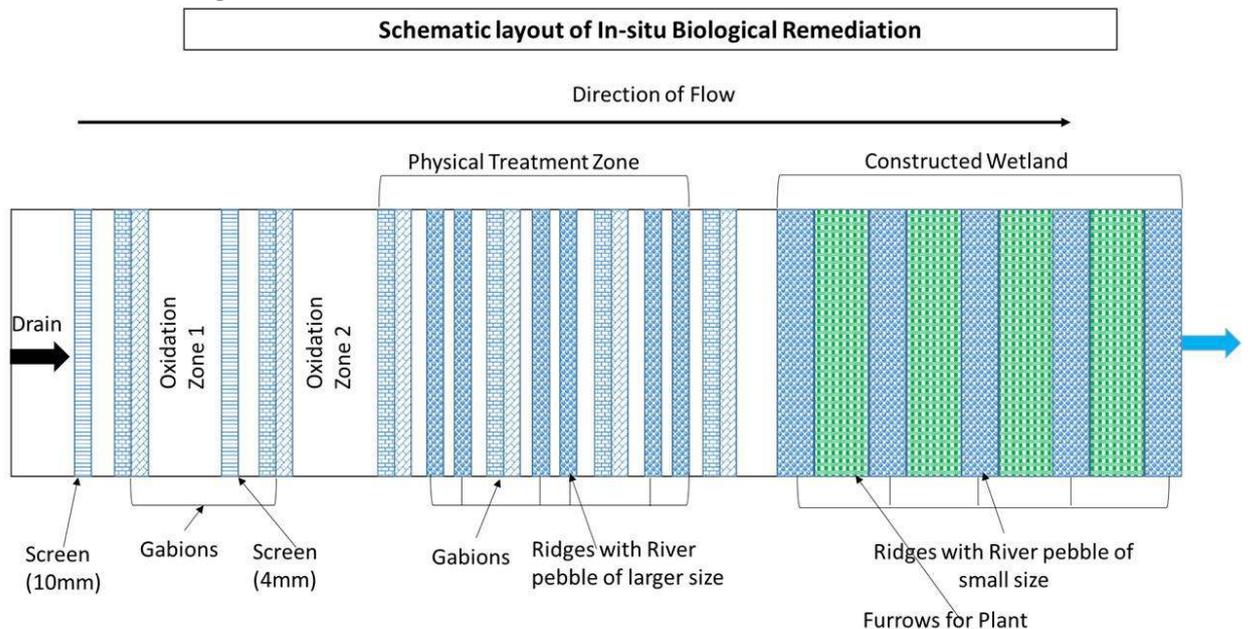


Figure 18: Schematic layout of *in-situ* Biological Remediation.

## 6.14 Model 14: Major sewage drain with moderate pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : < 100 mg/l

#### ➤ Hydraulic Loading

Flow : 50 -100 MLD

b) **Treatment scheme:** Facultative ponds (2 no.) + Lagoon + oxidation pond + Lagoon+ wetland or Oxidation pond (2 no.) + Physical Treatment unit (2 no.) + Constructed wetland

c) **Applicability:** This type of treatment scheme is suitable for drains carrying low pollution load (untreated sewage only) with wide channel suitable for in-situ construction. This type of model is suitable for 1<sup>st</sup> and 2<sup>nd</sup> order drains.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure 19). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

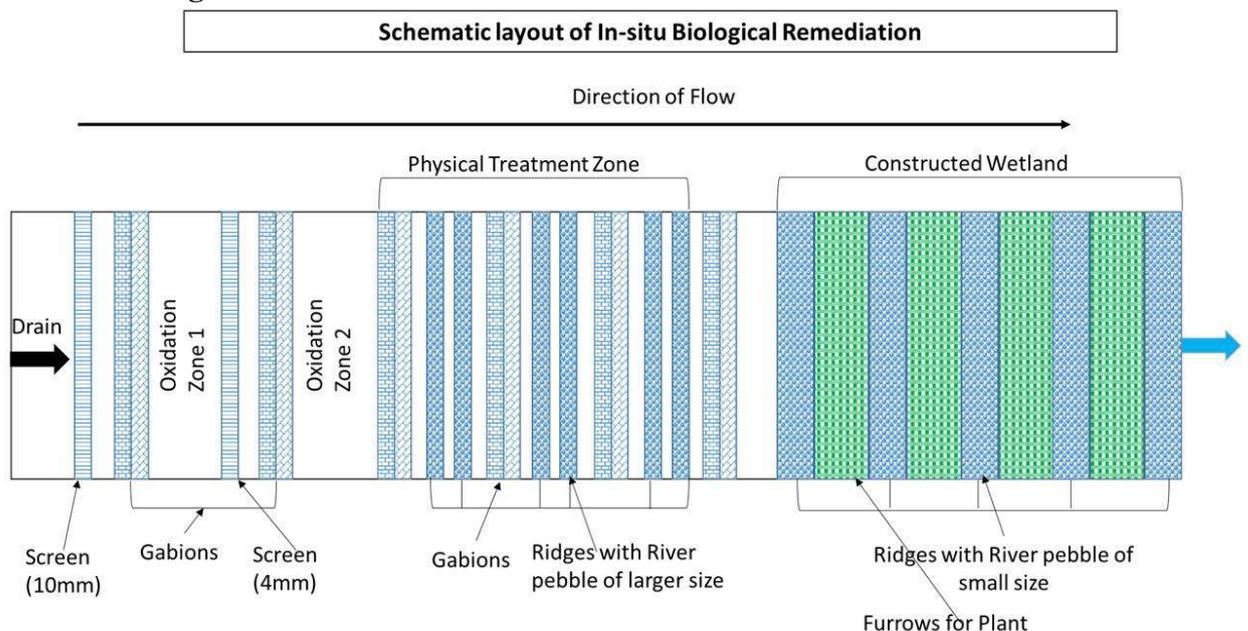


Figure 19: Schematic layout of *in-situ* Biological Remediation.

## 6.15 Model 15: Major sewage drain with low pollution load & broader channel

### a) Drain hydrological characteristics:

#### ➤ Physical Characteristics of Drainage System

Width of Drain : > 15 Meter

Depth of Flowing Water : 1 - 3 Meter

#### ➤ Organic Loading

BOD : < 50 mg/l

#### ➤ Hydraulic Loading

Flow : >100 MLD

b) **Treatment scheme:** Facultative ponds (2 no.) + Lagoon + oxidation pond (2 no.) + Lagoon+ wetland or Oxidation pond (2 no.) + Physical Treatment unit (2 no.) + Constructed wetland

c) **Applicability:** This type of treatment scheme can be used for biological remediation of polluted rivulets /rivers/major storm drains of cities by channelizing the drain bed up to 15 channels (distribution channels) and the CW stretch may extend up to 1000 m (1 km) and there may be more than 15 such stretches across a distance of 500 km (linear). The width of gabions should be at least more than 4m, as the river carry storm water.

d) **Design aspect:** Depending on the space availability and the flow rates of the 1<sup>st</sup> and 2<sup>nd</sup> order drain, oxidation pond, and a wetland with furrows and ridges should be developed. The ridges are made of stones/ pebbles specified in the typical model. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 20). In in-situ treatment techniques, length of the drain is only variable parameter for area calculation whereas available width of drain will remain fixed. Therefore, any design for *in-situ* is dependent on length of the drain.

### e) Schematic diagram:

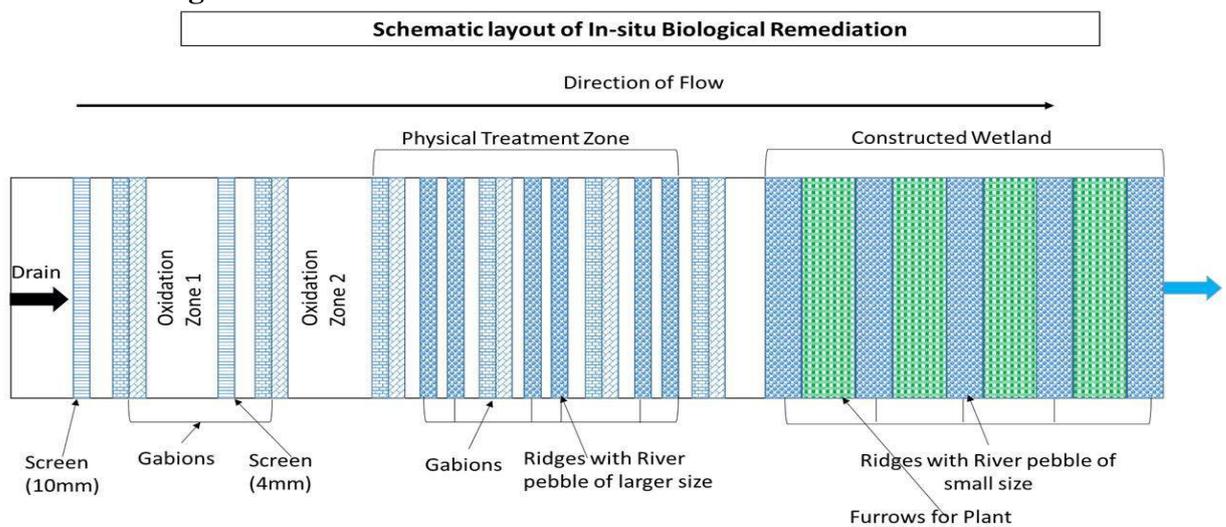


Figure 20: Schematic layout of *in-situ* Biological Remediation.

Table 1: Decision matrix for design of In-Situ / Ex-situ remediation techniques

Model no.	Description	Flow (MLD)	BOD Conc. (mg/l)	Drain Width (m)	Treatment Technology	Technology Type	Remarks
1.	Minor sewage drain with moderate pollution load & broader channel	< 20	< 100	> 15	Oxidation pond/ Facultative pond+ Lagoon+ Wetland or Waste Stabilization Pond or In-situ Activated Sludge Method	In situ	Lagoon sludge removal frequency – every 3 month, ponds HRT 20 hr min.
2.	Minor sewage drain with moderate pollution load & wide channel	< 20	< 100	3-15	Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	In situ/ Ex situ	Treatment unit may be in situ/ex situ as per available space
3.	Minor sewage drain with moderate pollution load & narrow channel	< 20	< 100	< 3	Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	In situ/ Ex situ	Oxidation pond will be ex situ & wet land may be in situ/ ex situ
4.	Minor sewage drain with high pollution load & broader channel	< 20	> 100	> 15	Facultative pond/Trickling filter + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	In situ	Sludge may be recycled partly in Facultative Trickling filler. Toxic sludge need to be disposed as per guideline

Model no.	Description	Flow (MLD)	BOD Conc. (mg/l)	Drain Width (m)	Treatment Technology	Technology Type	Remarks
5.	Minor sewage drain with high pollution load & wide channel	< 20	> 100	3-15	Facultative pond/Trickling filter + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	In situ/ Ex situ	All Treatment units may be in situ/ex situ as per available space
6.	Minor sewage drain with high pollution load & narrow channel	< 20	> 100	< 3	Facultative pond/Trickling filter + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	In situ/ Ex situ	Pond/filter/Lagoon will be ex situ & wet land may be in situ/ ex situ
7.	Medium sewage drain with low pollution load & broader channel	< 50	< 50	> 15	Facultative pond + Lagoon + Oxidation pond +Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months
8.	Medium sewage drain with low pollution load & wide channel	< 50	< 50	3-15	Facultative pond + Lagoon + Oxidation pond +Wetland or Constructed Wet Land (CWS)	In situ/ Ex situ	All Treatment unit may be in situ/ex situ as per available space
9.	Medium sewage drain with moderate pollution load & broader channel	< 50	< 100	> 15	Facultative pond + Lagoon + Oxidation pond (1-2 no.) + Lagoon+ Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months, pond HRT 20 Hr minimum

Model no.	Description	Flow (MLD)	BOD Conc. (mg/l)	Drain Width (m)	Treatment Technology	Technology Type	Remarks
10.	Medium sewage drain with moderate pollution load & wide channel	< 50	< 100	3-15	Facultative pond + Lagoon + Oxidation pond (1-2 no.) + Lagoon+ Wetland or Constructed Wet Land (CWS)	In situ/ Ex situ	All Treatment units may be in situ/ex situ as per available space
11.	Medium sewage drain with high pollution load & broader channel	< 50	> 100	> 15	Facultative pond (2 no.) + Lagoon + Oxidation pond (1-2 no.) + Lagoon+ Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months, pond HRT 20 Hr minimum
12.	Medium sewage drain with very high pollution load & broader channel	< 50	> 200	> 15	Pond with mud ball technology Facultative pond (2 no.) + Lagoon + Oxidation pond (1-2 no.) + Lagoon+ Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months, pond HRT 20 Hr minimum
13.	Major sewage drain with low high pollution load & broader channel	50-100	< 50	> 15	Facultative pond + Oxidation pond (1-2 no.)+ Lagoon + +Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months
14.	Major sewage drain with moderate pollution load & broader channel	50-100	< 100	> 15	Facultative pond + Oxidation pond (1-2 no.)+ Lagoon + +Wetland or	In situ	Lagoon removal efficiency – 1-3 months, pond HRT 20 Hr minimum

Model no.	Description	Flow (MLD)	BOD Conc. (mg/l)	Drain Width (m)	Treatment Technology	Technology Type	Remarks
					Constructed Wet Land (CWS)		
15.	Major sewage drain with low pollution load & broader channel	> 100	< 50	> 15	Facultative pond (2 no.) + Lagoon + Oxidation pond (1-2 no.) + Lagoon+ Wetland or Constructed Wet Land (CWS)	In situ	Lagoon removal efficiency – 1-3 months, pond HRT 20 Hr minimum
Note: All above models are generic in nature and actual design may vary as per actual site specific requirement							

## 7. CHALLENGES WITH APPLICATION OF ALTERNATIVE BIOLOGICAL TREATMENT TECHNOLOGY

- Application of any *in-situ* bioremediation of wastewater requires obstruction wall (check dam / weir) to slow down the velocity of flowing water. Any flowing wastewater in storm water drains carry huge volume of floating material (solid waste, plastic waste etc.) and silt. Such obstruction to slow down of the velocity of wastewater results in trapping of floating material and deposition of silt.
- Siltation of drains will result in ponding of wastewater in upstream of such structures that may also result in flooding of upstream areas. Therefore, provisions must be made for regular removal and proper disposal of deposited silt. Floating matter collected also need to be disposed off in scientific manner.
- Spacing between the gabions need to be cleaned on regular basis as it may get choked with silt and floating materials.
- Efficiency decrease in monsoon due to high flow.
- It needs regular harvest of biomass and cleaning of physical filters.
- Difficult to operate when depth of water in drain is more than three feet.
- Slow process as compared to conventional treatment.
- Not effective in backwater, flood water from river on high tides.

## 8. CASE STUDIES ON DIFFERENT ALTERNATIVE TREATMENT TECHNOLOGIES

Case studies of some of the wastewater interception, diversion and treatment facilities based on alternative treatment technologies namely constructed wetland, soil biotechnology, oxidation pond, trickling filter and aerated lagoon are as under:

### 8.1 Constructed Wetland

- a) Constructed wetland has been established at Neela Hauz lake near Sanjay Van by Centre for Environmental Management of Degraded Ecosystems (CEMDE), Delhi University in collaboration with DDA. The lake is fed by discharge from drain having 01 MLD flow. The constructed wetland effectively results in 90% reduction in BOD and has resulted in restoration of the Neela Hauz lake which was practically dead due to high pollution load. The project was started in November, 2016 and is currently in operation; it was constructed at a cost of Rs. 10 lakhs and requires annual harvest of dead biomass and annual cleaning of physical filters and removal of sludge from oxidation ponds.
- b) In-situ constructed wetland system at Rajokari water body was installed by Irrigation and Flood Control Department, Delhi with a project cost of Rs. 77.19 lakhs. The water body is fed by a drain having flow of 600 KLD. There is 84% reduction in BOD in the water body post construction of the wetland. The wetland is currently in operation.
- c) Ex-situ remediation for water body rejuvenation through Phytoid technology developed by CSIR-NEERI. This project has been implemented Pan India in 300 sites and is currently in operation in all the sites. The cost of the project was Rs 2.2 crore per

MLD for civil construction and O&M of Rs 20 Lakhs per MLD (including manpower, consumables, electricity, testing, contingency and miscellaneous items). The land requirement for the project is 1500 m<sup>2</sup> per MLD. The technology is highly efficient with BOD and TSS of treated water reduced to  $\leq 10$  mg/l and  $\leq 30$  mg/l respectively.

- d) In-situ restoration of drains viable for flow between 1-10 MLD through RENEU Technology developed by CSIR-NEERI. The restoration of six drains in Jhusi, Prayagraj was undertaken through this technology while work order has been received to implement RENEU in 10 drains at Gorakhpur. For implementation of this technology, drains having 1-10 MLD require a stretch of 180-200m while for drains having flow greater than 10 MLD, the stretch required will be 200-600m. The cost of the project was Rs Rs835 Lakhs per MLD for civil construction and O&M of Rs Rs255 Lakhs per MLD (including manpower, consumables, electricity, testing, contingency and miscellaneous items). The technology demonstrates 40% reduction in pollution with BOD and TSS of treated water reduced to  $\leq 30$  mg/l and  $\leq 30$  mg/l respectively.
- e) Constructed wetlands are under commissioning at Bithoor to treat 2.4 MLD sewage generated from seven drains directly discharging in River Ganga from Bithoor town. The constructed wetlands are designed for in-situ treatment of sewage. During the last visit by CPCB officials, the wetlands were found to be under construction.

## 8.2 Soil Biotechnology

- a) In Bah Bazar STP at Devprayag, soil biotechnology is adopted for treatment of 1.4 MLD sewage. An inspection of the STP by CPCB officials revealed that through soil biotechnology, a BOD and COD reduction of 80% and 76.39% respectively was achieved while TSS levels reduced by 78.53% and ammonical nitrogen showed a reduction of 66.66%. Thus, soil biotechnology is an effective treatment technology with only one drawback being that TDS reduced by only 6.48%.

## 8.3 Waste Stabilization Pond

- a) In Anupshahar, an STP of 1.75 MLD at STP Zone B has adopted waste stabilization pond technology with five ponds in series for sewage treatment. The analysis report of treated samples from the STP indicated 96.77% reduction in BOD, 92.27% reduction in COD and 100% reduction in TSS. Phosphate and sulphate content also reduced by 52.67% and 35.71% respectively. However, it was observed that nitrate content reduced only by 3.84% and there was no reduction in TDS, faecal coliform. Thus, treated samples were found to comply with general discharge standards.
- b) At STP of 0.85 MLD situated in Zone A of Anupshahar, U.P., the treatment technology is waste stabilization through five ponds in series for sewage treatment. The analysis report of treated samples from the STP indicated 74.48% reduction in BOD, 59% in COD and 81.39% in TSS. Also, there was marginal reduction in TDS (3.08%), sulphate (20.51%), chloride (10.2%) and phosphate (5.91%). However, there was increase in ammonical nitrogen by 22.72% and faecal coliform levels remained unchanged. The treated effluent complied with general discharge standards thus indicating that the in-situ treatment technology is effective despite increase in ammonical nitrogen.

- c) At the Vindhyachal STP of 4 MLD capacity located in Mirzapur, U.P., waste stabilization pond technology has been adopted with a total of four ponds (with three different functions); first pond is anaerobic (28.4 m x 49.6 m x 5.5 m), second is facultative (75.4 m x 148.5 m x 2.0 m), and two are maturation ponds (Maturation-1: 55.45 m x 150.4 m x 1.45 m; Maturation – 2: 56.5 m x 150.4 m x 1.55 m). Analysis of samples from final outlet indicated a reduction of 77.5% in BOD, 75% in COD and 63.69% in TSS.

#### 8.4 Oxidation Pond

- a) In the Fatehgarh STP of 2.7 MLD capacity, situated in FARRUKHABAD, the in-situ sewage treatment technology adopted involves primary oxidation ponds (2 in number) each of dimension 100m x 150m x 1.2 m, followed by secondary oxidation pond. The treated effluent is discharged into river Ganga. As per analysis report, the STP was found non-complying w.r.t general discharge standards for pH, BOD and TSS. However, BOD and COD showed a reduction of 53.98% and 34.95% respectively while ammonical nitrogen and phosphate levels reduced by 95.1% and 97.36% respectively.
- b) In the 6 MLD capacity STP at Baidyabati in West Bengal, there are a total of three lagoons in series for treatment of sewage before maturation pond. The analysis of treated sample indicated BOD and COD reduction of 78.57% and 27.3% respectively. However, during inspection by CPCB officials, it was observed lagoons are eutrophicated while baffle walls and embankment are partially damaged.

#### 9.0 AN EXAMPLE OF PROPOSED TREATMENT SCHEME

A typical first order drain having flow of 500 MLD with physical characteristics like length – 20 km, width of drain varying between 30-90 meter and organic loading of 100-250 mg/l of BOD may adopt *in-situ* constructed wetland system with horizontal and free-flowing system. This system will have two oxidation ponds, two physical treatment units and a constructed wetland.

The two oxidation units of 100 m long each are separated by three gabions; the two physical treatment units of 75 m long each and have vertical channels separated by gabions. The constructed wetland is of 150 m length and has 15 furrows of 8 m width, separated by 15 ridges of 2 m width. The schematic layout of the proposed constructed wetland is given in figure-21. Depending upon the width of the drain, the number of vertical channels varies and also length and height of gabions varies from site to site. Further design details of each unit are mentioned below:

1. Oxidation Pond:

Depth: Gabions of 4m width with height of 2.5 meter;

Width: As per availability (15-90 meter)

Length: 100 meter

Number of Oxidation Pond: 02

2. Physical Filters:

Vertical channels: Width upto 8 meter, height 1-5 meter, length 75-100 meter and number of channels varies as per width of drain

Depth: Gabions of 2m width with height of 1.5 meter;

Number of Physical Filters: 02

### 3. Constructed Wetland Systems

Depth: Gabions of 2m width with height of 1.5 meter;

Length- 150 m long

15 furrows of 8 m wide separated by 15 ridges of 2 m wide

Actual design may vary as per available physical characteristics and organic loading of drain

#### ➤ Expected Outcome

BOD removal: 50-70 % reduction

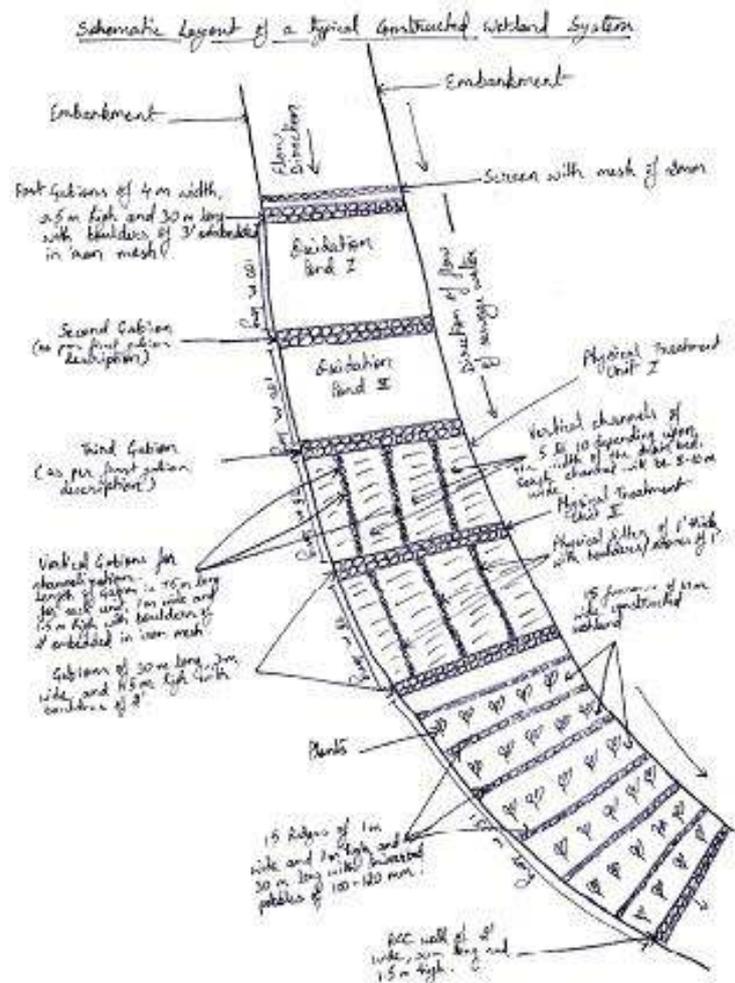


Figure 21: Schematic diagram of In-situ Remediation

## **9. ACKNOWLEDGEMENT**

Inputs provided in the preparation of models alternate biological treatment techniques for drains by Prof.C.R. Babu, Professor Emeritus, Centre for Environmental Management of Degraded Ecosystem, University of Delhi, Prof. P. K. Mishra, Head, Department of Chemical Engineering & Technology, IIT-BHU, Varanasi; Prof. S.N. Upadhyay, Ex Director, IIT-BHU, Varanasi and Prof. C.B. Majumdar, Head, Department of Chemical Engineering, IIT Roorkee are acknowledged.

**DESIGN AND PERFORMANCE DETAIL OF EX-SITU TREATMENT  
TECHNOLOGY**

**Design Criteria**

- **Requirement of Physical Characteristic of Drainage System**

Length of drain : 2-20 Km

Width of drain : 2-15 m

Depth of flowing water : 0.5 2 m

- **Organic Loading**

BOD : 100-250 mg/l

COD : 150-500 mg/l

- **Hydraulic Loading**

Flow : 2-20 MLD

Volumetric loading : 100-400 BOD g/m<sup>3</sup>.day

Typical characteristics of different types of Ex-Situ treatment technologies for treating domestic sewage are mentioned in table below:

SL. No	Characteristic	Facultative type Lagoon	Aerobic flow through type Lagoon	Aerobic with solids recycling Lagoon	Oxidation Pond
1.	Suspended solids concentration , mg/l	50-150	100-350	3000-5000	-
2.	Sludge age or mean cell residence time , days	High (because of settlement)	Generally 5	Warm:10-20 Temperate:20-30 Cold: over 30	-
3.	Overall BOD removal rate $K_L$ per day at 20 ° C	0.6-0.8	1-1.5	20-30	-
4.	Temperature coefficient,	1.035	1.035	1.01-1.05	
5.	Detention time, days	3-12	Generally 5	0.5-2	7-15 days
6.	BOD removal efficiency, %	70-90	50-60	95-98	80-90%
7.	Nitrification	None	Non favorable conditions	Likely under	-
8.	Coliform removal, %	60-99	60-90	60-90	99%
9.	Depth, m	2.5-5	2.5-5	2.5-5	1-1.5 m
10.	Land requirement, m <sup>2</sup> /MLD	2200	2200	1111	8800
11.	Power requirement,	12-15	12-14	18-24	-

<b>SL. No</b>	<b>Characteristic</b>	<b>Facultative type Lagoon</b>	<b>Aerobic flow through type Lagoon</b>	<b>Aerobic with solids recycling Lagoon</b>	<b>Oxidation Pond</b>
	KW/Person -year				
12.	Minimum power level, KW/1000 m <sup>3</sup> lagoon volume	0.75-1	2.75-5	15-18	-
13.	Sludge	Accumulates in lagoon; manual removal after some years	No accumulation; solids go out with effluent	Surplus sludge withdrawn continuously (daily) and disposed off suitably	Accumulates in Oxidation Pond; manual removal after some years
14.	Outlet management	Effluent flows over a weir	Partially or fully submerged pipe outlet	Weir or pipe	Weir or pipe

**DELHI JAL BOARD : GOVERNMENT OF NCT OF DELHI**  
**OFFICE OF THE CHIEF EXECUTIVE OFFICER**  
**VARUNALAYA PHASE II – KAROL BAGH, NEW DELHI – 110005**

**No:** CEO/IDMA/2020-

**Dated:**

**Minutes of the First Meeting of “Integrated Drain Management Cell” for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt of NCT of Delhi on 05.05.2020 constituted on the direction of Hon’ble NGT dated 05.03.2020 OA No 06/2012 in the matter of Manoj Mishra v/s Union of India & others.**

1. Due to COVID-19 Pandemic in India, meeting was held through Video Conferencing, which was attended by the officers concerned. Copies of the extant orders of Hon’ble NGT, Central Pollution Control Board (CPCB) Report, Powerpoint Presentation and other relevant documents were already emailed/Whatsapped prior to the meeting to all the Members of “ Integrated Drain Management Cell” (IDMC).
2. At the outset, CEO-DJB *Ex-officio Member Secretary of IDMC*, welcomed the Chief Secretary and all members to the 1<sup>st</sup> meeting of the IDMC. He apprized the members that the Integrated Drain Management Cell (IDMC) was set up under directions of Hon’ble NGT issued vide Order dated 05.03.2020. He outlined the key directions of Hon’ble NGT as follows:
  - a) IDMC is to be Chaired by Chief Secretary, Delhi and comprises of representatives of all agencies / departments / ULBs owning such drains not below the level of Chief Engineer dealing with the management of drains.
  - b) *The CEO-DJB will be the Ex-officio Member Secretary of IDMC.*
  - c) The IDMC may prepare and execute an action plan on ‘Alternate Technologies for Management of Wastewater in Drains’ after Techno-economic evaluation to be done in light of CPCB report referred by Yamuna Monitoring Committee (YMC) recommendations dated 20.01.2020 and 17.02.2020 or any other relevant inputs on the subject.
  - d) The Action Plan has to be prepared within three weeks from the constitution of IDMC, which may be ensured by the Chief Secretary, Delhi.
  - e) *The IDMC may meet atleast once in a week to start with.*

- f) Constitution of IDMC will not affect Ownership of drains.
  - g) IDMC to send reports to NGT every 2 months by e-mail at [judicial-nqt@gov.in](mailto:judicial-nqt@gov.in).
3. Member Secretary also informed the Members that the first meeting of IDMC was earlier scheduled in the month of March but could not be held due to COVID-19 Pandemic in India, as there has been Nationwide Lockdown since 24.03.2020.
  4. It was explained to IDMC that as per directions of Hon'ble NGT, CPCB has suggested a basket of Alternate Technologies for management of waste water of drain in their report, such as Phytoremediation, Constructed Wetlands(CWs), Microbials, Bioremediation, Ex-Situ Remediation Technique, Waste stabilization Ponds and Mechanically aerated Lagoons etc. Also categorization of drains has been carried out on the basis of discharge in the drains, their width, depth of water and pollution. Accordingly different Model- Treatment Schemes are suggested in CPCB report, which can be examined and Action Plan be prepared subject to proper techno-economical evaluation by the Drain Owning Agencies.
  5. It was also highlighted that NGT has categorically stated that the ownership of drains will remain unaffected as such the mandate of remediation of drain water rests squarely on the respective Drain Owning Agency.
  6. After detailed discussion, the following directions were given by the Chief Secretary, Delhi to the HODs of all Drain Owning Agencies/Departments:
    - a. All drain owning agencies must appoint a Nodal Officer, not below the level of Chief Engineer, who shall be responsible for the day-to-day activities pertaining to the IDMC and compliance of the directions issued therein. The Nodal Officer shall be appointed latest by 06.05.2020 and information, along the coordinates/email etc must be submitted to Member Secretary IDMC.
    - b. All Drain owning Agencies/Departments must ensure that the Action Plan for 'Alternate Technologies for Management of Waste Water in the drains' under their jurisdiction is prepared and submitted to the IDMC within a period of 3 weeks i.e. latest by 26.05.2020. It was further directed that appropriate techno-economic evaluation in the light of the reports of CPCB referred to

by the Yamuna Monitoring Committee (YMC) in their reports, or any other relevant inputs, must be done.

- c. It was emphasized that the time frame prescribed for preparation and submission of the Action Plan by drain-owning agencies is already in breach due to the prevailing extra-ordinary circumstances precipitated by Corona pandemic lockdown. Hence, no further delay of any kind can be brooked in this urgent matter.
- d. It was further directed to all HODs of Drain-owning Agencies/Departments/Urban Local Bodies to comply with the timelines already laid down by Hon'ble NGT as per their earlier directions in the matter of Manoj Mishra Vs UOI and ORS(OA No.06/2012) prior to 05.03.2020 as well.

*Meeting ended with thanks to the Chair*

--sd---  
(Nikhil Kumar)  
Member Secretary (IDMC)

**All Concerned**

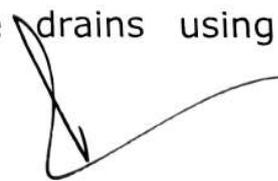
**DELHI JAL BOARD : GOVERNMENT OF NCT OF DELHI**  
**OFFICE OF THE CHIEF EXECUTIVE OFFICER**  
**VARUNALAYA PHASE II – KAROL BAGH, NEW DELHI – 110005**

**No:** CEO/IDMA/2020-

Dated: 15.05.2020

**Minutes of the Second Meeting of "Integrated Drain Management Cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt of NCT of Delhi on 15.05.2020 constituted on the direction of Hon'ble NGT dated 05.03.2020 OA No 06/2012 in the matter of Manoj Mishra v/s Union of India & others**

1. Due to COVID-19 Pandemic in India, meeting was held through Video Conferencing, which was attended by the officers concerned.
2. At the outset, CEO-DJB *Ex-officio Member Secretary of IDMC*, welcomed all members of the Integrated Drain management Cell (IDMC). He informed the members that due to another important COVID-19 related engagement, the Chief Secretary, Govt of NCT of Delhi directed him to conduct meeting on his behalf and desired that his directions be conveyed to all members of IDMC.
3. It was apprised by Member Secretary that the Integrated Drain Management Cell (IDMC) was set up under directions of Hon'ble NGT issued vide Order dated 05.03.2020. Accordingly, Action Plan by all the concerned Drain-owning Agencies was required to be submitted within three weeks from the constitution of Committee of IDMC. 1<sup>st</sup> meeting of IDMC was delayed due to COVID-19 and could be held on 05.05.2020 through Video conferencing.
4. It was informed that in compliance to directions of the Chief Secretary, Delhi during 1<sup>st</sup> meeting on 05.05.2020, Nodal officers have been appointed by all Drain-owning Agencies. The List of Nodal officers appointed by Drain-owning Agencies is attached as Annexure "A".
5. It was reminded by Member Secretary that Action Plan for the remediation and management of all the drains using Alternate



Technologies suggested by CPCB is required to be submitted within three weeks i.e. by 26.05.2020 by all Drain-owning Agencies of Delhi, so as to cover the entire drainage network within their jurisdiction.

6. HODs of Drain-owning Agencies/Departments/Urban Local Bodies are required to submit an Action Plan along with definite time lines on "Alternate Technologies for Management of Wastewater in Drains" after techno-economic evaluation to be done in light of CPCB report or any other relevant inputs on the subject and forward the same to the IDMC, so that same could be apprised to Hon'ble NGT.
7. Chairperson, NDMC informed that they have already covered majority of drains in NDMC area, except Kushak drain, which has inflow from some areas of South MCD as well. Further, remediation action using bio-enzymes, chemicals etc. was being done in many drains in NDMC area. Member secretary requested that the details of the action taken so far and the future Action Plan, as directed by Hon'ble NGT, may be submitted, which was agreed by Chairman NDMC.
8. Commissioner, South DMC informed that they have already initiated steps towards the formulation of the Action Plan and are in process of appointment of Consultant, probably IIT Delhi. It was assured that Action Plan for treatment of drain will be submitted at the earliest.
9. CEO, DCB informed that in Naraina Area, a major sewer/drain of DCB was earlier connected to sewerage system of DJB, which was disconnected during construction of Metro Line. They have requested DJB to re-connect their sewer line/drain to the DJB sewer line to alleviate the problems in their area.

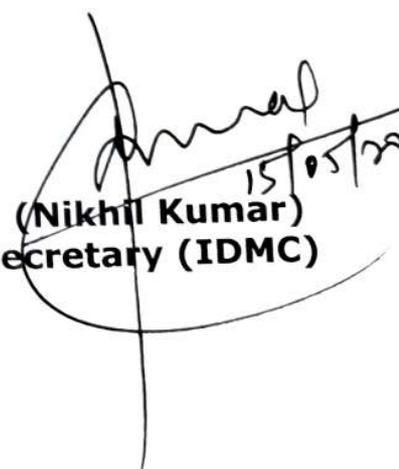
It was informed by CEO, DJB that DJB sewerage system is not designed to cater storm water discharge and it is not technically recommended to connect storm water drain in to the sewerage

system. However, for any issue of connectivity of sewer connection of Cantt area, the same will be jointly resolved by DJB and DCB. It was, further, clarified by Member Secretary that Action Plan, along with time lines for treatment of drains of Cantt area must be submitted to IDMC as per the prescribed schedule.

10. Nodal Officer, East DMC informed that treatment of 6 drains has already been planned and treatment of balance drains is being taken up as per directions of Hon'ble NGT. He submitted that consolidated Action Plan is under preparation and same will be submitted to IDMC.
11. Pr. Secretary, PWD informed that they are in process of preparation of Action Plan for the drains under PWD jurisdiction and the same will be submitted shortly, with timelines specified.
12. Finally, it was once again requested to all HODs of Drain-Owning Agencies/Departments/Urban Local Bodies to submit Action Plan, along with time lines, for Management of Wastewater in drain to the IDMC, so that compliance of Hon'ble NGT order could be achieved without any delay.

*Meeting ended with thanks to the Chair.*

**All Concerned**

  
15/05/20  
**(Nikhil Kumar)**  
**Member Secretary (IDMC)**

**DELHI JAL BOARD : GOVERNMENT OF NCT OF DELHI**  
**OFFICE OF THE CHIEF EXECUTIVE OFFICER**  
**VARUNALAYA PHASE II – KAROL BAGH, NEW DELHI – 110005**

**No:** CEO/IDMA/2020- / D - 277

Dated: 02.06.2020

**Minutes of the 3rd Meeting of "Integrated Drain Management Cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt of NCT of Delhi on 29.05.2020 constituted on the direction of Hon'ble NGT dated 05.03.2020 OA No 06/2012 in the matter of Manoj Mishra v/s Union of India & others**

1. Due to COVID-19 Pandemic in India, meeting was held through Video Conferencing, which was attended by the officers concerned, except from DDA .
2. At the outset, CEO-DJB *Ex-officio Member Secretary of IDMC*, welcomed all members of the Integrated Drain management Cell (IDMC) and Nodal officers appointed by DoAs (Drain owning Agencies).
3. It was apprised by Member Secretary that the Integrated Drain Management Cell (IDMC) was set up under directions of Hon'ble NGT issued vide Order dated 05.03.2020. So far, two meetings have been held and directions of the Chief secretary have been conveyed through Minute of Meeting already circulated to all concerned DoAs. Comprehensive Action Plan for the remediation and management of all the drains through alternate technologies as suggested by CPCB, was required to be submitted by all the concerned Drain-owning Agencies(DoAs) within three weeks i.e. by 26.05.2020, so as to cover the entire drainage network within their jurisdiction.
4. It was informed by Member Secretary that while Status report/ Action Plan for management of drain has been received from most of the DoAs but many of the plans are incomplete and not in sync with the over-arching principles enshrined in the orders of the Hon'ble NGT. It is observed that some of DoAs have cited various constraints like absence of land adjoining the drains, very shallow/ narrow drains, drains traversing highly congested areas, covered drains, drains passing under roads, drains connected to larger Storm water drains in their area etc, due to which bio-remediation or phyto-remediation is not deemed feasible.

5. It was clarified by Member Secretary that in Delhi, smaller drains originating from various inhabited regions discharge into larger drains and then to the major drains and finally outfall into the river Yamuna. Management of the wastewater in the drains has to be carried out in various stretches as per the feasibility, particularly in the regions where the drains originate, thereby tackling the problem at the very source itself. The treatment of the wastewater in the drain will be more effective if carried out at different portions, instead of a centralized/ single point treatment. It was also apprised that during the earlier meetings of various agencies and experts under the aegis of Hon NGT, it has been emphasized that wastewater remediation in the drains as to be carried out using alternate technologies and techno-economic feasibility at various portions of the drain, most importantly in the early stretches where they originate. Therefore, DoAs are required to submit action plan for management of the entire drain-length under their jurisdiction, after carrying out detailed survey like analysis of depth, width, discharge, quality parameter etc. as per the technologies of remediation suggested by the CPCB, so that pollution of river Yamuna is mitigated to the maximum extent possible.

It was, further, suggested that the DoAs can also explore the possibility of engaging some professional consultants to assist them in undertaking the detailed analysis and preparation of Action Plan with timelines after considering various Alternate Technologies of wastewater remediation suggested by CPCB, wherever techno-economically feasible.

6. Thereafter, detailed review and discussion was done with each DOA as follows:-

<b>S. No.</b>	<b>Department</b>	<b>Total Length of Drain in Km</b>	<b>Issue</b>	<b>Reply/Action to be taken</b>
1.	Public Works Department (PWD)	2064.08	Principal secretary, PWD informed that PWD drains are mainly responsible for collection and conveyance of storm water collected along the roads. However, the drain coming out from the	It was requested by Member Secretary that specific timelines for the 2 Bio-remediation plants may please be

			<p>unauthorized/ unsewered area is also connected to PWD Storm water drains, resulting in wastewater flow in PWD drains. Most of the PWD drains are discharging water other drains leading to natural drains. Hence, treatment made in the PWD portion of the drain will not be effective. He has further informed that they have proposed Bio-remediation at two locations at Chhattarpur &amp; Chatrasal Stadium for 2.5MLD and 1-1.5MLD respectively. He has also informed that due to constraints of land, alternate technologies suggested by CPCB cannot be adopted at remaining locations/ stretches .</p>	<p>intimated. Further, it was requested that the possibility of an action Plan for the entire drain length under jurisdiction may kindly be explored as per as per the orders of Hon'ble NGT.</p>
2.	Irrigation and Flood Control (I&FC) Deptt.	426.55	<p>It was informed by Nodal Officer I&amp;FC that proposal for appointment of NEERI on nomination basis is under submission to the Government.</p> <p>After appointment, three months time is required for study of the 55 Nos I&amp;FC drains and submission of feasibility report. Subsequently, timelines for execution of work will be submitted after receipt of feasibility report from NEERI.</p> <p>It was also informed that as per the reports of the consultants engaged earlier by IFC, bio-remediation/ phyto-remediation was not found techno-economically feasible in any of the 57 drains under the jurisdiction of IFC. However, efforts are presently being made to engage NEERI for studying the other feasibility of other</p>	<p>Member Secretary asked Nodal officer I&amp;FC to submit Action Plan along with timeline at the earliest.</p>

			Alternate Technologies suggested by CPCB.	
3	New Delhi Municipal Council	335.29	Chairperson, NDMC informed that most of the drains in NDMC area are covered and only 2.8km of open drain namely Kushak drain is there in their jurisdiction. NDMC is proposing Phytoremediation for this drain as alternate technology for its treatment. It was also informed that DJB has already disconnected the sewerage falling into this drain, resulting in relatively cleaner flow in the drain at present.	Member Secretary requested for the Action Plan with timelines for this specific drain stretch.
4.	South Delhi Municipal Corporation (SDMC)	258.78	Commissioner, South DMC has informed that they have engaged IIT Delhi for preparation of Action plan. They have awarded the work on 20.05.2020 and report is likely to be received within 10-15 days.	Member Secretary noted the steps taken and requested to submit Action Plan for entire length of drain along with specific time-line.
5.	Delhi Development Authority (DDA)	251.30	Absent. Action plan not received	
6.	East Delhi Municipal Corporation (EDMC)	140.63	Nodal Officer of EDMC informed that they have submitted that action plan for 21.5 Km. Action Plan for balance length shall be submitted after detailed feasibility study being conducted by Principal Scientific advisor (GOI).	Member Secretary informed that action plan submitted so far, is for length of only 21.5Km out of 140.63Km. It needs to be submitted for entire length of drain along with timelines for execution.
7.	North Delhi Municipal Corporation (NDMC)	122.46	Nodal Officer of North DMC submitted that drains maintained by North DMC are narrow, shallow and shorter in length and often covered /or passed beneath roads. North DMC drains are storm water drains only. Wherever these are carrying	After detailed clarification given by Member secretary as recorded in para-5 above, Nodal Officer North DMC agreed that they will resubmit the detailed Action

			<p>sewage, same is being disconnected by DJB.</p> <p>Moreover, North DMC drains passes mostly in urban area and thickly populated habitation thereby eliminating of adequate space required for in-situ /ex-situ bioremediation techniques. In view of same the standard Bioremediation techniques suggested by CPCB may not be feasible to implement on North DMC drains.</p>	<p>plan alongwith time lines after appointment of consultant, in compliance of directions of Hon'ble NGT.</p>
8	DSI IDC	98.12	<p>Nodal Officer of DSI IDC informed that they have mailed the Action plan.</p>	<p>It is informed that report be sent again on the given email ID. However, it is informed that action plan along with timeline should be for entire length of drain as per order of Hon'ble NGT.</p>
9.	Delhi Cantonment Board	39.68	<p>Action Plan along with timeline submitted.</p>	<p>The Action Plan was duly noted. Further, necessary action be taken by them.</p>
10.	National Thermal Power Corporation Limited (NTPC)	3.11	<p>Nodal Officer of NTPC informed that power Plant of Badarpur is closed since Oct-2018 and most of the drains are dry now. However, they are developing Eco Park which is biggest in India, in a area of about 884 Acre of land. Only Jaitpur drain is passing through NTPC land which carrying discharge from Delhi area. However, they are taking necessary action for the treatment of the drain alongwith its beautification.</p>	<p>Member Secretary asked to submit present status of the drain having length about 3.11 Km. Action Plan along with timeline be submitted to IDMC for the portion of the drain which is not dry / still carrying discharge and treatment of Jaitpur drain.</p>
11	DUSIB	NIL	<p>Nodal Officer of DUSIB informed that drains in their custody are connected to</p>	<p>Member Secretary requested to explore possibility of</p>

		either PWD drain or to MCD drain. As the drains are very narrow and passing through very narrow lanes therefore it is not possible to go for alternate technology due to land constrains	preparation of Action Plan for in-situ drain treatment, if technically possible, and submit accordingly along with timeline.
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Finally, all HODs/ Nodal officers of Drain-Owning Agencies/Departments/Urban Local Bodies were again requested to submit Action Plan, along with time lines, for Management of Wastewater in drain to the IDMC, so that compliance of Hon'ble NGT order could be achieved without any delay.

*Meeting ended with thanks to the Chair.*

*Nikhil Kumar*  
02/06/2020

**(Nikhil Kumar)**  
**Member Secretary (IDMC)**

**All Concerned**

**DELHI JAL BOARD : GOVERNMENT OF NCT OF DELHI  
OFFICE OF THE CHIEF EXECUTIVE OFFICER  
VARUNALAYA PHASE II – KAROL BAGH, NEW DELHI – 110005**

**No:** CEO/IDMA/2020- D- 328

Dated: 17.06.2020

**Minutes of the 4th Meeting of "Integrated Drain Management Cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt. of NCT of Delhi on 11.06.2020 constituted on the direction of Hon'ble NGT dated 05.03.2020 OA No 06/2012 in the matter of Manoj Mishra v/s Union of India & others**

1. Due to COVID-19 Pandemic in India, meeting was held through Video Conferencing, which was attended by the officers concerned except NTPC & DUSIB .
2. At the outset, CEO-DJB *Ex-officio Member Secretary of IDMC*, welcomed all members of the Integrated Drain management Cell (IDMC) and Nodal officers appointed by Drain owning Agencies (DoA).
3. It was apprised by Member Secretary that the Integrated Drain Management Cell (IDMC) was set up under directions of Hon'ble NGT issued vide Order dated 05.03.2020. So far three meetings have been held and directions of the Chief Secretary have been conveyed through the Minutes already circulated to all concerned DoA. Comprehensive Action Plan, for the remediation and management of all the drains through Alternate Technologies as suggested by CPCB, was required to be submitted by all the Drain-owning Agencies (DoA) latest by 26.05.2020, so as to cover the entire drainage network within their jurisdiction.
4. It was apprised by Member Secretary that Action Plan along with timeline for bio-remediation of the drains have been received only from Delhi Cantonment Board and NDMC so far. Rest of the DoA are yet to be submit complete action plan along with timelines. It was further apprised that some of DoA are still in process in appointment of Consultant and some of them are in process of finalization of Action Plan with Consultant. The entire process needs to be expedited so that compliance of Hon'ble NGT could be achieved.

5. All DoA have been requested to finalize their respective Action Plans alongwith specific timelines within the next 10 days and submit to IDMC so that compiled report could be submitted to the Hon'ble NGT.
6. On being asked by Engineering-in- Chief South DMC regarding requirement of fund for implementation of Action Plan, it was clarified that all DoA have to mobilize funds for Alternate Technology / Bio-remediation of the drains from their own sources. On the issue of funds, it was explained by the Secretary, DPCC that DoA can approach Central Pollution Control Board (CPCB) for funding of their projects for Alternate Technologies/Bio-remediation of drains through the Environmental Pollution Fund (EPF). Secretary DPCC assured that necessary guidelines for EPF will be circulated among all DoA of IDMC. However, Member Secretary clarified that implementation of Action Plan should not be delayed on this account.
7. In addition to above, following issues are discussed with respective DoA :-

S. No.	Department	Total Length of Drain in Km	Issue	Reply/Action to be taken
1.	Public Works Department (PWD)	2064.08	PWD is still in the process of appointment of consultant. Action Plan alongwith timeline for Bio-remediation is to be submitted by them.	In is informed by Member Secretary that action plan is required to be submitted for entire length of drain in their jurisdiction as per order of Hon'ble NGT. Also specific time line needs to be mentioned in the Action Plan. Also, the details of the drains (length etc.) covered under the proposal of Bio-remediation at Chhattarpur & Chatrasal Stadium needs to be mentioned.
2.	Irrigation and Flood Control (I&FC) Deptt.	426.55	It was informed by Nodal Officer I&FC that proposal for appointment of NEERI on nomination basis is under approval. After appointment, three months	Member Secretary asked Nodal officer I&FC to expedite process of appointment of Consultant and submit Action Plan along with

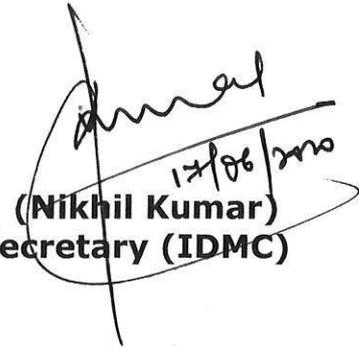
			time is required for study of the 55 Nos I&FC drain and submission of feasibility report. Subsequently, timeline for execution of work will be submitted after receipt of feasibility report from NEERI.	timeline at the earliest.
3	New Delhi Municipal Council	335.29	Out of 335.29 Km of drain NDMC have submitted that Bio-remediation in Kushak Nallah is being carried out since 2008-09 and testing of the samples is being carried out. Parameters like BOD, TSS, COD etc are being monitored. As per NDMC, for balance length of drain, no action plan is required for covered drain.	It was re-confirmed by Nodal Officer NDMC that all drains, other than Kushak Nalla, are covered, therefore, no further Action Plan is required.
4.	South Delhi Municipal Corporation (SDMC)	258.78	E-in-C South DMC has informed that they have engaged IIT Delhi for preparation of Action plan. Final report by IIT is now expected by 17.06.2020. After receipt of consultant report, same shall be forwarded to CPCB for their final comments. Final Action Plan along with timeline will be submitted after that.	Member Secretary was requested to submit Action Plan alongwith timelines within 10 days.
5.	Delhi Development Authority (DDA)	251.30	It was pointed out by Member Secretary that last 3 meetings were not attended by DDA. However, all proceedings along with MoM, were sent to Nodal officer DDA for compliance. The representative has apprised that he has joined recently and will respond accordingly	Member Secretary informed that as per order of Hon'ble NGT dated 05.03.2020 each drain owning agency has to submit Action Plan as per recommendation of CPCB for entire length of drain in their jurisdiction and explain entire proceeding of IDMC held so far in brief. DDA has been asked to submit detailed Action Plan along with timeline it within 10 days, without further delay.

6.	East Delhi Municipal Corporation (EDMC)	140.63	Nodal Officer of EDMC informed that they have submitted that action plan for 21.5 Km. Action Plan for balance length shall be submitted after detailed feasibility study being conducted by Principal Scientific advisor (GOI). There is no change in status	Member secretary asked them to submit the complete action plan alongwith timeline within a week time.
7.	North Delhi Municipal Corporation (NDMC)	122.46	E-In-C North DMC apprised that they will appoint Consultant within 3-4 days to study and submit Action Plan.	Member Secretary asked E-In-C North DMC to expedite process of appointment of Consultant and submit Action Plan along with timeline at the earliest.
8	DSI IDC	98.12	It is informed by Nodal Officer DSI IDC that NEERI is engaged for up gradation of CETPs and same agency is being requested for trapping of drain discharge into CETPs as existing CETPs are running under capacity and possibility of EX- Situ treatment of drain shall be explored by NEERI as well . DSI IDC after enquiry apprised that they will submit action plan to trap waste water of drain in consultation with NEERI by Wednesday i.e. 17.6.2020.	Member secretary informed that they have to submit Action Plan along with timeline for entire length to the drain under their jurisdiction.
9.	Delhi Cantonment Board	39.68	Action Plan along with timeline submitted. Nodal Officer Delhi Cantt. Confirmed that they have already started its implementation from yesterday i.e. 11.6.2020	Member Secretary asked Nodal Officer Delhi Cantt to submit their achievements/action taken after implementation of Action Plan within a week. Before and after photos be made part of their detailed report after implementation of Bio-remediation of drains for onward submission to Hon'ble NGT.

10.	National Thermal Power Corporation Limited	3.11	NTPC was supposed to submit present status of the drain having length about 3.11 Km. Action Plan along with timeline be submitted to IDMC for the portion of the drain which is not dry / still carrying discharge and treatment of Jaitpur drain.	NTPC was not represented in the meeting. Detailed report is yet to be received.
11	DUSIB	NIL	It is again being submitted by DUSIB that, JJ clusters are unplanned encroachment on Govt land, drains are Zigzag, shallow in depth and finally connected to PWD or MCD drains.  <b>Therefore it is not possible to go for alternate technology due to land constraints.</b> Moreover, these JJ clusters are under rehabilitation/ relocated and basic amenities are being provided under plan scheme of Delhi Govt.  <b>NO action Plan is possible.</b>	No representative of DUSIB attended the meeting.

Finally, it was once again requested to all HODs/ Nodal officers of Drain-Owning Agencies/Departments/Urban Local Bodies to submit Action Plan, along with time lines, for Management of Wastewater in drain to the IDMC within next 10 days, so that compliance of Hon'ble NGT order could be achieved without any delay.

*Meeting ended with thanks to the Chair.*

  
 12/06/2020  
**(Nikhil Kumar)**  
**Member Secretary (IDMC)**

**All Concerned**

**DELHI JAL BOARD : GOVERNMENT OF NCT OF DELHI**  
**OFFICE OF THE CHIEF EXECUTIVE OFFICER**  
**VARUNALAYA PHASE II – KAROL BAGH, NEW DELHI – 110005**

No: CEO/IDMA/2020- *D-342*

Dated: 07.07.2020

**Minutes of the 5<sup>th</sup> Meeting of "Integrated Drain Management Cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt of NCT of Delhi on 01.07.2020 constituted on the direction of Hon'ble NGT dated 05.03.2020 OA No 06/2012 in the matter of Manoj Mishra v/s Union of India & others**

1. Due to COVID-19 Pandemic in India, meeting was held through Video Conferencing, which was attended by the officers concerned except NTPC.
2. At the outset, CEO-DJB *Ex-officio Member Secretary of IDMC*, welcomed all members of the Integrated Drain Management Cell (IDMC) and Nodal Officers and apprised that the Integrated Drain Management Cell (IDMC) was set up under directions of Hon'ble NGT issued vide Order dated 05.03.2020. Accordingly, Action Plan for use of alternate technology for wastewater treatment in the drains was required to be submitted by all Drain owning agencies (DoA) along with time line, in compliance of directions of Hon'ble NGT.
3. Member Secretary apprised that so far four meetings of IDMC have been held and some progress is observed by most of DoA during last 4-5 weeks in formulation of Action Plan for Alternate Technology / Bio-remediation of the drains, inspite of various constrains due to COVID-19 Pandemic.
4. It was apprised by Member Secretary that Action Plan along with timeline for bio-remediation of the drains have been already received from Delhi Cantonment Board and NDMC. Both NDMC and Delhi Cantonment Board were requested to submit their

achievements/action taken after implementation of Action Plan through proper report in form of booklet, for appraisal of Hon'ble NGT.

5. In addition to above, following issues are discussed with respective

DoA :-

S. N o.	Department	Total Length of Drain in Km	Issue	Reply/ Action to be taken
1	Public Works Department (PWD)	2064.08	<p>Secretary, PWD has informed as per prevailing guidelines of Finance Deptt, due to COVID 19 and lack of funds, NO NEW PROJECT shall be sanctioned till March-2021.</p> <p>Regarding Alternate Technologies for entire length of drain under jurisdiction of PWD, they have requested IIT Delhi and DTU Delhi for Consultancy but final terms and conditions are yet to be received from them. These institutions usually carryout Consultancy work after advance payment made to them. Hence, this work may be taken up only after March -2021 due to lack of funds etc. It was informed by Nodal officer PWD that Consultancy work of construction of Bio-remediation plant at two locations shall be taken up June-2021 and shall be completed by Dec- 2021.Action Plan alongwith timeline to be submitted after receipt of Consultancy report. However, PWD will take up the matter for an early approval and getting the work done at the earliest.</p> <p>Nodal officer PWD further informed that proposal of construction Bio-remediation plant at two places is being reviewed due to some technical reasons and the work is held up as field visits of expert team is not possible due to COVID-19. It was informed that work of construction of Bio-remediation plant at two locations shall also be taken</p>	<p>It is informed by Member Secretary that Consultancy Report may be obtained in phased manner so that some progress can be achieved in compliance of directions of Hon'ble NGT.</p>

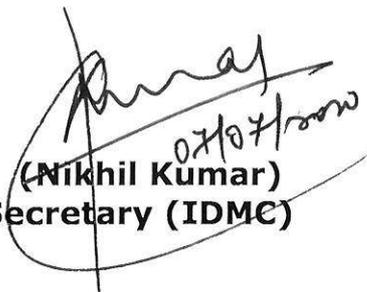
			up and likely to be completed by Dec- 2021.	
2	Irrigation and Flood Control (I&FC) Deptt.	426.55	It was informed by Nodal Officer I&FC that as per the reports of the Consultants engaged earlier by IFC, bio-remediation/ phyto-remediation was not found techno-economically feasible in any of the 57 drains under the jurisdiction of IFC. To examine the feasibility afresh, efforts are again being made to engage NEERI for studying the other Alternate Technologies as suggested by CPCB. Proposal for appointment of NEERI on nomination basis is under submission to the Government.	Member Secretary asked Nodal officer I&FC to expedite process of appointment of Consultant and submit Action Plan along with timeline at the earliest.
3.	South Delhi Municipal Corporation (SDMC)	258.78	It was intimated by E-in-C South DMC that Consultancy report from IIT Delhi received .They are in process of preparation of estimate. Once funding arrangements are made, time line for implementation of plan will be submitted to IDMC.	Member Secretary acknowledged the Consultancy report submitted by South DMC and further requested that timelines for its implementation be also submitted.  Member secretary informed that help of DPCC may be obtained for getting funds through EPF under CPCB, if required.
5.	Delhi Development Authority (DDA)	251.30	It was informed by Nodal officer of DDA that "Interim Report is submitted by them and further informed that they are constructing 09 wetlands on 09 Drains between DND flyover to Dhobi Ghat Jamia Nagar and likely to be completed by Oct 2020 . .  There is also proposal of Construction of 04 STPs of capacity 9.5MLD,7MLD,5MLD and 05 MLD respectively which includes TD-2 and TD-5 two major drains in Dwarka area , for which tender have been already invited and work is likely to be completed in two years .  In addition to the above, DDA has decided to engage IIT as Consultant for bioremediation of drains as per methods suggested by CPCB and their report is expected within 6 weeks.	Member Secretary desired that action plan linked with drain length under each STP / Wetland treatment process is required to be submitted by DDA to ascertain that total length of DDA drain i.e. 251 KM , is taken up for its treatment.  Member Secretary asked Nodal Officer DDA to expedite process of appointment of Consultant and submit Action Plan along with timeline at the earliest

6	East Delhi Municipal Corporation (EDMC)	140.63	<p>It was apprised by Addl Commissioner East DMC that action plan for 21.5 km already submitted. Action Plan for remaining drain length of 111 KM is submitted today itself. East DMC is having drain length of about 132 KM against 140 KM reported by Monitoring Committee.</p> <p>It was further apprised that EDMC is facing acute financial constraints, so funds for this project needs to be arranged either through Govt. Grants or Environmental compensation funds of Delhi.</p> <p>About 18 months are required for implementation of proposed action plan.</p>	Member secretary informed that help of DPCC may be obtained for getting funds through EPF under CPCB, if required.
7	North Delhi Municipal Corporation (NDMC)	122.46	Nodal officer North DMC informed that they are in process of appointment of IIT Delhi as a Consultant within day or two. Action plan will be submitted within 3 week thereafter.	Member Secretary requested that current status be submitted, so that Hon'ble NGT could be apprised accordingly.
8	DSI IDC	98.12	<p>It is informed by Nodal Officer DSI IDC that NEERI is engaged for up gradation of CETPs and same agency is being requested for trapping of drain discharge into CETPs as existing CETPs are running under capacity and possibility of EX- Situ treatment of drain shall be explored by NEERI as In-Situ treatment of drain is not possible being very narrow.</p> <p>It was informed by Nodal Officer DSI IDC that trapping of drains under command area of 17 industrial areas under 13 CETPs is expected to be carried out within 4 to 6 months after receipt of NEERI report by 30 Sep-2020. Up gradation of STP shall be taken up subsequently.</p> <p>For balance 11 industrial areas NEERI shall be submitting report by Dec-2020.</p>	It was informed by Member Secretary that timeline for up-gradation of CETPs be given, so that ultimate objective of treatment of drain discharge could be achieved before discharge into main drain and finally into River Yamuna. Action Plan along with timeline for 11 industrial areas be given within a week.

10	National Thermal Power Corporation Limited	3.11	NTPC was supposed to submit present status of the drain having length about 3.11 Km. Action Plan along with timeline be submitted to IDMC for the portion of the drain which is not dry / still carrying discharge and treatment of Jaitpur drain.	NTPC was not represented in the meeting. Detailed report is yet to be received.
11	DUSIB	NIL	It is apprised by DSIIDC that Action plan is <b>not possible to go for alternate technology due to land constraints</b> . Nodal officer of DDUSIB requested to consider their request from exemption of submitting action plan.	Noted

Finally, it was once again requested to all HODs/ Nodal officers of Drain-Owning Agencies/Departments/Urban Local Bodies to submit Action Plan, along with time lines, for Management of Wastewater in drain to the IDMC at the earliest , so that compliance of Hon'ble NGT order could be achieved without any delay.

*Meeting ended with thanks to the Chair.*

  
 (Nikhil Kumar)  
 Member Secretary (IDMC)

**All Concerned**



कार्यालय मुख्य अभियंता  
उत्तरी अंचल (एम.) लोक निर्माण विभाग,  
दिल्ली सरकार, पी.चवा तल, एम.एस.ओ.  
भवन, इन्द्रप्रस्थ एस्टेट, नई दिल्ली -  
110002

GOVT. OF NCT OF DELHI  
PUBLIC WORKS DEPARTMENT  
OFFICE OF CHIEF ENGINEER  
North Zone (M), PWD,  
GNCTD, 5<sup>th</sup> Floor, M.S.O. Building,  
I.P. Estate, New Delhi -110002.



Ph: 011-23325033, 23319952 Fax: 011-23356195 e-mail: cepwddelhimzm3@gmail.com  
सं. 4(4)/सहाअभि(अनु०)/लोनिवि/उत्तरी अंचल/MoM/ 185/780 दिनांक: 11/06/2020

सेवा में,

CEO, Delhi Jal Board,  
Member secretary, IDMC  
Varunalaya, Jhandewalan,  
New Delhi.

**विशय: Compliance of 3<sup>rd</sup> Meeting of Integrated Drain Management Cell.**

As per the directions issued in the Minutes of 3<sup>rd</sup> Meeting on Integrated Drain Management Cell held on 29.05.2020, the compliance is as under:-

**1. Time schedule for installation of bio-remediation plants**

It is observed that consumption of 2.5 MLD water is not possible to use in watering of greenery and plantation. Hence the design capacity of plant is to be reviewed.

Due to COVID- 19 situation at present field visits by expert team is not possible. The field visit is necessary for redesigning of plant. The monsoon is approaching fast hence field work may not be done during the Monsoon. The planning work like feasibility survey, sanction and calling of tenders may be completed.

Due to COVID-19 & lack of funds, no new project may be sanctioned till March-2021. At present No fund is available under the capital head works MH-5054.

1. Field feasibility survey and designing of Plants- June 2021
2. Sanction of bio-remediation plants Oct-2021
3. Installation of bio-remediation plants- Dec-2021.

**2. It was also directed to explore the possibility of an action plan for the entire drain length under jurisdiction and appointment of consultant.**

The PWD has already submitted action plan on 26.05.2020, it was also directed to explore the possibility of an action plan for the entire drain length under jurisdiction and appointment of consultant. The PWD has requested IIT Delhi and Delhi Technical University, Bawana for taking up the consultancy work to suggest use of alternative technology for management of waste water in the PWD Drains. Copy of the letters is enclosed for ready reference.

The final terms and condition and time schedule is not conveyed by the any of the Institution. These Institution carryout consultancy works after advance payment made to them. Hence this work may be taken up after March-2021. However PWD will take up the matter for an early approval and getting the work done at earliest.

मुख्य अभियंता  
उत्तर अंचल (एम०)

प्रतिलिपि:

1. Pr. Secy, PWD, 5<sup>th</sup> Floor, Delhi Secretariat, IP Estate, New Delhi for kind information.
2. Pr. CE(M), PWD, 12<sup>th</sup> Floor, MSO Building, New Delhi for kind information.
3. Chief Engineer(East and South Maint Zone ) PWD, Delhi
4. S.E., North West Maintenance Circle, PWD, New Delhi for information.
5. Guard File.

मुख्य अभियंता

**GOVT. OF NCT OF DELHI**  
**OFFICE OF THE CHIEF ENGINEER (I&F)**  
**IRRIGATION AND FLOOD CONTROL DEPARTMENT,**  
**L.M. BUND OFFICE COMPLEX, SHASTRI NAGAR, DELHI-110031**  
**Ph.: 011-21210877, E-mail: ceifed@gmail.com**

---

No.EE/CD-XIV/NGT/2020-21/ 4088

Dated: 27/5/2020

To,

The Chief Executive Officer,  
Delhi Jal Board,  
Member Secretary, IDMC,  
Varunalaya, Jhandewalan,  
Delhi.

**Sub.: Action plan in compliance to directions para 2 c & d of minutes of first meeting integrated drain management cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt. of NCT of Delhi on 05.05.2020 constituted on the direction of Hon'ble NGT dated 05/03/2020 OA No. 06/ 2012 in the matter of Manoj Mishra v/s Union of India & Others.**

Sir,

Kindly find enclosed herewith an action plan on the above cited subject, in respect of I&FC Department for kind perusal please.

Yours faithfully



(O.P. Srivastava)

Chief Engineer (I&FC) Zone-I

Dated:

No.EE/CD-XIV/NGT/2020-21/

Copy to:

1. Secretary (I&FC), I&FC Department, Varunalaya, Jhandewalan, Delhi.

  
Chief Engineer (I&FC) Zone-I

**ACTION PLAN IN COMPLIANCE TO DIRECTIONS PARA 2 c & d OF MINUTES OF FIRST MEETING INTEGRATED DRAIN MANAGEMENT CELL” FOR REMEDIATION AND DRAIN MANAGEMENT OF ALL DRAINS OF DELHI, CHAIRED BY THE CHIEF SECRETARY, GOVT. OF NCT OF DELHI ON 0505.2020 CONSTITUTED ON THE DIRECTION OF HON’BLE NGT DATED 05/03/2020 OA NO. 06/ 2012 IN THE MATTER OF MANOJ MISHRA V/S UNION OF INDIA & OTHERS.**

Direction of the Minutes of Meeting para no. 2c and 2d are as under:-

*(c) The IDMC may prepare and execute an action plan on ‘Alternate Technologies for Management of Wastewater in Drains’ after Techno-economic evaluation to be done in light of CPCB report referred by Yamuna Monitoring Committee (YMC) recommendations dated 20.01.2020 and 17.02.2020 or any other relevant inputs on the subject.*

*(d) The action plan has to be prepared within three weeks from the constitution of IDMC, which may be ensured by the Chief Secretary, Delhi.*

**Action plan of Irrigation and Flood Control Department.**

1. I&FC Department is maintain 57 drains having the length 382 Km. On the earlier directions of Hon’ble NGT, the department appointed consultants for 27 drains to expedite the feasibility report on the adaptability of Bioremediation and/or phytoremediation or any other remedial measures which could be taken up of in-situ treatment of water flowing in these drains. The feasibility reports of 27 drains from the appointed consultants namely M/s. Techno Green Environment Solution, M/s. INRM Consultants Pvt. Ltd. and Ecologique Science Technik (India) Pvt. Ltd. (Joint Venture) were received by the department and examined by the concerned Executive Engineers and Superintending Engineers.
2. On examinations of the feasibility reports, concerned Executive/ Superintending Engineer expressed that in their considered view, Bioremediation and / or Phytoremediation is not a viable / feasible option to treat the waste water of all the 57 drains of I&FC department. due to reason as under:
  - i. Sufficient land is not available along the drains for Bioremediation and or Phytoremediation treatment.
  - ii. The work of DJB for intercepting sewer of major drains are in progress and nearing to completions / commissioning.
  - iii. As suggested by the consultant that the proposed treatment system is feasible for flow upto 50 MLD. However the major drains of the department carrying heavy discharges more than 50 MLD & in case of minor drains no space is available.
  - iv. Most of the drains are having heavy discharge with heavy pollutant load and not having required BOD level as required for in-situ treatment.
  - v. As suggested by the consultant that heavy metals including cadmium, chromium lead and uranium cannot be biodegraded whereas most of the major drains catters

the discharges from various small drains that carry industrial waste having contents of heavy metals.

- vi. As suggested by the consultant that an approx expenditure of Rs. 2 crore per MLD shall be incurred on the treatment of waste water with minimum period of execution is about 18-24 months. Which are not cost effective.
3. In addition to the above that CSIR-NEERI, at their own motion conducted feasibility study in two of the I&FC drains namely Bund Drain and Biharipur drain on the viability of the use of RENEU system at these drains for the treatment of waste water. However, the NEERI after their study has suggested that the installation of RENEU system at these drains which will cause back flow in these drains coming from houses lying within the vicinity of these drains and ultimately will cause public distress. Hence, both these drains were considered not suitable for the installation of above-referred system.
4. Thus in view of above, it was that Bioremediation and/ or Phytoremediation not feasible in all 57 drains of I&FC Department.
5. However, the matter was taken up with CSIR-NEERI vide letter No. EE/CD-XIV/NGT/2015-16/3289-3309 dated 08.01.2020 requesting them to inspect the remaining 55 drains and to suggest the usage of Bioremediation and/ or Phytoremediation or any other remediation measures for the natural treatment of the water of these drains. CSIR-NEERI has, in-principle, agreed to take up the feasibility study of 55 drains of I&FC vide letter dated 28.01.2020. The total charges in respect of 55 drains would be Rs. 10,50,000/- + 18% GST. The NEERI has also desired that first instalment of 70% of the total charges shall be paid in advance at the time of start of inspection and the second instalment of 30% of total charges, after the submission of feasibility report of all the 55 drains. Further, the timeline to complete the survey has been proposed to be three months after the release of first instalment.
6. The matter was taken up with Finance Department for in-principle approval to release the payment at Rs. 10.50 lakhs + 18% GST. The Finance Department has examined the proposal of the department twice and FD observed that the proposal has not been recommended by the Hon'ble Minister concerned and for making selection for any agency for any work on nomination basis, the department requires to obtain approval of the cabinet of Delhi as per procedure being adopted in the Government.
7. CPCB has submitted the report to the (YPMC) Yamuna Pollution Monitoring Committee on alternative treatment technologies for waste water treatment of drain in compliance to the directions of Hon'ble NGT, vide which CPCB have suggested 15 Nos. model which are based on width of drain, depth of flowing water, Pollution load and flow. It is a general plan and requires detailed DPR for execution / implementation of the model in 55 Nos. I&FC drain, I&FC Department is in a view to appoint CSIR-NEERI as a consultant which is a expert agency in this field to submit the detail feasibility report/ DPR.

8. **The draft cabinet note for council of minister is under process.**
9. Subsequent upon the approval of cabinet on appointment of NEERI on nomination basis and payment shall be made by the department in agreed terms and conditions. Thereafter three months time is required for study of the 55 Nos. I&FC drains and submission of feasibility report.
10. After receipt of the feasibility report from NEERI further action for the preparation of detail project report and timelines for the execution of the work shall be submitted accordingly.

**OFFICE OF THE CHIEF ENGINEER (CIVIL-I)  
ROOM NO. 1518 15<sup>TH</sup> FLOOR  
NEW DELHI MUNICIPAL COUNCIL  
PALIKA KENRA: SANSAD MARG  
NEW DELHI - 110001**

No. D/47 /CE (C-I) 325132

Dated: 26-5-2020

**To  
The CEO  
Delhi Jal Board and Member Secretary, IDMC  
Varunalaya, Karol Bagh  
New Delhi-110005.**

**Sub: Minutes of the First Meeting of "Integrated Drain Management Cell" for remediation and drain management of all drains of Delhi, chaired by the Chief Secretary, Govt. of NCT of Delhi on 05.05.2020 constituted on the direction of Hon'ble NGT dated 05.03.2020**

**OA No. 06/2012 in the matter of Manoj Mishra V/s Union of India & Others.**

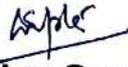
Sir,

In compliance of the decision taken in IDMC meeting and our earlier report vide D/43/CE (C-I) dated 13.05.2020, the present update status is submitted below:-

1. In the open portion of Kushak Nallah (2.82 Km), no dumping of malba and Sewer Connection of any sewer lines are taken place. As per topography, the drainage system is started from San Martin Roads to the Kushak Nallah where & DJB Sewer Line/Connection was outfall into the NDMC drainage System and now the same has been disconnected by the DJB vide letter No. DJB/East (South-West)-III/2020/7223 dated 17.03.2020.
2. The discharge in Barrels has been reduced after aforesaid disconnection by the SDMC but some discharge of grey water (without solid/sewer) is still observed.
3. Further examination/inspection of the drainage systems is carried out and it is found that the surface flow water from washing of the nearby taxi stands, overflow of gardening water from bungalows and embassies, flow from STP/Biodigester, Cooling Plants etc. in the area

- of Niti Marg/Chanakyapuri, from the Petrol Pumps, Hotels, Embassies etc. are the possible source.
4. The nearby J.J. Clusters such as Vivekanand Camp, Rajiv Gandhi Camp, Clusters on the bank of Kushak Nallah etc. are also checked and it is found that there are provisions of underground sewer lines and no sewer is directly discharging into the Kushak Nallah except waste water of washing/bathing/kitchen etc. Some flows is also coming from Bio Digester Toilets of CRPF and RAF Security personnel's residents near the bank of Kushak Nallah behind VVIP's Bungalows at Pt. Uma Shankar Dikshit Marg.
  5. However, the Bioremediation Treatment in Kushak Nallah is being carried out since 2008-09 as per advice of INTAC through continuous dosing of Microbial and Enzymes Solution at the upstream to control odour, to degrade and digest the organic contaminations. The testing is being carried out on monthly intervals from the reputed laboratories and the parameters such as BOD, TSS, O&G, COD etc. are found within the permissible limit of CPCB for Inland Surface Water.

In view of above, no further action is to be taken by NDMC in respect of Order dated 05.03.2020 on O.A. No. 06/2012.

  
(Sanjay Gupta)  
Chief Engineer (Civil-I)

**Copy to:-**

1. PS to Chairman, NDMC for Kind information please.
2. PS to Secretary, NDMC for kind information please.
3. SE(R-South)



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email : etslab2012@gmail.com | Website : www.etslab.in | Ph.: 9911516076, 9811736063



ISO 9001/14001/45001

## TEST REPORT

TEST REPORT NO.: ETS/1028-2/04/2020

DATE OF REPORT:

16.04.2020

### WASTE WATER SAMPLE ANALYSIS REPORT

Name And Address of Customer : ASSISTANT ENGINEER IV (R-IV)  
CIVIL ENGINEERING DEPARTMENT NEW DELHI MUNICIPAL  
COUNCIL, DRAINAGE SERVICE CENTRE, NEW DELHI-110021

Date of Sampling : 10.04.2020

Analysis Start Date : 11.04.2020

Analysis End Date : 15.04.2020

Sample ID No : 1028-2

Sampling Done By : ETS STAFF

Sampling Description : WASTE WATER

Sampling Location : KUSHAK NALLA- S.P. MARG (SAMPLE NO-02)

Sampling Method : ETS/STP/WATER-02

Sample Quantity : 2.0 Ltr.

Packing Condition : SEALED

Packed In : P.V.C. CANE

S. No.	Test Parameter	Unit	Result	Specification/Limit (As per CPCB)		Test Method
				Inland Surface Water	Public Sewers	
1	pH	...	7.35	5.5 - 9.0	5.5 - 9.0	APHA 4500-H+
2	Odour	...	Unpleasant	...	...	APHA 2150-B
3	Total Dissolved Solids,(TDS)	mg/L	1036	Not Specified	Not Specified	APHA 2540-C
4	Total Suspended Solids,(TSS)	mg/L	26.3	100	600	APHA 2540-D
5	Oil & Grease, (O & G )	mg/L	3.5	10	20	APHA 5520-D
6	Biological Oxygen Demand(BOD <sub>3d</sub> 27°C)	mg/L	12.0	30	350	IS: 3025 (Part-44)
7	Chemical Oxygen Demand,(COD)	mg/L	65.0	250	Not Specified	APHA 5220-C
8	Nitrate,(NO <sub>3</sub> )	mg/L	3.5	10	Not Specified	APHA 4500:(NO <sub>3</sub> )-B
9	Phosphate (P)	mg/L	1.2	5	Not Specified	APHA 4500:(P)-D
10	Chloride,(Cl)	mg/L	87.0	Not Specified	Not Specified	APHA 4500:(Cl) -B
11	Turbidity	NTU	6.0	Not Specified	Not Specified	APHA 2130-B

\*\*\*\*\*End of Test Report\*\*\*\*\*

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Page 1 of 1

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CHECKED BY

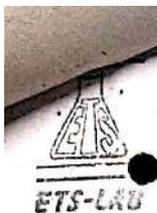


Ma Humraj  
Quality Manager

AUTHORIZED SIGNATORY

Note:-

1. This test report shall not be used in any advertising media or as evidence in the court of Law without prior written permission of the laboratory.
2. The samples received shall be destroyed after 15 days from the date of test report issued.
3. The results indicated only refer to the listed samples and listed applicable parameters.



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e-mail : etslab2012@gmail.com | Website : www.etslab.in | Ph.: 9911516076, 9811736063



ISO 9001/14001/45001

## TEST REPORT

TEST REPORT NO.: ETS/1028-1/04/2020

DATE OF REPORT: 16.04.2020

### WASTE WATER SAMPLE ANALYSIS REPORT

Name And Address of Customer : ASSISTANT ENGINEER IV (R-IV)  
CIVIL ENGINEERING DEPARTMENT NEW DELHI MUNICIPAL  
COUNCIL, DRAINAGE SERVICE CENTRE, NEW DELHI-110021

Date of Sampling : 10.04.2020

Analysis Start Date : 11.04.2020

Analysis End Date : 15.04.2020

Sample ID No : 1028-1

Sampling Done By : ETS STAFF

Sampling Description : WASTE WATER

Sampling Location : KUSHAK NALLA-SATYA SADAN (SAMPLE NO-01)

Sampling Method : ETS/STP/WATER-02

Sample Quantity : 2.0 Ltr.

Packing Condition : SEALED

Packed In : P.V.C. CANE

S. No.	Test Parameter	Unit	Result	Test Method
1	pH	...	7.50	APHA 4500-H+
2	Odour	...	Unpleasant	APHA 2150-B
3	Total Dissolved Solids,(TDS)	mg/L	1155	APHA 2540-C
4	Total Suspended Solids,(TSS)	mg/L	89.5	APHA 2540-D
5	Oil & Grease, (O & G )	mg/L	10.8	APHA 5520-D
6	Biological Oxygen Demand(BOD <sub>3d</sub> 27°C)	mg/L	43	IS: 3025 (Part-44)
7	Chemical Oxygen Demand,(COD)	mg/L	134	APHA 5220-C
8	Nitrate,(NO <sub>3</sub> )	mg/L	38	APHA 4500:(NO <sub>3</sub> <sup>-</sup> )-B
9	Phosphate (P)	mg/L	3.5	APHA 4500:(P)-D
10	Chloride,(Cl)	mg/L	155	APHA 4500:(Cl <sup>-</sup> )-B
11	Turbidity	NTU	48	APHA 2130-B

\*\*\*\*\*End of Test Report\*\*\*\*\*

FOR ENVIRO-TECH SERVICES

Page 1 of 1

For Enviro-Tech Services



CHECKED BY

Md Humray  
Quality Manager

AUTHORIZED SIGNATORY

Note:-

- This test report shall not be used in any advertising media or as evidence in the court of Law without prior written permission of the laboratory.
- The samples received shall be destroyed after 15 days from the date of test report issued.
- The results indicated only refer to the tested samples and listed applicable parameters.

**ANNEXURE-L**

**Action Plan**

**On**

**“Alternate Technology for Management of  
Wastewater in Drains” under the Jurisdiction of  
SDMC**

**Submitted to**

**South Delhi Municipal Corporation, Delhi.**

**Prepared by**



**Indian Institute of Technology, Delhi**

**June 2020**

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## **Action Plan on “Alternate Technology for Management of Wastewater in Drains” under the Jurisdiction of SDMC**

### **1.0 Background of the Project**

In view of directions issued by NGT vide order on Drains in Delhi (Item No. 1, Court No. 1, ‘Before the National Green Tribunal Principal Bench, New Delhi’ Original Application No. 6/2012, Manoj Mishra verse Union of India & Ors., Date of hearing: 18.02.2020 and Date of uploading of order: 05.03.2020) for reduction and abatement of pollution load in Yamuna and its drains and subsequently preparation of time bound action plan to implement pilots of ‘Alternate Technologies for Management of Waste Water in Drains of Delhi, a letter No. *D/CE/SZ/2020-21/27* received via email dated 8th May 2020 for submitting the project proposal. Further a project proposal on “Preparation of Action Plan on Alternate Technology for Management of Wastewater in Drains falling directly into river Yamuna” was submitted and subsequently vide letter no *D/CE/SZ/2020-21/27* dated 20<sup>th</sup> May project was awarded.

It is proposed to prepare an action plan in three weeks using existing reports and data. The major reports being considered for preparing the action plan are

1. Report prepared by CPCB on “Alternate Technologies for Management of Waste Water in Drains” submitted to Yamuna Monitoring Committee (YMC), 2020
2. Drainage Master Plan of NCT Delhi prepared by IIT Delhi (2018)

The quality of wastewater of the drains in Delhi is alarming due to waste water, industrial waste water and septage from the Delhi NCR. Wastewater from these drains is getting discharged to the

River Yamuna and contributing to its increased pollution load. BOD, COD, coliform count and heavy metal load of the waste water has been too high at various locations. The fumes of waste water in drains are also contributing to the air pollution and pollute the sub soil of the area along which it flows. Hence there is urgent need for rejuvenation of drains.

Based on the reports of CPCB, Yamuna Monitoring Committee (YMC) has suggested to adopt bio/phyto remediation to prevent pollution in drains in Delhi. The report also include guidelines, criteria for inclusion/exclusion, cost effectiveness of different technologies and models that have succeeded on the ground.

### **1.1. NGT ruling for STP's and NGT ruling for Drains in Delhi**

The subject has reference to the orders of NGT regarding drains in Delhi particularly:

1. Drains in Delhi (Item No. 1, Court No. 1, 'Before the National Green Tribunal Principal Bench, New Delhi' Original Application No. 6/2012, Manoj Mishra verse Union of India & Ors., Date of hearing: 23.08.2019 and Date of uploading of order: 11.09.2019
2. Drains in Delhi (Item No. 1, Court No. 1, 'Before the National Green Tribunal Principal Bench, New Delhi' Original Application No. 6/2012, Manoj Mishra verse Union of India & Ors., Date of hearing: 18.02.2020 and Date of uploading of order: 05.03.2020).
3. Drains in Delhi (Item No. 1, Court No. 1, 'Before the National Green Tribunal Principal Bench, New Delhi' Original Application No. 6/2012, Manoj Mishra verse Union of India & Ors., Date of hearing: 18.02.2020 and Date of uploading of order: 05.03.2020

To treat drain in NCT Delhi, Honorable NGT in order uploaded on 05.03.2020 and thereindirections (page 83); (A) In Respect of Report of the YMC dated 17.02.2020 on the subject of "Alternate Technologies for Management of Waste Water in Drains" says that IDMC may prepare and execute an action plan on the subject after appropriate techno-economic evaluation at its end in the light of reports of CPCB to by the YMC.

There is a need for treatment of drains using phytoremediation/bio-remediation /suitable technologies for controlling environmental damages in various systems like water bodies, aquifer, and rivers and preventing diseases like cholera and dysentery following the principles of effectiveness, relative simplicity, and cost effectiveness.

## **2.0 Scope of Work**

In view of the directions laid by National Green Tribunal for reduction and abatement of pollution load in Yamuna and its drains and subsequently preparation of time bound action plan to plan and implement pilots of Action Plan on “Alternate Technology for Management of Wastewater in Drains falling directly into river Yamuna” under the jurisdiction of SDMC need to be prepared.

Drainage is an important element of physical infrastructure and constitutes removal and disposal of surplus rain and irrigation water from the land, both in urban and rural areas. It has two aspects mainly flood protection and removal of storm water. NCT of Delhi in general, has well-integrated drainage system of the Yamuna Basin. The Yamuna basin is largely divided in three sub basin, (i) Barrapulla, (ii) Najafgarh, (iii) Trans Yamuna. As far as administrative responsibilities are concerned, three corporation, Department of irrigation and flood control, Delhi Cantonment Board, PWD, NDMC, DJB, manage drains in their respective jurisdiction. Though a scientifically designed drainage network exists in and around drains however are polluted as they also carry untreated domestic/industrial sewage. This poses a mammoth problem by not only polluting the Yamuna on the downstream side of the drains carrying sewage but affecting the whole environment of the City. With this background the overall objective of the project is to prepare a time bound Action Plan with the tentative scope as follows;

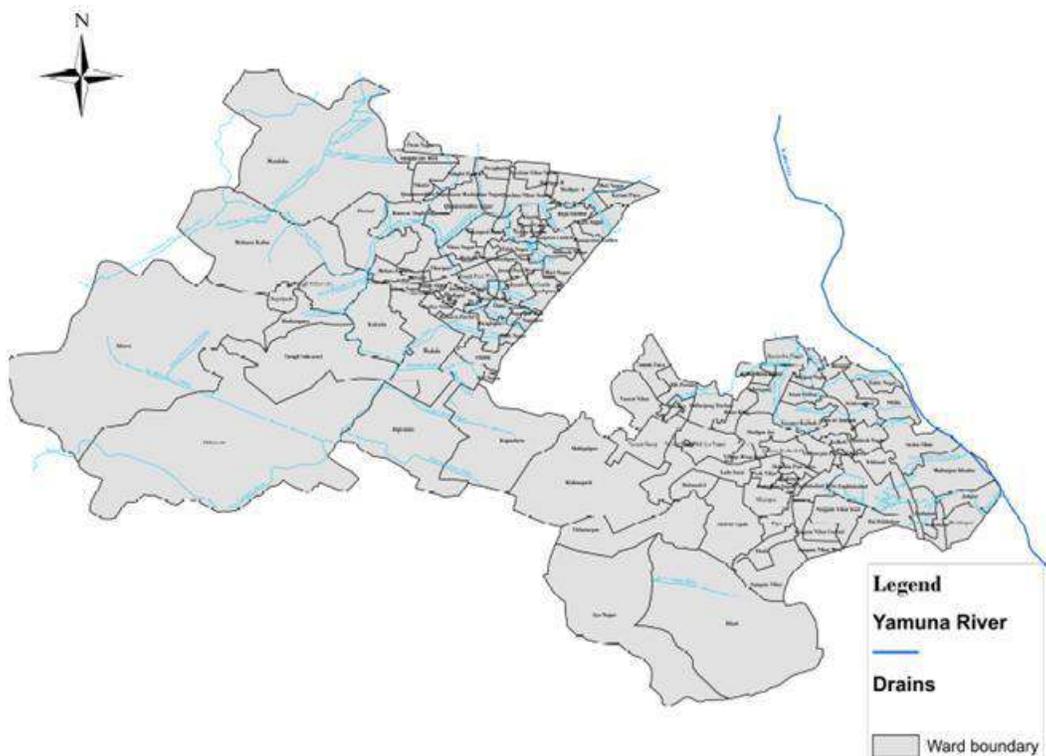
1. To carry out reconnaissance survey of the major drains including its catchment area.
2. To recommend a suitable/low cost remediation Technology/Technologies, keeping in mind end use of the harvested water
3. To ascertain the drains which are amenable to the proposed Remediation Technologies.
4. Coordination with CPCB, DJB, & I&FC, GNCTD

## **3.0 Methodology**

Time bound action plan is being prepared on the basis of various existing reports like “Drainage Master Plan for NCT of Delhi, 2018 prepared by IIT Delhi; Report on Alternate Technologies submitted by CPCB to YMC in 2020; Water Quality reports of CPCB etc. Also limited on ground survey and wastewater quality is being carried out. The methodology of the phase one has following steps

### 3.1. Study of the Drainage Master Plan in SDMC Area:

Figure 1 shows drainage map of SDMC prepared on the basis of drainage map prepared for Irrigation and Flood Control Department of Government of NCT Delhi. It covers major drains of SDMC. In year 2018 IIT Delhi as prepared a Drainage master plan of NCT of Delhi for IFCD of Govt. of NCT of Delhi. Drainage network of SDMC area is discussed in details in this section. Further secondary data such as catchment area, quantity of wastewater, details of existing treatment facilities etc. collected from other sources is also presented. As mentioned previously, drains in NCT of Delhi are under the Jurisdiction of several agencies. There are 270+ drains under jurisdiction of SDMC covering approximately 258 km. For administrative purpose these are divided in three zones, (i) South Zone, (ii) Najafgarh Zone, (iii) West Zone and (iii) Central Zone. Only some of the drains in Central zone are falling directly to Yamuna, while most of the other drains in SDMC area are first, second order and third order drains of Najafgarh and Barapullah Nallah respectively. Some of the SDMC drains are also discharging on land.



**Figure 1: Drainage map of SDMC**

Based on Drainage master plan for NCT Delhi prepared by Department of Civil Engineering, IIT Delhi and detailed discussion with SDMC official, it has been observed that SDMC own drainage network mainly in (i) Barapulla Baisn, and (ii) Najafgarh Basin. Drainage Master Plan has

recorded details of the drainage network owned by several agencies in NCT of Delhi. Basin wise comprehensive table of drainage network is prepared showing the length and width of the drains (table: 2&4). While recording the width maximum, minimum and average width across the length is recorded. Further based on the discussion with SDMC officials drains are divided in two categories (i) drains having avg. width <1m , (ii) drains with avg. width between >1 m. Further drains above 1 m are divided into four categories from the treatment strategy point of view. The same is explained in detail under the section 3.1.4.

### **3.1.1. Barapullah Basin characteristics**

Barapullah basin is situated on the western bank of the Yamuna River and is on the southern part of National Capital Territory of Delhi. The basin is surrounded by River Yamuna on the east, Haryana state on the south and Najafgarh basin on the north and west sides. The areas in this basin are completely urbanized. In this basin, Barapullah Nallah/drain is the biggest drain which carries almost 80% of the storm water from this region and outfalls into River Yamuna. Along with Barapullah drain, there are few more drains which are directly out falling into River Yamuna. Agra canal is passing through this basin region in which, four storm water drains outfall into it. The total catchment area of this Barapullah basin is 376.27sq.km. Southern part of the Barapullah catchment is on higher elevation level as compared to northern part of the catchment, because of the existence of hilly area in the southern part. The natural terrain of the flow is in south-east direction, i.e., towards River Yamuna. The land surface profile is such that there exist 3 different drains, i.e., Aruna Nagar Nallah, Old Chanderwal Nallah and Barapullah Nallah which are directly falling into Yamuna River and form 3 different basins. These 3 basins are Aruna Nagar Nallah basin (0.204 sq. km.), Old Chanderwal Nallah basin (1.26 sq. km.) and Barapullah basin (374.81 sq. km.). In this region, Barapullah basin is the biggest basin.

These hilly catchments separates the Barapullah basin from Najafgarh basin. Apart from river Yamuna, large numbers of water bodies are also present in the basin. The flood plain of the river Yamuna is more or less undisturbed. It is primarily used for agricultural activities or as an open area for the drainage outfalls. The land use of the region is broadly divided into crop land, urban, river and water bodies, grass and fallow lands. The basin region is the highly urbanized region in Delhi with approx. 30 % of total area contributing to built-up land use.

**Table 1: Area (in sq. km.) of each land use - Barapullah Basin**

Sr.No.	Land Use	Sub Divisions	Area (sq. km.)
1.	Rural/Crop Land	Cultivation Area, Farm limit, Plantation Area	31.10
2.	Urban Building Full	Parking, Paved Area, Poultry Dairy Farm, Road, Sports Complex, Traffic Islands etc.	91.83
3.	Grass	Golf Course, Garden Parks, Marshy Swamps, Nursery, Playground	34.91
4.	Fallow	Barren Land, Open Land, Orchard, Quarries, Sand Area	68.65
5.	Deciduous	Forest Area, Scrub Area, Sheet Rock	81.62
6.	Sub Total	1+2+3+4+5	308.11
7.	Water Network	River, Drains and Water Bodies	68.16
8.	Water Network under SDMC	@10% thumb rule (SDMC has 7% drain length out of total drain in Delhi	6.8

**Table 2: List of drains in Barrapulla Basin under the jurisdiction of SDMC**

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
			Max	Min	Avg.
1.	Chirag Delhi to Defense Colony Nallah	3700	60	1	17.3
2.	Sunhari Nallah	1800	50	45	47.5
3.	Pushpvihar main Nallah from MB Road to Press Enclave Road (RHS-LHS)	1933	32.5	1	18.5
4.	GK Nallah from Chirag Delhi Flyover to link road culvert near Central School	2075	31.7	1	25.5
5.	Chirag Delhi Vill. Nalla from Press Enclave Road to Outer Ring Road	1400	30.3	16.6	23.2
6.	Nalla No. 4 R.K. Puram from Outer Ring to EKTA camp	700	28	1	11.8
7.	Nallah no. 12 from Tilak Bridge to Yamuna River	1200	24.8	15	19.9
8.	Nauroji Nagar Nalla from Bhikaji Cama Place to Ring Road	1250	22	1	13.3
9.	Mathura road to Outfall in Yamuna	1050	19.5	1	10.8
10.	Nallah no. 14 from Gate no. 5 Pragati Maidan to Yamuna River	1640	19	10.5	15.1
11.	Vasant Vihar Nalla from Culvert on Munirka Marg to H.No. A-25, Olf Palme Marg	1450	19	1	7.3

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
12.	Covered Drain from C-2/60 SDA to Aurobindo Marg A	55	18	1	12.3
13.	Pushp vihar District Center, Saket Nalla from Mandir Marg M Block culvert to culvert on Pankaj Jewel Marg in Pushp vihar (RHS-LHS)	560	16.6	12	15
14.	M-Block Nallah Saket	1100	15	15	15
15.	Kalu Sarai Nallah Along Park Sarvpriya Vihar (RHS-LHS)	275	14.4	6.1	9.3
16.	DPS Nallah R.K.Puram to Ambedkar Basti Covered Nallah	480	14	1.1	
17.	Guru Harkishan Public School Nallah	500	14	1	9.7
18.	Panthnagar Nallah - LSR Collage to Barapulla Nallah	3700	13.5	7.5	10.9
19.	National Park Nallah	530	12.5	1	7.1
20.	JJ Colony Khadar (Sprite Vihar) Drain	1250	12.2	5.4	8.7
21.	Jagdamba Camp nalla from Triveni Complex culvert to Chirag Delhi nallah	200	12.1	5.2	8.6
22.	Nallah No. 6 from Outer Ring Road near Kendriya Vidyalaya Sec.-VIII R.K. Puram to T-point of Rao Tula Ram Marg and Som Nath Sharma Marg in R.K. Puram	950	12	2.5	7
23.	Aya Nagar phirni road drain	335	12	1.2	1.2
24.	Arjun Nagar Nalla from Humayunpur to A.I.I.M.S. (Near Cremation Ground Green Park)	1500	11.7	1	2.2
25.	Nalla No.5 R.K. Puram from Outer Ring Road to Sangam Cinema, R.K. Puram	950	11.2	1	3
26.	Bhim Nagar Nalla	1500	11	7.2	9.1
27.	Nalla No. 3, Sect.-3, R.K. Puram from H.No. 506 type IV, Sect.-3 R.K. Puram to Masjid Olf Palme Marg	700	11	1	6
28.	Taimoor Nagar C V Raman Marg to Block F	890	10.5	4.2	7.7
29.	Okhla Phase-1 to Sarita Vihar	3200	10.1	4.7	6.9
30.	Nallah no. 15 from Railway Track to Yamuna River	1740	10	1	6.6
31.	Nallah along August Kranti Marg from Panchsheel Club to Kamla Nehru College	1500	9.8	6	8
32.	Nallah 13a Mathura Road to Outfall in Yamuna	260	9.7		9.7
33.	Ambedkar Basti J.J. Camp Nalla from Kushta	900	9.5	9.5	9.5

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
	Camp to Ring Road				
34.	Central market Madangir Nallah from Shiv Nanda Public School up to Parking Near DDA Market Madangir Ph-II	590	9.3	5.6	7.5
35.	Badarpur Mad Nallah	2550	9.2	5.3	7.6
36.	Gautam Nagar Nallah	3000	9	1	2.3
37.	Pocket 12-14 Nallah	1650	7.9	3.6	5.1
38.	Sriniwas Puri	1100	7.5	2.5	5.7
39.	Nalla No. 2 R.K. Puram from Church to DDA park Sect. IV, R.K. Puram	1350	7	1	2
40.	Munirka Drain from D.D.A Flat to Outer Ring Road	450	6.5	1	2.1
41.	Muslim Nallah	180	6.4	3.8	3.6
42.	D/S Virat drain from BRT Corridor to main Nallah Pushp Vihar Sector – 4	400	6.3	1	3.2
43.	Katwaria Sarai Nallah	1170	6		6
44.	Z Block Nallah (Kohl Phase-II) X	3000	6	1	1.7
45.	Block 14, 16, 17 & 20 nallah Dakshinpuri Pocket 16 to main road.	385	5.6	5.5	5.6
46.	New Friends Club RHS	125	5.5	4	4.8
47.	Jia Sarai Nallah from Culvert Near Katwaria in IIT to Olof Palme Marg (RHS-LHS)	800	5.4	1	3
48.	Nallah from Block No.2 to Dakshinpuri Nallah at Maharishi Balimiki Marg	250	5.1	3.4	4.3
49.	Jamia Open Drain RHS	4950	5	2.7	3.4
50.	R&S block GK-1 from S-363 to B Block Nallah	700	4.9	1	3.1
51.	New Friends Colony A RHS	680	4.5	4.5	4.5
52.	RPS Drain from BRT Corridor near DDA Flats Madangir to DSIDC F-Block, upto Pushp vihar	1064	4.5	3.6	4.1
53.	East of Kailash	7	4		
54.	East of Kailash RHS	590	4	1.5	3.2
55.	Indian Air Lines Nalla	400	4	1.5	3.2
56.	Sukhdev Vihar RHS	1750	3.9	1.5	2.6
57.	Prahladpur Nallah	650	3.8	2.8	3.3
58.	Chattarpur Mandir Nalla from Mandir to Chattarpur Pahari	1400	3.5	2.2	2.6
59.	Garhi Village Nallah	650	3.4	2.1	2.7
60.	Prakash mohalla Nallah from Sant Nagar to Shera	1050	3	1	2.4

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
	Mohalla Garhi				
61.	Ashram Nallah	900	2.8	1	1.6
62.	Kalindi Kunj RHS	2100	2.5	2.5	2.5
63.	Mehrauli dargah Nallah to Jamali Kamali Nallah	163	2.5	1.4	1.9
64.	K&P block SDA drain from Saint Paul School to Aurbindo Marg drain	350	2.5	2.5	2.5
65.	Central Market Nallah from BRT to main Nallah Pushp Vihar	290	2.4	1.2	1.9
66.	Block B2 To Raj Nagar RHS	115	2.2	1.9	2.1
67.	Jangpura Nallah from Hospital Road to Barapulla	260	2	2	2
68.	Kilokari Nallah to Kilokari Village Ring Road	580	2	1	1.6
69.	Zonapur Village Nallah from Zonapur Village to 250m	250	2	2	2
70.	Nallah from House no L-Block to culvert near Mount Columbus School C Block Dakshinpuri	573	1.9	1.5	1.7
71.	Nallah from MB Road to Holi Chowk	1600	1.9	1	1.3
72.	Masjid Moth DDA Flat drain from DDA flat to outer Ring Road near Motor Mkt.	100	1.7	1.7	1.7
73.	Samshi Talab Nallah Mehrauli from Bagh to Samshi Talab	325	1.7	1.3	1.4
74.	Green Park Nalla from MCD School to Aurbindo Marg Evergreen Sweets	650	1.6	1.6	1.6
75.	Jalebi Chowk to Police Station Jaitpur	610	1.5	0.6	1
76.	Part-1 Govind Puri RHS	550	1.5	1.5	1.5
77.	Police booth D Pocket to Delhi Transco Ltd. RHS	345	1.5	1	1.2
78.	Sector A Pocket B & C from Shiv Mandir to Jal Board Office, Vasant Kunj	600	1.5	0.9	1.2
79.	Nallah from Janta Jewan Camp to MB Road via Pico Factory	600	1.5	0.7	1.2
80.	C Pocket Gate No.2 near Sant Giri School LHS	900	1.4	0.4	1
81.	Shahpur Jat Drain from DDA Flats to Asiad Village Nallah LHS	510	1.4	1.4	1.4
82.	Jamali Kamali Nallah	710	1.4		
83.	Police booth D Pocket to Delhi Transco Ltd. LHS	310	1.3	1	1.1
84.	Police station Jaitpur to Samosa Chowk	690	1.3	0.5	0.9
85.	Aggrawal Sweets to Police Booth Sarita Vihar LHS	290	1.2	1.2	1.2
86.	Aggrawal Sweets to Police Booth Sarita Vihar RHS	260	1.2	1	1.1

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
87.	Main Jagdamba Road	1190	1.2	1	1.1
88.	Metro station Sarita Vihar to Madanpur Khadar Aggrawal Sweets RHS	140	1.2	1	1.1
89.	Ratia Marg Drain	1855	1.2	1	1.1
90.	Sarita Vihar ( T Point near Delhi Jal Board Office to T-Point Madanpur Khadar Road)	820	1.2	1	1
91.	U/S Nalla No.6 & Vasant Enclave Drain	100	1.2	1.2	1.2
92.	Sanjay camp Nallah along Sanjay Camp & Dhobi Ghat	460	1.1	0.8	1
93.	Nallah from Mandir	576	1.1	0.8	1
94.	Hawa singh Block Drain Asiad Village. From Hawa Sing Block to Dustbin near Lavy Pento	1300	1.1	1	1.1
95.	4 Sector C Pkt-9 Vasant Kunj covered Nallah LHS	390	1	1	1
96.	4 Sector C Pkt 9 Vasant Kunj covered Nallah RHS	370	1	1	1
97.	M-Block Nalla, Saket from Anupam Cinema to M-Block, Saket Mandir Marg	1100	1	1	1
98.	Chamberdad Flats Madangir gali no 28 to Main Nallah Pushp Vihar RHS-LHS	881	1	0.4	0.7
99.	Covered Drain from C-2-60 SDA to Aurbindo Marg	150	1	1	1
100.	Madanpur Khadar Road (LIG Flats) to Open Land	360	1	0.8	0.9
101.	Munirka Vihar outfall Drain	300	1	0.6	0.8
102.	Munirka Village outfall drain from Village to DDA flats Munirka	160	1	0.6	0.8
103.	Indian Air Lines Nallah in Vasant Vihar to Poorvi Marg	400	1	1	1
104.	Part-2 Govindpuri RHS	115	1	1	1
105.	Road from Govt. School to Raj Nagar	270	1	0.7	0.8
106.	Som Vihar nalla from Som Vihar Apartment to DPS School (Coverd Nallah)	320	1	1	1
107.	T-Point 'F' Pocket to T- Point 'J' Pocket Sarita Vihar	580	1	0.2	0.7
108.	Bhumiya Mandir Madangir Phase	430	0.9	0.7	0.8
109.	S-Block Panchsheel Park Covered Drain from S 1 to S 60 (RHS-LHS)	200	0.9		
110.	Shahpur Jat Drain from DDA Flats to Asiad Village Nallah RHS	750	0.9	0.7	0.8
111.	Karumar Mandir Madangir	470	0.9	0.5	0.7

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
112.	Nallah from Jalebi Chowk to Durga Vihar Drain	1163	0.8	0.5	0.7
113.	C Pocket Gate No.2 near Sant Giri School RHS	900	0.8	0.3	0.5
114.	Gulmohar Enclave outfall Drain	210	0.8		
115.	Sector D-34	280	0.8	0.8	0.8
116.	Drain from Pyare Lal Bhawan to Sales Tax Office	430	0.8	0.8	0.8
117.	Sapna Park to Kalka Devi Marg (East of Kailash)	510	0.8	0.8	0.8
118.	Aya Nagar Sunday market drain upto out fall	900	0.75	0.75	0.75
119.	Block B2 to Raj Nagar LHS	115	0.7	0.4	0.5
120.	5 Sector C Pkt-8 Vasant Kunj LHS	140	0.6	0.6	0.6
121.	5 sector C Pkt-8 Vasant Kunj RHS	165	0.6	0.6	0.6
122.	Chattapur Village covered drain from Mata Chowk in Chattapur Village to SSN Marg	500	0.6	0.6	0.6
123.	Jia Sarai outfall Drain along IIT Boundary wall	80	0.6	0.6	0.6
124.	Pushp Vihar Sector 5 LHS	260	0.5	0.5	0.5
125.	Pushp Vihar Sector 5 RHS	175	0.5	0.5	0.5
126.	Saidulajab Nalla from Gali No-2 to IGNOU Road Saijulajab	350	0.5	0.5	0.5

### 3.1.2. Najafgarh Basin Characteristics

The Najafgarh drain is the biggest drain in National Capital Territory (NCT) of Delhi. It enters South-West corner of Delhi from Haryana. It traverses a length of 57.489 km before joining river Yamuna, downstream of Wazirabad barrage. In its initial stage through South-West district of National Capital Territory of Delhi, the drain carries flood water, wastewater from Haryana and surface runoff from the adjoining catchment.

Out of the 57.489 km stretch of the drain, nearly 30.943 km stretch of the drain passes through South-West district from near Dhansa to Kakraula. Thus, nearly 53.82% of the length of Najafgarh drain flows through south-west district of National Capital Territory (NCT) of Delhi. Moreover, from Dhansa to Kakraula regulator, 28 small drains join this big drain and subsequently after Kakraula, nearly 74 big and small drains join Najafgarh drain. Supplementary drain is the second largest drain which joins the Najafgarh drain just before its outfall into Yamuna River and total 71 small drains join the supplementary drain. The Najafgarh drain comprises three major blocks, namely, Alipur, Kanjhawala, Najafgarh and some urban part of South-West Delhi. The total catchment area of Najafgarh drain is around 977.26 sq.km within NCT of Delhi.

Natural flow direction of this region is towards river Yamuna. The land use of the region is broadly divided into crop land, urban, forest, water bodies, grass and fallow lands. Najafgarh basin covers a very large part of Delhi. Najafgarh basin has a natural depression called Najafgarh Jheel. It receives the spill from Delhi, as well as from Haryana and Rajasthan Territories. Najafgarh Jheel earlier used to be a big water body. Apart from river Yamuna, numerous pockets of water bodies are also present in the basin like Najafgarh Jheel, Balswa lake etc.

**Table 3: Area (in sq. km.) of each land use – Najafgarh Basin**

Sr.No.	Land Use	Sub Divisions	Area (sq. km.)
1.	Rural/Crop Land	Cultivation Area, Farm limit, Plantation Area	404.798
2.	Urban	Building Full, Parking, Paved Area, Poultry Dairy Farm, Road, Sports Complex, Traffic Islands etc.	192.419
3.	Grass	Golf Course, Garden Parks, Marshy Swamps, Nursery, Playground	45.739
4.	Fallow	Barren Land, Open Land, Orchard, Quarries, Sand Area	209.867
5.	Deciduous	Forest Area, Scrub Area, Sheet Rock	65.55
6.	Sub Total	1+2+3+4+5	918.373
7.	Water Network	River, Drains and Water Bodies	58.887
8.	Water Network under SDMC	@10% thumb rule (SDMC has 7% drain length out of total drain in Delhi	5.9

**Table 4: List of drains in Najafgarh Basin under the jurisdiction of SDMC**

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
1.	Subhash Nagar Drain	1750	7.0	3.0	5.0
2.	Drain On Prof. Joginder Singh Marg To Mota Singh School	1340	4.1	2.0	3.0
3.	Nallah Malaria Office To Pankha Road Nallah	220	3.0	2.5	2.8

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
	In JJ Colony Hastal.				
4.	Various Nallha Ap No-9	1080	2.5	1.1	1.9
5.	Tilak Vihar Drain Infront Of Cremation Ground	405	2.2	1.1	1.4
6.	Rama Park Road From Pipal Wala Road To Nawada School LHS	895	2.1	1.1	1.8
7.	Open Nallah Along Road No.77 West Zone In West Punjabi Bagh	135	2.0	1.8	2.0
8.	Dharampur Drain LHS	1240	2.0	2.0	2.0
9.	E Block JJ Khyala Drain	280	1.8	1.6	1.7
10.	Vikrant Chowk To Deep Vihar Transformer 40 ft Road	760	1.8	0.9	1.5
11.	Drain From Deep Enclave To Hastal Village (40 Feet Road)	660	1.8	0.9	1.4
12.	Drain From Cremation Ground(baprolla) To Mungesh Pur Drain (Jai Vihar)	1700	1.6	0.6	1.1
13.	M-block Toilet To Titarpur Drain In Raghubir Nagar	175	1.5	1.5	1.5
14.	Covered Nallah Shivaji Park Buster Pump in West Punjabi Bagh	375	1.5	1.0	1.3
15.	Covered Drain In Madipur.	480	1.5	1.2	1.3
16.	Hastal Ranhola Road Nallha From Commander Chowk To NQ.drain RHS	1795	1.5	0.8	1.1
17.	Block Tilak Nagar Drain LHS	650	1.5	0.8	1.1
18.	Drain From Vikrant Chowk To Rajapur Khurd. RHS	1270	1.4	0.9	1.2
19.	C-o Nalla Binda Pur Road Both Side Though Potters Colony	375	1.4	1.0	1.2
20.	Covered Drain From Rz-1 To G-8 Parjapat Colony LHS	470	1.4	0.7	1.0
21.	Firni Road Khayala Village Ap N0- 70	1100	1.3	0.8	1.1
22.	Malik Music Center To Manoj Builder B	350	1.3	0.7	1.1
23.	Malik Music Center To Manoj Builder	18	1.3	1.3	1.3
24.	Drain At Maharani Enclave From Yadav Property To Hastal Village (40 Ft Rd.)	580	1.3	1.2	1.2
25.	A-block Vikas Puri Drain LHS	430	1.3	0.6	1.0
26.	Covered Drain From Rz-1 To G-8 Parjapat	960	1.3	0.7	1.1

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
	Colony RHS				
27.	Rz Block Vishnu Garden Drain	275	1.3	1.0	1.1
28.	Covered Nalla Binda Pur To Matiala Road (ap.sno. 7&9) LHS	1405	1.3	0.6	0.9
29.	Malik Music Center To Manoj Builder A	145	1.3	0.9	1.1
30.	Ne 195 To Na 224 Visnu Garden	270	1.3	0.9	1.1
31.	S-221-1 To New Khyala Road	280	1.3	1.0	1.1
32.	Nalla Baludyen To Subhash Park LHS	370	1.2	0.8	1.0
33.	Pipe Drain At Dada Bhaya Road Ranhola Village From Najafgarh-nangloi Road To Hari Ram pardhan	75	1.2	1.2	1.2
34.	A-block Vikas Puri Drain RHS	335	1.2	0.7	0.9
35.	Hastsal Road From N.g.road (m.pillar No.662) To A-2 Block Uttam Nagar	380	1.2	0.8	1.1
36.	Pali Factory To Binda Pur Village Piped Drain Anup Nagar	670	1.2	0.9	1.0
37.	B-block To Sewarge Treat Plant Bakkarwala Jj Colony	225	1.2	1.2	1.2
38.	Covered Drain Along Police Chowki Road From N.g. Road To 1-51 Kiran Garden LHS	465	1.2	0.7	1.0
39.	Rajokri	1570	1.2	1.0	1.1
40.	Drain At Dal Mill Road From N. G. Road(pillar No.-685)to Holi Chowk Uttam Nagar LHS	570	1.1	0.9	1.0
41.	Nallah In Hastsal Lig Flats And Covered Drains Hastsal Village(pipal Wala Chowk)	980	1.1	0.8	1.0
42.	Drain From Gill House To Sr.sec. School	575	1.1	0.8	1.0
43.	Hastsal Nawada Drain From Pond To Hastsal Village.	760	1.1	0.7	0.9
44.	Covered Drain Pocket-4 Binda Pur Village RHS	415	1.1	0.7	0.8
45.	Covered Nalla Binda Pur To Matiala Road RHS	800	1.1	0.6	0.8
46.	Hari Mandir (chand Nagar Road) To F-166 F Block Visnu Garden	205	1.1	0.9	1.0
47.	III-a 7 To III-a 102 Gurudwara Bhatta Sahib Drain	118	1.1	1.0	1.1

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
48.	A-block To Sewarge Treat Plant Bakkarwala Jj Colony	235	1.1	0.9	1.0
49.	Drain From S5a To S-51 Param Puri LHS	330	1.0	0.5	0.7
50.	Transit Camp Drain 0	85	1.0	0.8	1.0
51.	40 Foota Road LHS	2500	1.0	1.0	1.0
52.	40 Foota Road RHS	800	1.0	1.0	1.0
53.	SDMC West Zone M-IV	290	1.0	1.0	1.0
54.	M141 RHS	370	1.0	1.0	1.0
55.	DDA Nallah LHS	900	1.0	1.0	1.0
56.	Old Mehrauli Road Lhs from railway line LHS	420	1.0	1.0	1.0
57.	Village Dhansa RHS	195	1.0	1.0	1.0
58.	Palm Link Road To Dad Out Fall Near Jain Public School RHS	300	1.0	1.0	1.0
59.	Shahabad Mohd.pur Village LHS	860	1.0	1.0	1.0
60.	Pochanpur LHS	650	1.0	1.0	1.0
61.	Ramphal Chowk To Shiv Mandir Palm Village RHS	770	1.0	1.0	1.0
62.	Mad Primary School Palam Village To Dad Out Fall Manglapuri LH	510	1.0	1.0	1.0
63.	Sec.16a JJ Colony LH	640	1.0	1.0	1.0
64.	Sec.16a JJ Colony S	605.	1.0	1.0	1.0
65.	Drain Connected Firni Of Village Matiyala To Sehyog Vihar 123 LHS	650	1.0	1.0	1.0
66.	Nallah In Village Nanak Heri RHS	1200	1.0	0.5	0.6
67.	Matiyala Approach Road Both Side LHS	880	1.0	1.0	1.0
68.	Matiyala Approach Road Both Side RHS	890	1.0	1.0	1.0
69.	Rewla Khanpur Village LHS	470	1.0	1.0	1.0
70.	Rewla Khanpur Village RHS	610	1.0	1.0	1.0
71.	Matiyala Firni LHS	365	1.0	1.0	1.0
72.	Matiyala Firni RHS	620	1.0	1.0	1.0
73.	Matiyala Firni2 LHS	180	1.0	1.0	1.0
74.	Matiyala Firni2 RHS	110	1.0	1.0	1.0
75.	Opp. Govt. School Matiyala Firni To Achar Factory LHS	320	1.0	1.0	1.0
76.	Opp. Govt. School Matiyala Firni To Achar	340	1.0	1.0	1.0

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
	Factory RHS				
77.	Gurudwara Road From N.g Road (m.pillar No.743) To H. N. A-65 Mohan Garden LHS	75	1.0	1.0	1.0
78.	Manglapuri Ph.-II Drain	235	1.0	0.0	0.7
79.	Mother Dairy To Dustbin To Dad Nallah LHS	220	1.0	1.0	1.0
80.	Mother Dairy To Dustbin To Dad Nallah RHS	435	1.0	1.0	1.0
81.	Old Mehrauli Road –From Railway Line Boundary Wall To Palam Village RHS	650	1.0	1.0	1.0
82.	Palm Goal Chaker To Near Fly Over RHS	240	1.0	1.0	1.0
83.	West Sagarpur Drain	520	1.0	0.0	0.8
84.	Block Tilak Nagar Drain RHS	680	1.0	0.9	0.9
85.	Covered Drain From T-30 To T-136 Sukkar Bazar Road RHS	295	1.0	0.5	0.7
86.	Drain From S5a To S-51 Param Puri RHS	910	1.0	0.8	0.9
87.	Shyam Nagar To Main Khayala Road	110.	1.0	0.9	1.0
88.	Nalla Baludyan To Subhash Park RHS	370	1.0	0.6	0.8
89.	Piped Drain Pocket-4 To C-1 Pankha Road	590	1.0	0.8	0.9
90.	Covered Drain Along Police Chowki Road From N.g. Road To 1-51 Kiran Garden RHS	480	1.0	0.6	0.9
91.	Community Center J Block To J-220-21	265	0.9	0.9	0.9
92.	Vipin Garden To Shive Mandir Booth Side LHS	245	0.9	0.5	0.8
93.	Kakrola Dairy LHS	135	0.9	0.9	0.9
94.	Drain Connected Matiyala Extn. To Dad Nallah LHS	240	0.9	0.9	0.9
95.	Drain Connected Matiyala Extn. To Dad Nallah RHS	34	0.9	0.9	0.9
96.	Covered Drain From T-30 To T-136 Sukkar Bazar Road LHS	490.	0.9	0.5	0.7
97.	sump well to pankha road drain	850	0.9	0.9	0.9
98.	Covered Drain Pocket-4 Binda Pur Village LHS	395	0.9	0.5	0.7
99.	Drain From A Block RHS	280.	0.8	0.8	0.8
100.	Gali No-7 Sadh Nagar	1380	0.8	0.8	0.8
101.	Rond Kharkhadi RHS	225	0.8	0.8	0.8
102.	Issapur Village LHS	2020	0.8	0.8	0.8

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
103	Neelkanth Mandir Nallah LHS	990	0.8	0.8	0.8
104	Rangpuri Village Near Telco Station LHS	990	0.8	0.8	0.8
105	Vipin Garden To Shive Mandir Booth Side RHS	230	0.8	0.7	0.7
106	Cremation Ground Nallah	295	0.8	0.8	0.8
107	Bagdaula Village RHS	230	0.8	0.8	0.8
108	Barthal Village LHS	1300	0.8	0.8	0.8
109	Drain Bala Ji To Flood Drain	297	0.8	0.8	0.8
110	Kapasera Village LHS	530	0.7	0.7	0.7
111	Kapasera Village RHS	525	0.7	0.7	0.7
112	Kakrola Road Girl School LHS	795	0.7	0.7	0.7
113	Kakrola Road Girl School RHS	790	0.7	0.7	0.7
114	Ashok Nagar Barrel Drain	800	0.7	0.7	0.7
115	Najafgarh Road LHS	450	0.6	0.6	0.6
116	M141 LHS	200	0.6	0.6	0.6
117	Gallibpur Village Nallah LHS	1080	0.6	0.6	0.6
118	Mahipalapur Extension Open & Covered Drain	550	0.6	0.6	0.6
119	Mansa Ram Park RHS	425	0.6	0.6	0.6
120	Mahipalpur L Block Nallah Open & Covered LHS	550	0.6	0.6	0.6
121	Mahipalpur L Block Nallah Open & Covered RHS	710	0.6	0.6	0.6
122	Mahipalpur L Block Nallah Open & Covered RHS-1	105	0.6	0.6	0.6
123	Mamta Bakery Nallah LHS	230	0.6	0.6	0.6
124	Mamta Bakery Nallah RHS	270	0.6	0.6	0.6
125	Samalkha Village LHS	95	0.6	0.6	0.6
126	Ambrai Village LHS	430	0.6	0.6	0.6
127	Ambrai Village RHS	370	0.6	0.6	0.6
128	H-block To Old Mehrauli Road RHS	165	0.6	0.6	0.6
129	Kair Village LHS	345	0.6	0.6	0.6
130	Kakrola Housing Complex Nallah LHS	95	0.6	0.6	0.6
131	Kakrola Housing Complex Nallah RHS	410.	0.6	0.6	0.6
132	Nallah In Chawla Village At Dhulsiras Road LHS	2440.0	0.6	0.6	0.6

Sr. No.	Drain Name	Length (m)	Width (m)		
			Max	Min	Average
133	Drain 4 136-2 To Chemist Shop LHS	340	0.6	0.6	0.6
134	Nallah In Village Bedu Sarai LHS	360	0.6	0.6	0.6
135	Patel Graden –Small RHS	365	0.6	0.0	0.3
136	Pochanpur RHS	1570	0.6	0.6	0.6
137	Raj Nagar (corner Of Park To Dada Dev Mandir Road) LHS	17	0.6	0.6	0.6
138	Raj Nagar (corner Of Park To Dada Dev Mandir Road) RHS	33	0.6	0.6	0.6
139	Drain Connected To Phirni Of Village Matiala And Sector-3 RHS	450	0.6	0.6	0.6
140	Nallah In Village Kangan Heri LHS	440	0.6	0.6	0.6
141	Old Palm Road Final LHS	1500	0.6	0.6	0.6
142	Old Palm Road Final RHS	1700	0.6	0.6	0.6
143	Panwala Kalan LHS	650	0.6	0.6	0.6
144	Panwala Kalan RHS	370	0.6	0.6	0.6
145	Mansa Ram Park Diamond General Store To Delhi Najafgarh Road LHS	520	0.6	0.6	0.6
146	Mansa Ram Park Diamond General Store To Delhi Najafgarh Road RHS	510	0.6	0.0	0.5
147	Daulatpur Village LHS	1070	0.6	0.6	0.6
148	Segyog Vihar Nallah RHS	380	0.6	0.6	0.6
149	Main Surakhpur Road LHS	1100	0.6	0.6	0.6
150	Gummanhera Village LHS	1050	0.5	0.5	0.5
151	Shyam Vihar 25 Foota Road RHS	1100	0.5	0.5	0.5
152	Village Kazzipur RHS	540	0.5	0.5	0.5

### 3.1.3. STP and Sewerage Network in Delhi

Delhi generates 3268 MLD of sewage per day against available treatment capacity of 2756 MLD, whereas only around 2083 MLD is being treated (Source: Yamuna- Revival website). The data for sewage generation, treated, capacity of STP, function and total STPs in Delhi has been sourced from information available from different sources in public domain as on June 2020 and provided in Table 5. The data of All sources provide different set of data as shown in Table 5. CPCB in its CUPS report of 2005-06 (CUPS/61/2005-06) estimated that the sewage generation in Delhi was 3.88 million KLD, which is higher than the present estimates (5). These estimates are corroborated by Table 5 values, considering the flow-in to the drains, which is estimated to be around 3991 MLD.

**Table 5: Delhi Sewage Treatment Scenario at a glance**

Source	Hindustan Times (1) (Feb 2019) (In MLD)	3 <sup>rd</sup> Interim Report to NGT (2) (Feb 2020) (In MLD)	Yamuna Revival(3)/ DPCC (4) (2019) (In MLD)
Sewage generation	2.275	2832	3268
Sewage treated	1737	1855	2083 <sup>A</sup>
			2029 <sup>B</sup>
Treatment Capacity	2298	2260	2756
			2579 <sup>C</sup>
Functional STPs	33  37 <sup>D</sup>		32  34 <sup>C</sup>
Total STPs	41		41

*Notes: The report by the Yamuna Revival website provides two different treatment volumes. The volume of A is provided as an overall treatment achieved in Delhi and that of B is provided as treatment volume realised from operational STPs. The treatment capacity and functional STP in C has been quoted by the DPCC for January, 2019. The treatment capacity & functional STPs as provided in D is quoted as per the Chapter-3 of the Water supply and Sanitation report by Planning Department, Government of NCT Delhi, 2019.*

As per DPCC report of 2019 (4), there are 41 STPs in Delhi spread over 22 locations. Two STPs are closed, 2 under are renovations. 37 STPs are operational in 20 locations. However, the sewerage master plan states that 34 STPs are working in 21 locations. The details of present STPs with their locations in Delhi are provided in Table 6. The sewerage network is 8400 km in length with the internal & peripheral sewer consisting of 200 km trunk sewers supported by 58 major

sewage pumping stations. The largest cluster of STPs is situated in Okhla cluster consisting of six numbers of treatment plant with capacity of 771.72 MLD. This is followed with two STPs in Rithala cluster with 373.2 MLD capacity and three STPs in Keshopur with 352.62 MLD capacity. All three cluster of STPs fall under the administrative boundary of SDMC. However it may be noted that the treatment capacity realised is only 77.88% at current levels. In general, in Delhi, the sewage treatment achieved is 65.69% of the total wastewater (sewage) generation. The sewerage is managed Delhi Jal Board (DJB) for municipal areas comprising of 95% of the total area.

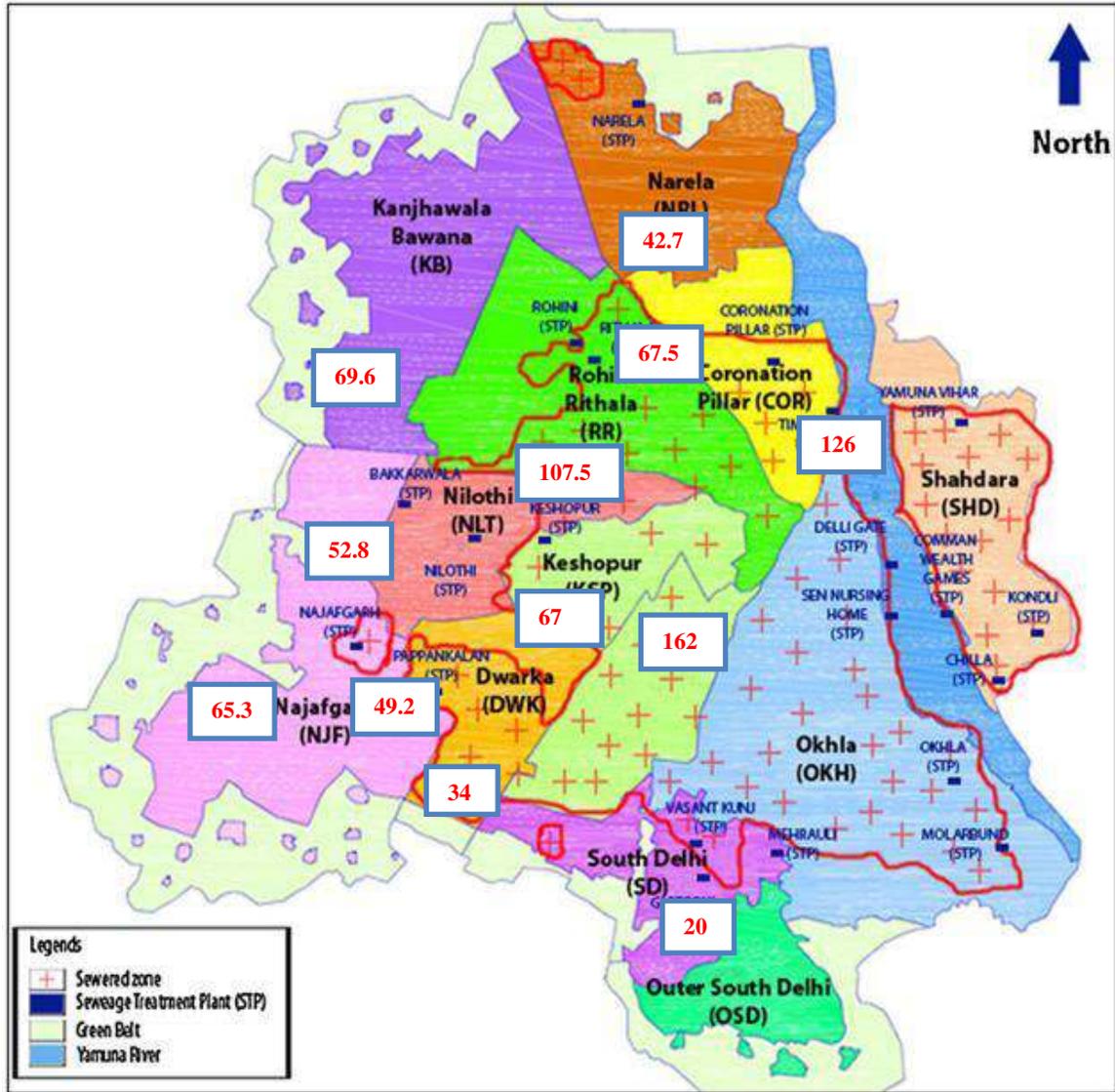
Deficiency in actual treatment and generation sewage can be attributed to settlement of sewers, non operation of sewage pumping stations, overflow from sewers into storm water drains. Presently, the urban area of Delhi is served by a gravity collection sewerage system involving a large network of branch sewers, intercepting sewers, peripheral and trunk sewers. In past the emphasis was to provide piped water supply to both urban & rural areas. As a result, growth in sewerage facilities has not been commensurate with the sewage generation. Even today, only about 55% of the population of Delhi is served by the sewerage system and drains also carry the sewage flow from entering into storm water drains and laying of sewers in unauthorized colonies.

**Table 6: Present STP locations in Delhi with their capacities**

Sr.No	Name of the STP	Location (No of STP's)	Installed Treatment Capacity (2018)MLD
1.	Okhla-1	Okhla (06)	771.72
2.	Okhal-2		
3.	Okhla-3		
4.	Okhla-4		
5.	Okhla-5		
6.	Okhla-6		
7.	Keshopur, Phase-1	Keshopur (03)	325.62
8.	Keshopur, Phase-2		
9.	Keshopur, Phase-3		
10.	Coronation Pillar, Phase-1	Coronation Pillar (03)	181.6
11.	Coronation Pillar, Phase-2		
12.	Coronation Pillar, Old		
13.	Kondli, Phase-1	Kondli (04)	45.4
14.	Kondli, Phase-3		45.4
15.	Kondli, Phase-2		317.8
16.	Kondli, Phase-4		

Sr.No	Name of the STP	Location (No of STP's)	Installed Treatment Capacity (2018)MLD
17.	Rithala Phase-1	Rithala (02)	373.2
18.	Rithala, Pase-2		
19.	Vasant Kunj, Phase-1	Vasant Kunj (02)	22.70
20.	Vasant Kunj, Phase-2		
21.	Yamuna Vihar, Phase-1	Yamuna Vihar (03)	204.4
22.	Yamuna Vihar, Phase-3		
23.	Yamuna Vihar, Phase-2		
24.	Narela	01	45.4
25.	Pappan Kalan, Phase-1	Pappan Kalan (02)	181.6
26.	Pappan Kalan, Phase-2		
27.	Najafgarh	01	22.7
28.	Delhi Gate Nallah, Phase-1	Delhi Gate (02)	69.0
29.	Delhi Gate Nallah, Phase-2		
30.	Sen Nursing Home Nallah	01	9.98
31.	Rohini	01	68.1
32.	Nilothi, Phase-1	Nilothi (02)	272.4
33.	Nilothi, Phase-2		
34.	CWG village	01	4.54
35.	Molarband	01	2.99
36.	Kapashera	01	22.7
37.	Chilla	01	40.86
38.	Mehrauli	01	68.1
39.	Ghitorni	01	22.7 (Non-functional)
40.	Bakarwala (mini STP)	01	2.99(Closed)
41.	Timarpur (Oxidation Pond)	01	27.24 (Closed)

For the management of drainage, Delhi is divided into twelve zones (Figure 2) i.e. 1) Rohini-Rithala, 2) Coronation Pillar 3) Keshopur; 4) Okhla; 5) Trans Yamuna; 6) Outer South Delhi; 7) South Delhi; 8) Dwarka; 9) Najafgarh; 10) Nithoi; 11) Kanjhawala; 12) Narela



**Figure 2: Sewerage and drainage zone in Delhi and projected Wastewater generated from different Zones, 2021 in MGD**

Table 7 provides the STP catering to the drain or discharge as the case is. It may be noted from the table that Najafgarh drain currently experiences the highest hydraulic load among all the drains.

**Table 7: STP catering to Drains and Discharges**

Sr.No.	Drain/Discharge	STP Catering to the drain/Discharge
1.	Najafgarh (Drain)	Coronation Pillar (supplementary drain), Narela, Rohini, Rithala, Nilothi, Pappan Kalan and Timarpur
2.	Shahdara (Drain)	Sonia Vihar, Yamuna Vihar and Kondli
3.	Delhi Gate (Drain)	Delhi Gate (Power Plant)
4.	Sen Nursing Home (Drain)	Sen Nursing Home (Power Plant)
5.	Barapulla (Drain)	No STP
6.	Tughlakabad (Drain)	No STP
7.	Hauz Khas Lake (Discharge)	Vasant Kunj
8.	Agra Canal (Discharge)	Okhla

Though figure 2 shows significant area of SDMC is under sewer. However Due to expansion of irregular colonies, still huge amount of untreated sewage still flows into drains in SDMC area. It can be seen from table 8, showing future projects to be taken up by Government of Delhi for providing sewerage connections to corresponding STPs or Waste Water Treatment Plant (WWTP) in catchment areas that major projects are under administrative boundaries of SDMC.

**Table 8: Unauthorized colonies and locations with their proposed WWTP**

Sr.No.	Selected Colonies and Locations	Catchment area (WWTP)
1.	Batla House Sub-drainage Zone (Phase-I) Pul Prahladpur, Vishwakarma Colony Chungi No.3 and Lal Kuan, Maidangarhi & Saidulajab, Batla House, Phase-II GOC, Sangam Vihar GOC Ph-I, Vijay Enclave, Mahaveer Vihar, Bengali Colony	Okhla
2.	Colonies of Mehrauli Chhattarpur & Lado Sarai	Mehrauli
3.	Rangpuri Pahari, Nangal Dewat, Ghitorni village, Ghitorni Extn. & Ghitorni Enclave	Ghitorni
4.	F & D Block, Mahaveer Enclave, Kailashpuri Extn. Sagarpur & Durga Park	Dwarka
5.	Gokalpur, Mustafabad and Karawal Nagar	Yamuna Vihar
6.	Vikaspuri, Shiv Enclave colonies, Ranhola	Nilothi

Some other proposed work as provided by the Planning Department, Delhi Jal Board is provided in Table 9. Here also it shows that out of seven projects, five are under SDMC administrative area.

**Table 9: Proposed STP, Sewage Pumping Station (SPS) and Waste Water Pumping Station**

STP	SPS, Peripheral Sewer	Drains
9 Nos.	1 no.	Najafgarh drain (Dhansa to Goyla)
5 Nos.	2 no	Najafgarh drain Goyla to Keshopur
25 MLD		Rejuvenation of Timarpur oxidation ponds using PhytoridTechnology with natural sustainable treatment process
8 MGD		Delhi Cantonment Board
80 MGD	1 no	Maharani Bagh
4 MGD	1 no WWPS	Okhla
8 MGD	1 no WWPS	Ghitorni

### 3.1.3.1 Mixing of Sewage and Drainage

The purpose of drains is to provide a safe passage to the water accumulated due to rainfall or to any other clean surface water. It is fundamentally neither suitable nor designed for carrying sewage or industrialwastewater or even septic tank effluent. Even the effluent from the sewage treatment plant cannot be discharged into drain unless it meets the norms set by theCentral Pollution Control Board. One of the common practice in Delhi in orderto avoid back flow and immediate relief is puncturing the sewerage line and divertingthe sewage to nearby drains. Thus the raw sewage mixed with stormwater directly flow to the major drains and ultimately to the Yamuna. In Delhi another common site is punctured sewer lines before enteringinto the compound of the STP and the untreated sewage allowed to flow in the drains.

### 3.1.3.2 Segregation of sewage and drainage

The major problem pollution of drainage in Delhi is mixing of sewagewith storm water and discharge into the drains. The storm water drains are neither designed nor supposed to carry the sewage. Delhi should have separate sewerage and drainage network. It is recommended that separate drainage and sewerage system be planned and constructed and necessary measures to be taken so that sewage is not mixed with storm water drains during floods

### **3.1.4. Site Analysis of the drains on the basis of secondary data:**

Overall in NCT of Delhi there are 18 drains which flow into Yamuna. The treated water from some of the STPs also drain into these. Table 10 provides the list of major drains, hydraulic load handled and organic load in tonnes per day outflowing into Yamuna. The data is from 2011-12. Hence, assuming that the decadal growth of population from 2011-2021 is 18.03% as per Census of India, the load would have increased to around 18% by 2020. Figure 3 shows schematic diagram of drains falling out in Yamuna. Najafgarh drain contributes around 65%, Shahdara drain, around 20%, Delhi gate 7%, Sen Nursing Home, 3%, Barapulla and Tuglakabad, both 2% each. Drains carry treated/untreated wastewater comprising of Municipal Sewage and Industrial effluent from different clusters of Delhi.

Drains out flowing to Yamuna from SDMC area are (i) Delhi Gate, (ii) Sen Nursing Home + Drain no 12, (iii) Drain no, 14, (iv) Barapulla drain, (v) Maharani Bagh, (vi) Abu Fazal drain, (vii) Jaitpur drain, (viii) Tuglakabad Drain. Out of these drains Maharani Bagh is proposed to have 80 MLD STP which is more than drain flow. Other major drain have STP at Delhi Gate, and Sen Nursing Home also have STPs but with much lesser capacity than flow. Leaving these three drains there are five drains out falling to Yamuna without passing through STP.

#### **(i) Delhi Gate drain**

Delhi gate drain contributes about 222 MLD of wastewater to river Yamuna and its share is about 6.5 % of total flow of drains joining river Yamuna between Wazirabad to Okhla. The BOD load contribution is about 20 t/d (8.7 %). Only one STP (Delhi Gate STP) having 69 MLD capacity is installed in the catchment of this drain

#### **(ii) Sen Nursing Home drain + Nallah no 12**

Sen Nursing home drain contributes about 68 MLD of wastewater to river Yamuna and its share is about 2 % of total flow of drains joining river Yamuna between Wazirabad to Okhla. The BOD load contribution is 10 t/d (4%). Only one STP (Sen nursing home STP) having capacity of 10MLD is installed in the catchment of this drain.

#### **(iii) Barapulla Drain**

Barapulla drain discharge 86 MLD of wastewater to river Yamuna and contributes about 2.5 % of total flow of drains added to river Yamuna from Wazirabad to Okhla stretch. No STP is located in

catchment area of Barapulla drain. However one Bio-remediation project “Lotus” is working on this drain

**(iv) Tugalkabad drain**

90 MLD of wastewater is discharged to river Yamuna whereas BOD load is 6 t/d. Tugalkabad drain contributes 2.6 % of hydraulic load whereas contribution of organic load is 2.6 %.No STP is located in catchment area of Barapulla drain

**Table 10: Drains of NCT Delhi out flowing to Yamuna**

Sr.No.	Drains	Flow in 2012, MLD	Estimated Flow in 2020 (MLD)	BOD load (TPD)
1.	Najafgarh Nallah	2064	2435.52	108
2.	Magzine Road drain	17	20.06	3
3.	Sweeper Colony drain	4	4.72	0.15
4.	Khyber Pass drain	4	4.72	0.18
5.	Metcalf House drain	6	7.08	0.27
6.	ISBT + Mori gate drain	45	53.1	3.38
7.	Tonga Stand drain	5	5.9	1.14
8.	Kailash Nagar drain	8	9.44	1.22
9.	Civil Mill drain	40	47.2	4.39
10.	Delhi Gate (power house) drain	222	261.96	20.01
11.	Sen Nursing home drain	68	80.24	10.53
12.	Drain no.14	8	9.44	0.18
13.	Barapulla drain	86	101.48	6.25
14.	Maharani Bagh drain	33	38.94	3.49
15.	Abu Fazal drain	26	30.68	1.13
16.	Jaitpur drain	19	22.42	1.30
17.	Tuglakabad drain	90	106.2	6.20
18.	Shahdara drain	638	752.84	57.19
	<b>Total</b>	<b>3383</b>	<b>3991.94</b>	



**Figure 3: Schematic diagram of drains falling out in Yamuna**

Besides drains out falling to Yamuna other drains in SDMC area were analyzed for the purpose of in situ treatment. Drains were analyzed on the basis of physical parameters i.e. width and length as both the parameter are critical for insitu treatment. Further on the basis of discussion with SDMC it was decided to choose drains above 1 m width and depth for intervention.

Total drains having width and depth more than 1 m under the jurisdiction of SDMC are presented in table 11. Total length of such drains in SDMC area is approximately 200 km with approximate discharge 175-200 MLD untreated sewage in dry weather (Approximation using data from table 6, table 10, and table 11)

These drains are further classified in four categories (i) with maximum width more than 9 m, sufficient length, and if their outfall is in Yamuna, are proposed for in situ treatment intervention to achieve discharge quality as per NGT norms, (ii) having width between 4-9 m to be treated following scheme upto secondary treatment to meet MoEF standards and, (iii) drains with width between 1 m to 4m to be treated upto secondary treatment but not to meet discharge standards. All drains below 1 m will be subjected to primary treatment while closed drains will be provided with screens at the outfall. More discussion on treatment strategy is in methodology section. It can be

seen that maximum width of drains in Najafgarh zone is less than 5 mand also no drain of Najafgarh zone in SDMC area is out falling into Yamunatherefore all the drains in Nazafgarh zone are type three drain and subjected to secondary treatment but not to meet any discharge norms. Type I and II drains needed treatment to meet discharge norms fall only in south, west and central zone. Type I drains needed major interventions to meet NGT discharge norms are presented in table 23.

**Table 11: : Details of drains under the Jurisdiction of SDMC**

S.No	Drain	Concerned Division	Length (m)	Cross section of the drain near/ at the outfall	Dry weather discharge MLD	Is any remediation/ waste water treatment system/STP has been installed in the said drain	Provision of screening made in the drain	The outfall point where the said drain is meeting with the bigger drain/ Yamuna	The outfall drain owing Authority/Agency	Remarks
1	Jia Sarai nalla from culvert near Katwaria in IIT to Olof Palme Marg	EE-M-I/SZ	800	0.95 x 3.10	NA	No	Yes	Outer Ring Road at Deer Park	DDA	
2	Jia Sarai outfall drain along IIT Boundary wall	EE-M-I/SZ	80	0.65 x 1.40	NA	No	Yes	Outer Ring Road at PWD Drain	PWD	
3	Arjun Nagar Nalla from Humayunpur to A.I.I.M.S. (Near Cremation Ground Green Park	EE-M-I/SZ	1500	5.00 x 4.30	NA	Yes	Yes	Ansari Nagar Nalla	CPWD	K Block Park Green park Ext
4	Nauroji Nagar nalla from Bhikaji Cama Plaec to Ring Road	EE-M-I/SZ	1250	14.50 x 4.30	NA	No	Yes	Ring Road near sarojini Nagar Flyover	NDMC	
5	Covered drain from C-2/60 SDA to Aurbindo Marg	EE-M-I/SZ	150	2.30 x 1.85	NA	No	No	Aurobindo Marg drain	PWD	
6	Green Park Nalla from MCD School to Aurbindo Marg Evergreen Sweets	EE-M-I/SZ	650	1.60 x 1.65	NA	No	No	Aurobindo Marg drain	PWD	
7	K&P block SDA drain from Saint Paul School to Aurbindo Marg drain	EE-M-I/SZ	350	2.30 x 1.85	NA	No	Yes	Narender Pandey Marg Drain	PWD	
8	Kalu Sarai nalla Begumpur to along Park, Sarvpriya Vihar	EE-M-I/SZ	275	1.70 x 1.50	NA	No	No	Outer Ring road drain	PWD	
9	Gautam Nagar Nallah from Indian Oil to bridge behind AIIMS (reach from IOC to	EE-M-I/SZ	310	8.50 x 2.80	NA	No	Yes	Gautam Nagar Nalla AIIMS portion	CPWD	

	F-130, F-110 Gautam Nagar)									
10	Gulmohar Enclave outfall drain covered (20 Nos. Manhole)	EE-M-I/SZ	210	0.50 x 1.25	NA	No	Yes	Balbir Saxena Marg Drain	PWD	
11	Vasant Vihar Nalla from Culvert on Munirka Marg to H.No. A-25, Olf Palme Marg	EE-M-I/SZ	1450	14.50 x 3.00	NA	Yes	Yes	Olef Palme Marg near Indira Market	SDMC	STP pertains to Horticulture Deptt
12	Guru Harkishan Public School Nalla in Vasant Vihar from DDA park to Vasant Vihar	EE-M-I/SZ	500	1.50 x 1.80	NA	No	Yes	Vasant Vihar Nalla	SDMC	
13	Indian Air Lines nalla in Vasant Vihar from H.No. 38 to Poorvi Marg, Indian Airlines	EE-M-I/SZ	400	1.55 x 1.60	NA	No	Yes	Indian Lines Chamber in Poorvi Marg	PWD	
14	U/S. Nalla No. 6 & Vasant Enclave Drain	EE-M-I/SZ	100	1.10 x 1.65	NA	No	Yes	Olef Palme Marg near RTR crossing	SDMC	
15	DPS Nalla R.K. Puram from DPS School to Ambedkar Basti (Covered during CWG)	EE-M-I/SZ	480	1.10 x 4.65	NA	No	No	Ambedkar Basti Nalla	SDMC	
16	Ambedkar Basti J.J. Camp Nalla from Kushta Camp to Ring Road	EE-M-I/SZ	900	9.50 x 6.10	NA	No	Yes	Ring Road near CNG Pump	NDMC	
17	Som Vihar nalla from Som Vihar Apartment to DPS School	EE-M-I/SZ	320	0.80 x 1.20	NA	No	No	DPS Nalla	SDMC	
18	Nalla No.5 R.K. Puram from Outer Ring Road to Sangam Cinema, R.K. Puram	EE-M-I/SZ	950	4.00 x 3.20	NA	No	Yes	Som Vihar Nalla	SDMC	
19	Nallah No. 6 from Outer Ring Road near Kendriya Vidyalaya Sec.-VIII R.K. Puram to T-point of Rao Tula Ram Marg and Som Nath Sharma Marg in R.K. Puram	EE-M-I/SZ	950	2.50 x 2.00	NA	No	No	At T point of RTR and Major Somnath Marg Sector-12 Nalla	PWD	
20	Nalla No. 4 R.K. Puram from Outer Ring to EKTA camp	EE-M-I/SZ	700	8.00 x 5.30	NA	No	Yes	Ambedkar Basti Nalla at Mohan Singh Market Culvert	SDMC	
21	Munirka drain from D.D.A. Flat to Outer Ring Road	EE-M-I/SZ	450	0.60 x 1.50	NA	No	No	Olef Palme Marg (PWD Drain)	PWD	
22	Nalla No. 2 R.K. Puram from	EE-M-I/SZ	1350	9.00 x 4.50	NA	No	Yes	Africa Avenue	SDMC	

	Church to DDA park Sect. IV, R.K. Puram							Marg near 36pproxRK Puram Sector-2		
23	Nalla No. 3, Sect.-3, R.K. Puram from H.No. 506 type IV, Sect.-3 R.K. Puram to Masjid Olf Palme Marg	EE-M-I/SZ	700	11.00 x 3.30	NA	No	Yes	Africa Avenue Marg near DJB Pump House (Rose Garden)	DDA	
24	Minirka Vihar outfall dain	EE-M-I/SZ	300	0.60 x 1.50	NA	No	Yes	at Nelson Mendela Marg DDA Park	DDA	
25	Munirka Village outfall drain from Village to DDA flats Munirka	EE-M-I/SZ	160	0.60 x 1.50	NA	No	Yes	Near Rock Garden Gate	SDMC	
26	From DPS School Pushp Vihar Sector-6 to Press Enclave Road	M-II/South	440	19.50 x 2.00	NA	No	No	--	SDMC	
27	D/S Virat drain from BRT Corridor to main Nallah Pushp Vihar Sector – 4	M-II/South	400	1.00 x 1.80	NA	No	Yes	Chirag Delhi Drain	SDMC	
28	L-Block Nallah from H. No. 322 L-Block to culvert near Mount Columbus School C-Block Dakshin Puri	M-II/South	573	3.00 x 1.80	NA	No	No	Chirag Delhi Drain	SDMC	
29	Central Market Nallah from BRT to main Nallah Pushp Vihar	M-II/South	270	2.40 x 2.40	NA	No	No	Chirag Delhi Drain	SDMC	
30	GK Nallah from Chirag Delhi Flyover to link road culvert near Central School	M-II/South	2075	19.50 x 2.00	NA	Yes	Nil	Barapulla	SDMC	
31	Shapur Jat drain from DDA office to August Kranti Marg Nallah	M-II/South	300	0.85 x 1.50	NA	No	NA	August Kranit Marg	SDMC	
32	R&S Block Nallah from S-363 to B- 272 GK-I	M-II/South	700	1.80 x 1.50	NA	No	Yes	Chirag Delhi Drain	SDMC	
33	Ajeet Arcade Nallah near LSR Nallah College from Lal Lajpat Ray Marg to Kalka Devi Marg	M-II/South	100	3.00 x 1.80	NA	No	No	PWD drain on Kalka Devi Marg	PWD	
34	Sant Nagar Cevered drain	M-II/South	600	1.80 x 1.50	NA	No	No	Chirag Delhi Drain	SDMC	
35	Nallah along August Kranti Marg from Panchsheel Club to	M-II/South	1500	2.40 x 2.00	NA	No	No	Chirag Delhi Drain	SDMC	

	Kamla Nehru College									
36	Masjid Moth DDA Flat drain from DDA flat to outer Ring Road near Motor Mkt.	M-II/South	100	1.70 x 1.80	NA	No	No	Chirag Delhi Drain	SDMC	
37	Back side drain Tara Apartment from Gate of Tara Appt. To Ravi Dass Marg	M-II/South	60	1.00 x 1.50	NA	No	No	PWD drain on Guru Ravi Das Marg	PWD	
38	DDA Flat Nallah Kalkaji near Ramhji Lal Complex	M-II/South	300	0.75 x 1.50	NA	No	No	Chirag Delhi Drain	SDMC	
39	Chirag Delhi Vill. Nalla from Press Enclave Road to Outer Ring Road	M-II/South	1400	19.50 x 2.00	NA	No	No	Barapulla	SDMC	
40	Jagdamba Camp nalla from Triveni Complex culvert to Chirag Delhi nallah	M-II/South	200	3.00 x 1.80	NA	No	Yes	Chirag Delhi Drain	SDMC	
41	S-block Panchsheel Park covered drain from S-I to S-60	M-II/South	200	0.9 x 1.25	NA	No	No	August Kranit Marg	SDMC	
42	Mehrauli dargah Nallah & Dargah Jamali Kamali Nallah	EE-M-III/SZ	163	2.50 x 2.00	NA	Yes	No	Jamali Kamali DDA Nallah	DJB	The outfall of these drain on STP , Ladda Sarai
43	Nallah from Mandir to Police Station Mehrauli	EE-M-III/SZ	123	0.80 x 1.20	NA	Yes	No	P S, Mehrauli	DJB	
44	Samshi Talab Nallah Mehrauli from Bagh to Samsi Talab	EE-M-III/SZ	235	1.20 x 1.25	NA	Yes	No	Near Shamshan Ghat DDA Nallah	DJB	
45	Nallah from M.B. Road to Jalebi chowk	EE-M-III/SZ	850	0.80 x 1.30	NA	No	No	MB Road	PWD	
46	Nallah from Janta Jewan Camp to M.B. Road via Pico Factory	EE-M-III/SZ	600	0.80 x 1.30	NA	No	No	MB Road	PWD	
47	Nallah from Jalebi Chowk to Durga Vihar	EE-M-III/SZ	1163	0.95 x 1.30	NA	No	No	Jalebi Chowk	SDMC	
48	Block 14, 16, 17 & 20 nallah Dakshinpuri Pocket 16 to main road.	EE-M-III/SZ	385	1.00 x 1.60	NA	No	No	Deep Sweet Chowk Dakshinpuri	PWD	
49	From H.No760 Block No.3 Dakshinpuri Extn. To Boundary Wall of Jahan Panah City Forest	EE-M-III/SZ	148	1.00 x 1.30	NA	No	No	Mohalla Clinic, B/W of Jahan Panah City Forest	DDA	
50	Nallah from Block No.2 to Dakshinpuri Nallah at	EE-M-III/SZ	250	1.00 x 1.50	NA	No	No	Near Block 1/225 Maharishi	PWD	

	Maharishi Balimiki Marg							Balmiki Marg Dakshinpuri		
51	Central Market Madangir nallah from Shiv Nanda Public School upto Parking near DDA Market Madangir Ph-II	EE-M-III/SZ	590	0.80 x 1.50	NA	No	No	Parking at BRT	SDMC	
52	RPS Drain from BRT Corridor near DDA Flats Madangir to DSIDC F-Block, upto Pushp vihar	EE-M-III/SZ	881	2.00 x 2.00	NA	No	No	Footover bridge Khanpur BRT	SDMC	
53	Pushp vihar main nalla from MB Road to culvert near DPS International School, Pushp vihar	EE-M-III/SZ	980	1.80 x 2.00	NA	No	No	Culvert near DPS International School	SDMC	
54	Pushp vihar District Center, Saket Nalla from Mandir Marg M Block culvert to culvert on Pankaj Jewel Marg in Pushp vihar	EE-M-III/SZ	560	2.20 x 1.50	NA	No	No	Culvert near Distt. Centre Saket	PWD	
55	Katwaria Sarai Nalla Sh.Jeet Singh Marg to Culvert IIT	M-IV/SZ	200	1.00x4.50	NA	No	No	IIT drain, IIT wall, Katwaria sarai	IIT	
56	M-Block Nalla, Saket from Anupam Cinema to M-Block, Saket Mandir Marg	M-IV/SZ	1100	1.00x4.50	NA	No	No	Pushp vihar drain, near Select city mall, M-block, Saket	SDMC (M-II/SZ)	
57	Pocket D-1 & D-2, Vasant Kunj	M-IV/SZ	600	0.60x1.30	NA	No	No	Mehrauli Mahipalpur road drain, Infront of D1&D2, Vasant Kunj	PWD	
58	B 1 Pocket to Fortis Hospital, Vasant Kunj	M-IV/SZ	400	0.40x1.30	NA	No	No	Aruna Asaf Ali road drain, Near fortis hospital	PWD	
59	Phirni Nallah, Rajokari Village	M-IV/SZ	375	0.70x1.30	NA	No	No	NH8 drain, entry point of Rajokari village	CPWD	
60	Sector A Pocket B & C from Shiv Mandir to Jal Board Office, Vasant Kunj	M-IV/SZ	600	0.60x1.30	NA	No	No	Sumpwell, pocket- pocket- B&C, Vasant	SDMC	

								Kunj		
61	Pocket D-3, 4 Gate No.1 to Shopping Centre, Vasant Kunj	M-IV/SZ	600	0.60x1.30	NA	No	No	Mehrauli Mahipalpur road drain, Infront of D3&D4, Vasant Kunj	PWD	
62	Saidulajab Nalla from Gali No-2 to IGNOU Road Saijulajab	M-IV/SZ	350	0.90x2.50	NA	No	No	IGNOU road drain, infront of Hanuman Dharam kanta, Saidulajab	PWD	
63	Chattarpur Mandir Nalla from Mandir to Chattarpur Pahari	M-IV/SZ	1400	1.30x3.00	NA	No	No	60 ft. road, PWD drain, near Chattarpur mandir	PWD	
64	Chattapur Village covered drain from Mata Chowk in Chattapur Village to SSN Marg	M-IV/SZ	500	0.95x0.90	NA	No	No	SSN marg, PWD drain, opposite J.E store, Chattarpur	PWD	
65	Zonapur Village Nallah from Zonapur Village to 250m	M-IV/SZ	250	1.20x1.60	NA	No	Yes	Kachcha drain, near post office, Zonapur	I&FC	
66	Aya Nagar phirmi road drain	M-IV/SZ	335	1.20x1.60	NA	No	Yes	Bandh road drain, near shamshan ghat, Aya Nagar	I&FC	
67	Aya Nagar Sunday market drain upto out fall	M-IV/SZ	900	0.75x1.20	NA	No	Yes	E-block drain, near Dhalao, E-block, Aya Nagar	I&FC	
68	Amberhai Village	M-1/NGZ	500	0.6x1.2	0.5	No	No	Near water body Sector-19	DDA	
69	Pochanpur	M-1/NGZ	1600	0.6x1.2	0.5	No	No	Sector -23 DDA Drdain	DDA	
70	Surakhpur Road both side	M-1/NGZ	2000	0.6x1.5	0.6	No	Yes	Bahadurgarh Road	PWD	
71	Neel Kanth Mandir Nallah	M-1/NGZ	600	08.x1.35	0.5	No	Yes	PWD Drain Near Power house Delhi Road	PWD	
72	28 foota Road	M-1/NGZ	400	0.6x1.2	0.45	No	Yes	I&FC Drain Near School	I&FC	
73	Captain Rishal Singh Marg	M-1/NGZ	280	0.6x1.2	0.45	No	No	PWD Drain Near Reliance fresh	PWD	
74	40 foota Road	M-1/NGZ	2280	0.9x1.3	0.5	No	Yes	I&FC Drain Near	I&FC	

								Metro Quarters		
75	Gurudwara road Nallah	M-I/NGZ	180	0.6x1.2	0.45	No	No	Dharampura drain Near Soot Factory Road	SDMC	
76	Dharampura drain	M-I/NGZ	1275	1.25x2.15	0.9	No	No	Near Bhim Singh Pulia	I&FC	
77	Vaishali Drain,	M-II/NGZ	200	0.75 x1.20	0.4	No	Yes	Near Jindal Public school	I&FC	
78	P & T Barat Ghar to Gali No.63, West Sagarpur	M-II/NGZ	400	0.45x1.20	0.3	No	Yes	Near SI Office	PWD	
79	Gali No.6 Main Sagarpur Nallah	M-II/NGZ	367	0.75x1.20	0.7	No	Yes	Sagarpur Main Road	PWD	
80	Nagar Van Park Road Nallah	M-II/NGZ	400	0.75x1.20	0.5	No	Yes	Sagarpur Main Road	PWD	
81	Dimple Public School Sagarpur to RZ-113/298	M-II/NGZ	220	0.65x1.30	0.8	No	Yes	Near Bus Terminal Manglapuri	PWD	
82	Drain along M.C Pry. School Mangla Puri	M-II/NGZ	250	0.60x1.30	0.3	No	Yes	Near Bus Terminal Manglapuri	PWD	
83	Drain along Mangla Puri Ph-I	M-II/NGZ	530	0.80x1.20	0.2	No	Yes	JE Store	PWD	
84	Drain along MCD Office	M-II/NGZ	340	1.10x1.20	0.4	No	Yes	G.V Public School	I&FC	
85	Shyam Vihar 25 feet road	M-II/NGZ	836	0.45x1.20	0.5	No	Yes	Near Madhu Vihar Bus Stand	DDA	
86	Nallah in Raja Puri from Raja Puri Main Road Back Side of Petrol Pump	M-II/NGZ	450	1.20x1.20	0.6	No	Yes	Nagarvan Road	PWD	
87	Football Chowk to M.C.Pry School Shahabad Mohd.Pur Village in Ward No. 47-S/NGZ	M-III/NGZ	450	1.00 x 1.50	0.35	No	No	Railway Line near MC Pry. School	I&FC	
88	Gurdwara to Railway Station in Shahabad Mohd.Pur in Ward No. 47-S/NGZ	M-III/NGZ	585	1.00 x 1.20	0.15	No	No	Near Railway Station SDMC Drain	SDMC Drain	
89	Bijwasan village in Ward No. 48-S/NGZ	M-III/NGZ	270	0.75 x 1.20	0.10	No	Yes	I&FC Drain near Cremation Ground	I&FC	
90	Bijwasan village in Ward No. 48-S/NGZ	M-III/NGZ	225	0.60 x 1.50	0.15	No	Yes	I&FC through PWD out fall	PWD	
91	Kapashera (Phirni Nallah)	M-III/NGZ	800	0.76 x 1.67	0.15	No	Yes	Najafgarh Drain	I&FC	

	Village in Ward No. 49-S/NGZ									
92	Mahipal Pur Extension open & Covered in Ward No. 50-S/NGZ	M-III/NGZ	430	1.5 x 1.2	0.20	No	No	Chamber on NH-8	NHIA	
93	Mahipal Pur L-Block Nallah cover & open in Ward No. 50-S/NGZ	M-III/NGZ	885	0.8 x 1.2	0.15	No	No	Chamber on NH-8	NHIA	
94	Ranpuri village near Telco Station in Ward No. 50-S/NGZ	M-III/NGZ	800	1.5 x 1.2	0.20	No	No	Chamber on NH-8	DJB	
95	Sector C Pkt-9 in Vasant Kunj covered nallah in Ward No. 50-S/NGZ	M-III/NGZ	345	1.5 x 1.2	0.20	No	Yes	Drain Near STP C-9 Vasant Kunj	DDA	
96	Raj nagar II( Old Mehrauli road LHS) in Ward No. 46-S/NGZ	M-III/NGZ	800	0.75 x 1.50	0.30	No	No	Near Shiv Mandir	PWD Drain	
97	Raj nagar II(Back side of Dada Dev road ) in Ward No. 46-S/NGZ	M-III/NGZ	350	0.60 x 1.20	0.30	No	No	Mela Ground	DDA	
98	Raj nagar II(H block) in Ward No. 46-S/NGZ	M-III/NGZ	147	0.75 x 1.50	0.30	No	Yes	Near Transfarmer	DJB	
99	Raj nagar II(Mamta bakeri road both side) in Ward No. 46-S/NGZ.	M-III/NGZ	275	0.50 x 1.20	0.20	No	Yes	Near Nirankari Bhawan	SDMC	
100	Kakrola Dairy to Metro Pillor No. 810	M-IV	500	5.0 x 1.5	0.5	No	No	SDMC Drain	SDMC	Open
101	Beri Waala Baag to Chowdhary Chowk, Old Palam Road (Both Side)	M-IV	2600	2.6 x 1.5	0.5	No	No	DDA Drain	DDA	covered drain
102	Vijay Medicose to Chowdhary Chowk to Kakrola Housing Complex (Both Side)	M-IV	800	0.8 x 1.2	0.5	No	Yes	SDMC Drain	SDMC	covered drain
103	Patel Garden Chowk from Delhi Najafgarh Road	M-IV	350	0.35 x 1.2	0.45	No	Yes	PWD Drain	PWD	covered drain
104	Sector-16A, J J colony, Ramdal house	M-IV	1100	1.1 x 1.2	0.45	No	No	DDA Drain	DDA	covered drain
105	Brithish Saloon to House Tax Office Kakrola Old Palam Road	M-IV	1500	3.8 x 1.2	0.5	No	Yes	PWD Drain	PWD	covered drain
106	Matiyala, jain colony road Road	M-IV	550	0.55 x 1.2	0.45	No	No	MATIALA PHIRNI	SDMC	covered drain

								NALLAH		
107	Drain Connected Matiyala Ext. to DDA Nalla	M-IV	450	0.45 x 1.2	0.9	No	No	I&FC NALLAH SEC 3 DWARKA	I&FC	OPEN
108	Drain Connected to Phirni of Village Matiyala & Sector-3.	M-IV	200	0.2 x 1.2	0.61	No	No	I&FC NALLAH SEC 3 DWARKA	I&FC	OPEN
109	Drain Connected to Phirni of Village Matiyala to Sehyog Vihar	M-IV	300	0.3 x 1.5	0.15	No	No	MATIALA PHIRNI NALLAH	SDMC	covered drain
110	Mansa Ram Park	M-IV	1000	1.0 x 1.2	0.44	No	No	PWD NALLAH	PWD	covered drain
111	Mansa Ram Park	M-IV	370	0.37 x 1.2	0.70	No	No	PWD NALLAH	PWD	covered drain
112	Matiyala Approach Road both side	M-IV	1400	1.4 x 1.2	0.53	No	No	PWD NALLAH	PWD	covered drain
113	Matiyala Phirni Nalla	M-IV	2650	2.65 x 1.2	0.44	No	No	I&FC NALLAH SEC 3 DWARKA	I&FC	OPEN
114	Sehyog Vihar Nalla	M-IV	500	0.5x 1.5	1.00	No	No	DDA DAIN	DDA	covered drain
115	Nallah in Chawla village at main Dhulsiras road	M-IV	200	0.2 x 1.2	0.53	No	No	I&FC Drain	I&FC	covered drain
116	Galibpur Village Nallah	M-IV	300	0.3 x 1.2	0.44	No	No	I&FC Drain	I&FC	Open & covered drain
117	Gumanhera village	M-IV	300	0.3 x 1.2	0.70	No	No	I&FC Drain	I&FC	Open Drain
118	Nallah in Village Badusarai	M-IV	180	0.2x 1.2	0.53	No	No	I&FC Drain	I&FC	covered drain
119	Nallah in Village Kanganheri	M-IV	180	0.2 x 1.2	0.44	No	No	I&FC Drain	I&FC	covered drain
120	Nallah in Village Nanak Heri	M-IV	200	0.2 x 1.2	0.70	No	No	Sump Well	SDMC	covered drain
121	Panwala kalan	M-IV	280	0.28x 1.2	0.53	No	No	I&FC Drain	I&FC	Open & covered drain
122	Paprawat Village	M-IV	230	0.23 x 1.2	0.44	No	No	I&FC Drain	I&FC	covered drain
123	Rewla Khanpur & Daulatpur village	M-IV	190	0.2 x 1.2	0.70	No	No	I&FC Drain	I&FC	Open & covered drain
124	Rond Kharkhadi	M-IV	836	0.836 x 1.2	0.53	No	No	I&FC Drain	I&FC	covered drain
125	Balmiki Mohlalla	M-IV	240	0.24 x 1.2	0.44	No	No	I&FC Drain	I&FC	covered drain
126	Khushi Ram house	M-IV	200	0.2 x 1.2	0.61	No	No	PWD Drain	PWD	covered drain
127	M.C. Pry School Main Main Road to Pond Kazipur	M-IV	200	0.2 x 1.2	0.44	No	No	PWD Drain	PWD	covered drain
128	Sr. sec School main road to Pond Kazipur	M-IV	225	0.225 x 1.2	0.70	No	No	I&FC Drain		
129	Govt. School Mundela Khurd bus stand & Balmiki Chopal to Shiv	M-IV	200	0.2x 1.2	0.44	No	No	I&FC Pond	I&FC	covered drain
130	Govt. School Kair Road, Pry	M-IV	250	2.5 x 1.2	0.70	No	No	I&FC Pond	I&FC	Covered

	School to FC Drain Mundela Khurd									
131	Nallah in G-Block Vijay Enclave	M-IV	250	2.5 x 1.2	0.70	No	No	I&FC Drain	I&FC	Covered
132	Railway Road Drain	M-IV	1250	1.25 x 1.2	0.44	No	No	I&FC Drain	I&FC	Covered
133	Old Mahrauli Road (RHS)	M-IV	800	0.8 x 1.2	0.61	No	No	I&FC Drain	PWD	Covered
134	Palam Harizan Basti	M-IV	900	0.9x 1.2	0.53	No	No	I&FC Drain	DDA	Covered
135	Palam Village	M-IV	1550	1.55 x 1.2	0.61	No	No	I&FC Drain	DDA	Covered
136	Drain No. 12 from Tilak Bridge to Railway Pathak.	Div (M)- I/CNZ	1200	11.00x3.00	NA	NA	NA	NA	NA	NA
137	Drain from Police HQ to Pyare Lal Bahawan		590	0.90x1.00	NA	NA	NA	NA	NA	NA
138	Nallah No 14 from Gate No 5 Pragati Maidan to Outer ring road		1640	5.00x3.00	NA	NA	NA	NA	NA	NA
139	Nallah No 12 A +2 from Metro station Pragati Maidan (mathura road to ring road )		1620	3.00x2.50	NA	NA	NA	NA	NA	NA
140	Nallah No. 15 from Railway Track to Yamuna River		1740	3.00x2.50	NA	NA	NA	NA	NA	NA
141	Barapullah Nallah from Mathura road to Railway Track		800	6.00x4.50	NA	NA	NA	NA	NA	NA
142	Barapullah Nallah from Railway Track to ring road		850	6.00x4.50	NA	NA	NA	NA	NA	NA
143	Drain from Mnokamna Mandir to Pocket -B Sidharth Extn.		320	1.20x1.30	NA	NA	NA	NA	NA	NA
144	Lajpat Nagar Nallah from Feroz Gandhi to Railway X-ing		1200	8.00x3.00	NA	NA	NA	NA	NA	NA
145	Kilokari Nallah from Kilokari Village to Ring Road		120	2.00x3.00	NA	NA	NA	NA	NA	NA
146	Jangpura -A Nallah from Hospital Road to Barapulla Nallah	300	2.500x2.50	NA	NA	NA	NA	NA	NA	
147	Pipe Drain from Pocket A sidharth Extn. To Sump-well Pocket -B Sidharth Extn	600	NA	NA	NA	NA	NA	NA	NA	
148	Sunehripulla Nallah from Dayal singh College to Barapulla Nallah	1800	20.00x3.00	NA	NA	NA	NA	NA	NA	

149	Khushak Nallah from Railway Crossing to Barapulla Nallah (Lala Lajpat Rai Marg)	2050	8.00x3.00	NA	NA	NA	NA	NA	NA
150	Barapulla Nallah from Link Road Culvert to Mathura Road	810	12.00x3.00	NA	NA	NA	NA	NA	NA
151	jangpura Nallah from Railway Crossing to Barapulla Nallah	790	1.50x3.00	NA	NA	NA	NA	NA	NA
152	Drain from jangpura Flyover to Round about A-Block jangpura Extn	2000	0.75x1.250	NA	NA	NA	NA	NA	NA
153	Khushak Nallah from INA Market to Railway X-ing near Sewa nagar	1643	6.00x2.50	NA	NA	NA	NA	NA	NA
154	Drain from A-Block NDSE-1 to Kushak Nallah	350		NA	NA	NA	NA	NA	NA
155	Defence Colony Nallah from Ring road to kushak Nallah	1600	12.00x3.00	NA	NA	NA	NA	NA	NA
156	Chirag Delhi Nallah from Andrews Ganj to Ring Road	560	10.00x3.50	NA	NA	NA	NA	NA	NA
157	Drain in D-Block Defence colony from Central road to Ratan Lal sechdev Marg	1400	0.60x1.20	NA	NA	NA	NA	NA	NA
158	Drain in C Block Defence Colony from Central road to Ratan Lal Sechdev Marg	600	0.60x1.20	NA	NA	NA	NA	NA	NA
159	Anand Lok Nallah from kamla Nehru collage to Andrews Ganj Nallah	2300	2.00x3.00	NA	NA	NA	NA	NA	NA
160	LSR Nallah from kalka Devi Marg to Ring road (Banglow no 1)	660	4.50x3.00	NA	NA	NA	NA	NA	NA
161	LSR Nallah from kalka Devi Marg to Ring road to Feroz Gandhi Marg	570	6.00x3.00	NA	NA	NA	NA	NA	NA
162	National Park Nallah from Frank Anothoni School to L.S.R Nallah	530	2.00x3.00	NA	NA	NA	NA	NA	NA
163	Garahi Nallah from A-Block East of Kailash to Ren Basera on Captain Gaur Marg	500	2.00x2.50	NA	NA	NA	NA	NA	NA

164	Friends Colony Nalla (Along Mathura Road ) from Petrol Pump to Club Nalla		800	4.00x2.00	NA	NA	NA	NA	NA	NA
165	Friends Colony Nalla (west) from railway colony to mathura Road		230	4.00x1.50	NA	NA	NA	NA	NA	NA
166	Club Naila (Friends Colony west)/Magarani Bagh Nalla		750	6.00x2.10	NA	NA	NA	NA	NA	NA
167	Sri Niwas puri Naila from Subzi Mandi to Railway Line		700	1.20x1.50	NA	NA	NA	NA	NA	NA
168	PKT A-4 Nalla	M-II/CNZ	300	1.30x1.50	NA	NA	NA	NA	NA	NA
169	Transit Camp	M-II/CNZ	50	1.20x3.00	NA	NA	NA	NA	NA	NA
170	Z-Block Nallah	M-II/CNZ	480	3.00x1.50	NA	NA	NA	NA	NA	NA
171	Okhla Ph-1,Nallah	M-II/CNZ	1100	3.00x1.20	NA	NA	NA	NA	NA	NA
172	Tata Steel Nallah	M-II/CNZ	1100	2.00x1.60	NA	NA	NA	NA	NA	NA
173	AC&Block Main Nallah	M-II/CNZ	550	0.60x1.20	NA	NA	NA	NA	NA	NA
174	Sanjay Colony Camp Nallah OLA PH=II	M-II/CNZ	450	1.20x1.00	NA	NA	NA	NA	NA	NA
175	Bangali Campa Nallah OLA PH-II	M-II/CNZ	500	0.60x0.90	NA	NA	NA	NA	NA	NA
176	Taimoor Nagar, Nallah	M-II/CNZ	450	7.50x2.75	NA	NA	NA	NA	NA	NA
177	Nai Basti Nalla	M-II/CNZ	1500	2.50x2.75	NA	NA	NA	NA	NA	NA
178	Abul Fazal Enclave Nalla	M-II/CNZ	750	3.00x2.5	NA	NA	NA	NA	NA	NA
179	Tughlakabad Extn Nallah	M-III /CNZ	735	1.0 x 2.00	NA	NA	NA	NA	NA	NA
180	Ratiya Marg Drain, Sangam Vihar	M-III /CNZ	805	0.60 x 1.20	NA	NA	NA	NA	NA	NA
181	Raitia Marg Drain(sangam vihar)	M-III /CNZ	1050	0.60 x 1.20	NA	NA	NA	NA	NA	NA
182	Pocket 12/14 Nallah	M-III /CNZ	600	3.50 x 2.0	NA	NA	NA	NA	NA	NA
183	Gola Kaun Camp Nallah	M-III /CNZ	150	1.20 x 1.20	NA	NA	NA	NA	NA	NA

184	VIP camp Nallah	M-III /CNZ	200	3.00 x 0.70	NA	NA	NA	NA	NA	NA
185	MIG Flats pul Prahaldpur Nallah	M-III /CNZ	780	2.50 x 1.60	NA	NA	NA	NA	NA	NA
186	Muslim Camp Nallah	M-III /CNZ	180	4.00 x 3.00	NA	NA	NA	NA	NA	NA
187	Badarpur Nallah	M-III /CNZ	350	3.00 x 2.5	NA	NA	NA	NA	NA	NA
188	Pepsi Cola Nallah	M-III /CNZ	350	4.00 x 2.5	NA	NA	NA	NA	NA	NA
189	Covered drain in Madipur.	E.E.(M)-I/WZ / 001-S	400	0.45 x 1.20	50% of full capacity of drain	No	No	Road No. 29 Drain.	PWD	
190	Subhash Nagar drain From Chowkhandi Road Culvert to Sant Nagar Extn	E.E.(M)-I/WZ / 006-S	1832	9.0 x 3.0			Yes	Najafgarh Drain	FD&ID.	{ (Covered Portion L=1038 m, section -9m x 3.8 m) + Uncovered portion L=794m, Section 6m x 3m ) }
191	Mukherjee Park drain	E.E.(M)-I/WZ / 006-S	460	0.75 x 1.20		NA	No	Chand Nagar Road Drain	PWD	
192	Vishnu Garden drain	E.E.(M)-I/WZ / 006-S	1100	0.60 x 1.20		NA	No	K-87 Block Shyam Nagar Drain	SDMC	
193	Harijan Basti drain	E.E.(M)-I/WZ / 006-S	340	0.60 x 1.20		NA	No	IIIrd A Block Drain	SDMC	
194	Choukhandi Village drain	E.E.(M)-I/WZ / 006-S	260	0.60 x 1.20		NA	No	100 ft. Road Drain	PWD	
195	D/o Shyam Nagar Nallah in A.P. No. 67.	E.E.(M)-I/WZ / 007-S	1200	0.60 x 1.20		NA	No	100 ft Road Drain	PWD	
195	D/o from III-A-7 to III A-102 Gurudawara Bhatta Shahib Road One side	E.E.(M)-I/WZ / 007-S	400	0.60 x 1.20		NA	No	Punjabi Mkt. Road Drain	SDMC	
196	D/o from DDA Market Khyalla to Patel Chowk Both Side	E.E.(M)-I/WZ / 007-S	400	0.60 x 1.20		NA	No	Main Khyalla Road Drain	SDMC	
197	D/o from Horticulture Park to A-Block Khyalla Maszid One Side	E.E.(M)-I/WZ / 007-S	400	0.60 x 1.20		NA	No	Punjabi Mkt. Road Drain	SDMC	

198	D/o from Plot No 10 to Plot No 398 Chand Nagar Road No 1 One Side	E.E.(M)-I/WZ / 007-S	250	0.60 x 1.20	NA	No	Punjabi Mkt. Road Drain	SDMC	
199	D/o from Shitla Mata Mandir to Mangal Bazar Road Vishnu Garden One Side	E.E.(M)-I/WZ / 007-S	400	0.75 x 1.20	NA	No	Najafgarh Drain	Flood Deptt and Irrigation Deptt.	
200	D/o from Hari Mandir (Chand Nagar Road) to F-166 F Block Vishnu Garden One Side	E.E.(M)-I/WZ / 007-S	400	1.8 x 1.80	NA	No	Najafgarh Drain	Flood Deptt and Irrigation Deptt.	
201	Main Khyalla Road (One side)	E.E.(M)-I/WZ / 007-S	1300	0.60 x 1.20	NA	No	Road No. 28 Drain	PWD	
202	D/o Nallah in Firmi Road Khayala Village	E.E.(M)-I/WZ / 008-S	1200	0.60 x 1.20	NA	No	Road No. 28 Drain	PWD	
203	D/o various nallahs in Ward No. 008-S	E.E.(M)-I/WZ / 008-S	1400	0.75 x 1.20	NA	No	Bus Stand 857 Road No. 28	PWD	
204	D/o from N-5 to S-221/200 Vishnu Garden One Side	E.E.(M)-I/WZ / 008-S	400	0.75 x 1.20	NA	No	80 Ft. Chowkhandi Road	PWD	
205	D/o from S/221/1 to New Khyalla Road One Side	E.E.(M)-I/WZ / 008-S	260	0.75 x 1.20	NA	No	80 Ft. Chowkhandi Road	PWD	
206	Mukherjee Park drain	E.E.(M)-I/WZ / 006-S	260	0.75 x 1.20	NA	No	Subhash Nagar Drain	SDMC	
207	Raghubir Nagar drain	E.E.(M)-I/WZ / 006-S	1100	0.75 x 1.20	NA	No	Subhash Nagar Drain	SDMC	
208	Vishnu Garden drain	E.E.(M)-I/WZ / 006-S	250	0.75 x 1.20	NA	No	Subhash Nagar Drain	SDMC	
209	Punjabi Mkt. Road drain	E.E.(M)-I/WZ / 006-S	1500	0.6 x 1.20	NA	No	100 ft. Road Drain	PWD	
210	Choukhandi JJ Colony drain	E.E.(M)-I/WZ / 006-S	600	0.6 x 1.20	NA	No	IIIRD A Block Road	SDMC	
211	Mukhran Garden drain	E.E.(M)-I/WZ / 006-S	1300	0.6 x 1.20	NA	No	100 ft. Road Drain	PWD	
212	Sant Nagar Extn. Drain	E.E.(M)-I/WZ / 006-S	480	1.0 x 1.20	NA	No	Pacific Mall Road	PWD	
213	Sant Nagar drain	E.E.(M)-I/WZ / 006-S	200	0.6 x 1.20	NA	No	Road No. 28 Drain	PWD	

214	A Block JJ Colony Drain	E.E.(M)- I/WZ / 007-S	300	0.60 x 1.30		NA	No	100 ft. Road Drain	PWD	
215	III-A Block Darin	E.E.(M)- I/WZ / 007-S	280	0.95 x 2.25		NA	No	IIIrd A Block Road	SDMC	
216	B-1 Block Drain	E.E.(M)- I/WZ / 007-S	180	0.95 x 2.25		NA	No	100 ft. Road Drain	PWD	
217	Wood Land Park	E.E.(M)- I/WZ / 008-S	220	0.75 x 1.4		NA	No	Pacific Mall Road	PWD	
218	New Khyalla Road	E.E.(M)- I/WZ / 008-S	300	1.00 x 1.5		NA	No	Road No. 28 Drain	PWD	
219	NG Road to Rama Park (A-151)	EE(M- II)/West Zone	0.47	0.75 x 1.30	50% of full capacity of drain	NA	No	PWD at Najafgarh Road	PWD	
220	Pipal Wala Road from N.G. road(M.Pillar No-753) to H.No A-15 Mohan Garden.	EE(M- II)/West Zone	0.3	0.60 x 1.40		NA		PWD at Najafgarh Road	PWD	
221	Gurudwara Road from N.G. road(M.Pillar No-743) to H.No.A-65 Mohan Garden	EE(M- II)/West Zone	0.191	0.75 x 1.40		NA		PWD at Najafgarh Road	PWD	
222	Rama Park Road from Pipal Wala Road to Nawada School.	EE(M- II)/West Zone	0.2	0.80 x 1.40		NA		PWD at Najafgarh Road	PWD	
223	D.K. Road from N.G. road (M.Pillar No-751) to Nawada Rama Park road	EE(M- II)/West Zone	0.15	0.5 x 1.40		NA		PWD at Najafgarh Road	PWD	
224	Covered drain from RZ-1to G-80 Parjapati Colony	EE(M- II)/West Zone	0.68	0.75 x 1.40		NA		RZ1 Parjapati Colony Pali Factory Road.Uttam Nagar	SDMC	
225	Drain from one side from S-5A to parampuri to RZ-6 manas kunj	EE(M- II)/West Zone	0.15	0.90 x 1.70		NA		Opp. SDMC School at Santosh Park.	SDMC	
226	Covered drian along Police Chowki road from N.G Road to B-1/51 Kiran Garden	EE(M- II)/West Zone	0.64	0.75 x 1.30		NA		PWD at Najafgarh Road	PWD	
227	Covered drain along from A-6 Sanjay Enclave to C-27 Subhash park and s-51 Parampuri to T-213 to T-Block	EE(M- II)/West Zone	0.9	0.6x1.2		NA		At Sanjay Chowk Opp. Sanjay Enclave Uttam Nagar.	SDMC	

	Matiyala Road								
228	Covered drian from RZ-6 Manas Kunj to Sanjay Chowk.	EE(M-II)/West Zone	0.82	4.7x2.80	NA		At Sanjay Chowk Opp. Sanjay Enclave Uttam Nagar.	SDMC	
229	Covered Drain both side from Binda Pur Village Sanjay Chowk Matiyala Road.	EE(M-II)/West Zone	1.18	0.6x1.4	NA		At Sanjay Chowk Opp. Sanjay Enclave Uttam Nagar.	SDMC	
230	Covered drain one side RZ-1 Indra park to Binda Pur Village.	EE(M-II)/West Zone	0.92	0.6x1.5	NA		At near Indira Park Extn. Part-II	SDMC	
231	Covered drain from one side Opp. RZB-85 to H.No-110 Bindapur Village (talab road) and covered drain one side shop No-4 Pkt-IV Bindapur JJ Colony to RZ-85 near Pump House.	EE(M-II)/West Zone	0.9	0.6x1.2	NA		At Opp. Community Hall C-Block JJ Colony Bindapur kt-IV	SDMC	
232	RZ Block, Vishnu Garden Drain	EE(M-III)/WZ	0.2	0.75x1.3	No	No	Najafgarh Drain (Deep Barrel)	I&FC	
233	Drain from JG-2 Block, Vikaspuri to Najafgarh Drain near SBI Apartments, Vikas Puri		1.5	9x3	No	No	Najafgarh Drain	I&FC	
234	12- Block Tilak Nagar Drain		0.2	2.9x2.5	No	No	Subhash Nagar Drain	SDMC	
235	Deep Barrel starting from 4/1 Ashok Nagar to Najafgarh Road near Sanatan Dharam Mandir Ashok Ngr		0.9	11.5x3	No	No	Subhash Nagar Drain	SDMC	
236	Drain starting from 25/5 Tilak Nagar to 20 Block Gurudwara Tilak Nagar		0.2	1.8x2.1	No	No	PWD Drain on Lala Ganesh Dass Khatri Marg	PWD	
237	Drain in Tilak Vihar & near Cremation Ground		0.6	0.6x1.2	No	No	Subhash Nagar Drain	SDMC	
238	Subhash Nagar Drain (First Portion- Pacific Mall on Najafgarh Road to Chaukhandi Pulia-625m Covered & 40 m		1.16	0.6x1.2	No		Najafgarh Drain	I&FC	

	Open, Second Portion from lakdi Wala Pul, Sant Nagar to Najafgarh Road-450m Covered & 40 m Open) So Total Covered-1075m & Open-80m)								
239	Drain from Professor Joginder Singh marg near B-1 Block Janakpuri to Pankha Road Drain near A-1 Block Janakpuri		2.1	0.75x1.40		No	No	Pankha Road Drain	I&FC
240	Pankha Road Drain		0.55	0.75x1.40		No		Najafgarh Drain	I&FC
241	Internal Drain of C-2 Block janakpuri & C-4C Block Janakpuri		0.9	0.75x1.2		No	No	Pankha Road Drain	I&FC
242	Solanki Bridge to Gopal Dairy		0.2	0.75x1.2		No	No	Pankha Road Drain	I&FC
243	From Dabri Palam Road to Gali No.16 Sita Puri along Police Station		0.3	0.75x1.2		No	No	Pankha Road Drain	I&FC
244	Nallah Dayal Sir Road Uttam Nagar		1.2	0.75x1.2		No	No	PWD Drain on Najafgarh Road	PWD
245	Ball Udhyan Marg		1.2	0.75 dia pipe		No	No	PWD Drain on Najafgarh Road	PWD
246	Malik Music Center to manoj Builder	EE(M-III)/WZ	348	2.6x2		No	No	DDA near C&D waste plant Bakkarwala	DDA
247	Manoj Builder to Nitish telecom Centre C-Block Bakkarwala JJ Colony.		144	0.6x1.2		NA	No	DDA near C&D waste plant Bakkarwala	DDA
248	B-block to sewarge Plant Bakkarwala JJ Colony.		206	1.00x1.4		NA	No	DDA near C&D waste plant Bakkarwala	DDA
249	A-Block to Sewrage Treat Plant Bakkarwala JJ Colony		154	0.60x1.2		NA	No	DDA near C&D waste plant Bakkarwala	DDA
250	Pipe drain at Dada Bhaiya Road Ranholla Village from Najafgarh Nangloi Road to Hari Ram Pardhan		703	0.60x1.2		NA	No	PWD Drain near MCD Store	PWD

251	Nallah Malaria office to Pankha road nalla in JJ Colony Hastsal		317	0.75x1.5		NA	Yes	Pankha Road Drain	I&FC	
252	Drain at Dal Mill Road, from N.G. Road (.Pillar No-685) to Holi Chowk Uttam Nagar. (Both sides) 564+570= 1134		1134	0.60x1.2		NA	No	Najafgarh Road	PWD	
253	Hastsal Road from N.G Road(M.PillarNo-662) to A-2 Block Uttam Nagar.		436	0.90x1.3		NA	No	Najafgarh Road	PWD	
254	Hastsal Nawada Drain from Pond to Hastsal Vihar.		473	0.75x1.2		NA	No	Sumpwell	SDMC	
255	Nallah in Hastal LIG flats and covered drains Hastsal Village (Pipal wala chowk).		906	0.75x1.3		NA	No	Road No. 237	PWD	
256	Drain at Maharani Enclave from Yadav Property to Hastsal Village. (40ft Rd.)		511	1x1.4		NA	No	Najafgarh Drain at Maharani Enclave	I&FC	
257	Drain from Deep Enclave to Hastal Village (40f.t. Rd.)		614	0.75x1.25		NA	No	Najafgarh drain at Deep Enclave	I&FC	
258	Vikrant Chowk to Deep vihar Transfarmer 40 ft Rd		792	0.75x1.3		NA	No	Najafgarh drain at Deep Vihar	I&FC	
259	Drain from Vikrant chowk to Rajapur Khurd		2694	1x1.4		NA	Yes	Najafgarh drain at Vikrnat chowk rajapur khurd	I&FC	both sides ( 1194+1500= 2694)
260	Hastsal Ranholla Road Nallah From Commander Chowk to N.G. Drain (R.H.S)		1069	0.75x1.3		NA	No	Najafgarh drain at Commandar Chowk	I&FC	
261	Drain from Baba Syed Marg towards Najafgarh drain (Hastsal Ranholla Road) both sides		656	1x1.4		NA	Yes	najafgarh drain at Baba Sayed Marg	I&FC	
262	Drain from Cremation Ground (Baprolla) to Mangesh Pur Drain (Jai Vihar).		1580	0.75x1.25		NA	No	Mangesh Pur Drain at Jai Vihar	I&FC	

**Table 12: List of identified drains in central and south zone for major Interventions**

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
			Max	Min	Avg.
1.	Chirag Delhi to Defense Colony Nallah	3700	60	1	17.3
2.	Sunhari Nallah	1800	50	45	47.5
3.	Pushpvihar main Nallah from MB Road to Press Enclave Road (RHS-LHS)	1933	32.5	1	18.5
4.	GK Nallah from Chirag Delhi Flyover to link road culvert near Central School	2075	31.7	1	25.5
5.	Chirag Delhi Vill. Nalla from Press Enclave Road to Outer Ring Road	1400	30.3	16.6	23.2
6.	Nalla No. 4 R.K. Puram from Outer Ring to EKTA camp	700	28	1	11.8
7.	Nallah no. 12 from Tilak Bridge to Yamuna River	1200	24.8	15	19.9
8.	Nauroji Nagar Nalla from Bhikaji Cama Place to Ring Road	1250	22	1	13.3
9.	Mathura road to Outfall in Yamuna	1050	19.5	1	10.8
10.	Nallah no. 14 from Gate no. 5 Pragati Maidan to Yamuna River	1640	19	10.5	15.1
11.	Vasant Vihar Nalla from Culvert on Munirka Marg to H.No. A-25, Olf Palme Marg	1450	19	1	7.3
12.	Covered Drain from C-2/60 SDA to Aurobindo Marg A	55	18	1	12.3
13.	Pushp vihar District Center, Saket Nalla from Mandir Marg M Block culvert to culvert on Pankaj Jewel Marg in Pushp vihar (RHS-LHS)	560	16.6	12	15
14.	M-Block Nallah Saket	1100	15	15	15
15.	Kalu Sarai Nallah Along Park Sarvpriya Vihar (RHS-LHS)	275	14.4	6.1	9.3
16.	DPS Nallah R.K.Puram to Ambedkar Basti Covered Nallah	480	14	1.1	
17.	Guru Harkishan Public School Nallah	500	14	1	9.7
18.	Panthnagar Nallah - LSR Collage to Barapulla Nallah	3700	13.5	7.5	10.9
19.	National Park Nallah	530	12.5	1	7.1
20.	JJ Colony Khadar (Sprite Vihar) Drain	1250	12.2	5.4	8.7
21.	Jagdamba Camp nalla from Triveni Complex culvert to Chirag Delhi nallah	200	12.1	5.2	8.6
22.	Nallah No. 6 from Outer Ring Road near Kendriya	950	12	2.5	7

Sr. No.	Drain Name	Length (m) (Approx)	Width (m)		
	Vidyalaya Sec.-VIII R.K. Puram to T-point of Rao Tula Ram Marg and Som Nath Sharma Marg in R.K. Puram				
23.	Aya Nagar phirni road drain	335	12	1.2	1.2
24.	Arjun Nagar Nalla from Humayunpur to A.I.I.M.S. (Near Cremation Ground Green Park)	1500	11.7	1	2.2
25.	Nalla No.5 R.K. Puram from Outer Ring Road to Sangam Cinema, R.K. Puram	950	11.2	1	3
26.	Bhim Nagar Nalla	1500	11	7.2	9.1
27.	Nalla No. 3, Sect.-3, R.K. Puram from H.No. 506 type IV, Sect.-3 R.K. Puram to Masjid Olf Palme Marg	700	11	1	6
28.	Taimoor Nagar C V Raman Marg to Block F	890	10.5	4.2	7.7
29.	Okhla Phase-1 to Sarita Vihar	3200	10.1	4.7	6.9
30.	Nallah no. 15 from Railway Track to Yamuna River	1740	10	1	6.6
31.	Nallah along August Kranti Marg from Panchsheel Club to Kamla Nehru College	1500	9.8	6	8
32.	Nallah 13a Mathura Road to Outfall in Yamuna	260	9.7		9.7
33.	Ambedkar Basti J.J. Camp Nalla from Kushta Camp to Ring Road	900	9.5	9.5	9.5
34.	Central market Madangir Nallah from Shiv Nanda Public School up to Parking Near DDA Market Madangir Ph-II	590	9.3	5.6	7.5
35.	Badarpur Mad Nallah	2550	9.2	5.3	7.6
36.	Gautam Nagar Nallah	3000	9	1	2.3
37.	Z Block Nallah (Kohl Phase-II) X	3000	6.0	1.0	1.7

Absract for category wise drains in SDMC region is given in table no.13. Further using existing survey reports the present conditions of some of the drains in SDMC area (water quality etc.) are analyzed and presented in table 14. However some preliminary water quality analysis of few drains of the central and south zoneis carried out by IIT Delhi team and presented in table 15 and 16. This tentative water quantity and quality data is used to propose the action plan.

**Table 13: Abstract of drain length category wise in SDMC area**

S. No.	Width of the drain (in meters)	Nos.	Length	Nos.	Length	Nos.	Length	Nos.	Length	Nos.	Length
		Central		South		West		NGZ		Total	
1	<1	10	8830	26	12471	65	41061	26	15830	127	78192
2	1-4	27	18290	30	14495	4	4717	42	26871	103	64373
3	4-9	10	10613	4	3860	1	1150	0	0	15	15623
4	>9	6	6320	7	8215	3	5112	0	0	16	19647
		<b>53</b>	<b>44053</b>	<b>67</b>	<b>39041</b>	<b>73</b>	<b>52040</b>	<b>68</b>	<b>42701</b>	<b>261</b>	<b>177835</b>

**Table 14: Decadal variation of Water Quality of 04 Major drains in SDMC Area (2004-2012)**

Sr.No	Monitoring Location	Period	Parameter (Annual Range)	
			BOD (mg/l)	TSS (mg/l)
1	Delhi Gate drain	2004	147 – 563	151 - 1365
		2011	36 – 139	72 - 317
		2012	72 - 117	7 - 305
2	Sen Nursing Home drain	2004	87 - 219	162 - 548
		2011	30 – 166	59 - 522
		2012	73 – 333	107 - 522
3	Barapulla Drain	2004	34 - 150	26 - 178
		2011	39 - 87	21 - 205
		2012	39 – 117	30 - 172
4	Tuglakabad drain	2004	37 – 86	31 - 855
		2011	29 – 145	113 – 707
		2012	41 – 116	160 - 1437

Note: Data includes Monsoon Period

**Table 15: Results of Analysis of Wastewater from Various Drains.**

Sr. No	Sampling Station	Sampling Point Coordinates (N)	Sampling Point Coordinates (E)	Drain Depth	Drain Top Width (Approx)	Average Surface Velocity	Flow Rate	Temp	Alkalinity	DO
				m	m	m/s	m <sup>3</sup> /s	°C	(mg/L)	(mg/L)
1.	Bhikaji cama Drain	28.56844	77.190705	0.25	2.00	0.01	0.005	34	65	4.7
2.	Bhikaji cama Drain 2	28.569332	77.197749	0.4	5.00	0.28	0.56	33	65	4.1
3.	Lajpat Nagar Drain	28.565116	77.240291	0.45	20	0.26	2.34	29	50	4.3
4.	Greater Kailash Drain 1	28.553379	77.230264	0.5	11.60	0.40	2.32	30	90	4.9
5.	Kalindi Kunj Intersection Drain	28.529965	77.303621	2.8	55.00	0.57	87.93	26	30	4
6.	Sarita Vihar Metro Station	28.52521	77.293232	0.6	1.50	0.14	0.12	27	145	4.4
7.	Munrika Drain (Baba Gangnath Marg)	28.55377	77.164674	NA	NA	NA	NA	31	505	4.3
8.	Drain Near Chirag Delhi	28.542434	77.22706	NA	NA	NA	NA	30	90	4.8
9.	Drain Near PSRI Hospital	28.531579	77.224285	NA	NA	NA	NA	30	90	4.7
10.	Katwaria	28.5445	77.195849	0.2	0.60	0.25	0.03	30	450	5
11.	IIT Delhi	28.546196	77.187262	0.3	0.10	0.21	0.0063	31	435	4.7

Sr. No	Sampling Station	Sampling Point Coordinates (N)	Sampling Point Coordinates (E)	Drain Depth	Drain Top Width (Approx)	Average Surface Velocity	Flow Rate	Temp	Alkalinity	DO
				m	m	m/s	m <sup>3</sup> /s	°C	(mg/L)	(mg/L)
	Drain Near Masala Mix									
12.	Barapullah Drain INA side	28.575618	77.218389	0.35	2.80	0.1	0.098	32	315	4.8
13.	Barapullah Near Khanna Market	28.579563	77.222705	0.35	2.00	0.2	0.14	32	355	`
14.	Barapullah Near Sewa Nagar	28.579669	77.235538	0.2	50.00	0.25	2.5	31	355	5.8
15.	Barapullah Nea West Nizamuddin	28.586759	77.246274	0.5	50.00	0.166	4.15	31	305	5.7
16.	South Delhi Drain 15	28.603265	77.253122	NA	NA	NA	NA	29	NA	2.7
17.	South Delhi Drain 12 (STP)	28.621	77.2478	NA	NA	NA	NA	31	NA	2.5
18.	South Delhi Drain 12 (W/O STP)			NA	NA	NA	NA	31	NA	1.2
	Taimur Nagar	28.57135	77.266521					31		2.4

**Table 16: Wastewater Quality of Various Drains**

Sr. No	Sampling Station	Colour	BOD	COD	pH	Electrical Conductivity	Total Dissolved Solids	Total Suspended Solids	Total Hardness	Alkalinity
		PCU	(mg/L)	(mg/L)		(µS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1.	Bhikaji cama Drain	154	34.6	64	9.6	1171	831	70	255	65
2.	Bhikaji cama Drain 2	577	40	264	7.6	1062	753	320	240	65
3.	Lajpat Nagar Drain	530	40	248	7.45	828	588	277.5	245	50
4.	Greater Kailash Drain 1	664	80	240	7.92	1396	991	667.5	385	90
5.	Kalindi Kunj Intersection Drain	74	66.6	112	7.71	503	357	23	155	30
6.	Sarita Vihar Metro Station	654	64	296	7.44	2150	1510	320	500	145
7.	Munrika Drain (Baba Gangnath Marg)	1854	61.3	368	7.17	1520	1080	210	240	505
8.	Drain Near Chirag Delhi	657	69.3	192	7.9	1341	951	635	320	90
9.	Drain Near PSRI Hospital	597	69.3	128	7.88	1303	925	742.5	280	90
10.	Katwaria	604	56	60	7.96	1330	943	107.5	255	450
11.	IIT Delhi Drain Near Masala Mix	1014	50.6	304	7.42	1298	920	870	280	435

Sr. No	Sampling Station	Colour	BOD	COD	pH	Electrical Conductivity	Total Dissolved Solids	Total Suspended Solids	Total Hardness	Alkalinity
		PCU	(mg/L)	(mg/L)		(µS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
12.	Barapullah Drain INA side	390	24	120	7.83	966	685	17.5	200	315
13.	Barapullah Near Khanna Market	657	24	200	7.63	1040	738	217.5	230	355
14.	Barapullah Near Sewa Nagar	540	32	552	7.92	1063	752	165	240	355
15.	Barapullah Near West Nizamuddin	477	24	96	7.6	966	685	125	210	305
16.	South Delhi Drain 15	74	40	88	7.93	1852	1320	175	508	360
17.	South Delhi Drain 12 (STP)	584	104	248	7.32	1038	738	175	228	304
18.	South Delhi Drain 12 (W/O STP)	180	120	168	7.4	564	401	230	160	156
19.	Taimur Nagar	444	109.3	160	7.32	1041	740	210	208	332

**Table 17: Wastewater Quality of Various Drains (Continued)**

S No	Sampling Station	Ammonical Nitrogen	Total Phosphorus	Chloride	Sulphate	Flouride	Nitrate	Nitrite
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1.	Bhikaji cama Drain	7.97	0.52	184.94	77.25	1.1	3.88	0.18
2.	Bhikaji cama Drain 2	23.04	1.59	109.97	53.25	1.16	5.11	0.09
3.	Lajpat Nagar Drain	23.25	1.16	97.47	55.16	0.26	4.31	0.08
4.	Greater Kailash Drain I	36.95	1.18	167.45	74.25	0.92	5.38	0.08
5.	Kalindi Kunj Intersection Drain	2.2	0.4	59.98	43.44	0.75	1.45	0.06
6.	Sarita Vihar Metro Station	79.63	1.54	314.9	85.44	0.73	6.38	0.07
7.	Munrika Drain (Baba Gangnath Marg)	52.38	1.3	174.95	63.71	0	21.55	0.15
8.	Drain Near Chirag Delhi	46.25	0.99	154.95	57.8	0.28	5.93	0.08
9.	Drain Near PSRI Hospital	32.12	1.15	147.45	53.98	0.36	5.66	0.07
10.	Katwaria	52.09	0.69	144.96	99.44	1.35	4.06	0.05
11.	IIT Delhi Drain Near Masala Mix	43.22	1.34	167.45	64.35	0.33	7.51	0.09
12.	Barapullah Drain INA side	37.02	0.52	114.96	47.53	0.26	3.56	0.04
13.	Barapullah Near Khanna Market	24.84	1.08	127.46	48.53	0.41	4.97	0.07
14.	Barapullah Near Sewa Nagar	42.72	0.84	152.45	37.16	0.58	4.46	0.08

S No	Sampling Station	Ammonical Nitrogen	Total Phosphorus	Chloride	Sulphate	Flouride	Nitrate	Nitrite
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
15.	Barapullah Nea West Nizamuddin	39.19	0.7	114.96	44.62	0.58	3.74	0.06
16.	South Delhi Drain 15	-	1.03	-	141.53	2.87	0.35	0.04
17.	South Delhi Drain 12 (STP)	-	3.81	-	68.71	2.37	4.63	0.06
18.	South Delhi Drain 12 (W/O STP)	-	2.4	-	54.34	2.49	1.05	0.02
19.	Taimur Nagar	-	3.87	-	57.44	2.49	3.36	0.04

## **4.0 Technology Options Available for Treatment**

There are several technologies available for treatment of wastewater from drains. The technologies /treatment methods are either in-situ or ex-situ. Ex –situ technologies are costlier and take around 2-3 years to come in operational phase. However application for drains treatment in India is very limited due to various design constraint and pollutant removal efficiency. Mostly project are conducted as pilot study.

In this section we have given details of some of the class of technologies in both approaches. Also given their pre-requisites for application. Several Ex –situ technologies available which are costly and take around 2-3 years to come in operational phase

### **4.1.In-Situ Treatment**

While planning for in-situ treatment of drains it's important to understand the quality of wastewater, contaminations in the drain (domestic sewage, run-off from catchment areas and industrial effluent if any). The purpose of the treatment is to reduce the pollution load being discharged to river Yamuna and meeting discharge norms.Following schemes can be applied for treatment of wastewater in drains;

#### **4.1.1. Treatment Steps**

##### **STEP I - Screening of Floating Material**

##### **STEP II- Silt Arrest System**

##### **STEP III- Biological Treatment/ remediation**

##### **STEP I - SCREENING OF FLOATING MATERIAL**

The drains in SDMC area being flowing in urban areas contains a large amount of floating material such as polythenes, packaging materials, leaves etc. Removal of floating material is the first step in cleaning drains. We have given details of three different methods for collecting floating materials namely, litter trap, bubble curtains and simple screens. Selection of method depends on the site specific conditions.

#### **A) Litter Trap**

At first screen or floating trash removal systems will be installed in the drain to retrieve the arrested trash from the open big drains. Illustrative examples are as follows;



**Figure 4: Litter Trap**

- Litter Trap is a floating device installed at strategic locations along waterways to collect and retain floating litter, vegetation and other debris.
- The system operates silently without any mechanical assistance, capturing and retaining debris ready for removal and disposal.
- Litter Traps are suitable for most waterways wider than 2 meters, including waterways subject to tidal action, rivers, streams, channels and open bodies of water.

### **How It Works**

- Litter Trap floats on waterways, given buoyancy by exceptionally strong and durable polyethylene pipes. The unit is held in place by chains attached to ground anchors or fitted to rider poles for canal installations. Outspread collection booms direct floating litter through a one-way gate into the trap where it is retained ready for removal.
- Re-entrainment is prevented by a system of counterweights and paddles that close the entry gate when the water flow ceases or there is a change in flow direction due to tide or wind. A polyethylene side skirt beneath the waterline prevents debris escaping under the main floats.

### **Advantages**

- Debris is directed via collection booms through a patented one way flap or gate to capture floating litter and debris.

- Cost effective and requires little maintenance.
- Operates silently 24 hours a day without mechanical assistance.
- Does not impede water flow or cause upstream flooding.
- Security fittings used to reduce vandalism.
- Debris cannot be dislodged once trapped.
- Quality, durable and corrosion resistant materials used.

Litter trap is designed to float in waterways in order to capture litter before it flows farther downstream by using the current to guide debris into the trap. This performance floatable control technology continuously operates 365 days a year without any mechanical assistance to capture floating litter. It gives a proven, cost-effective solution for floatables control and is the answer to the growing problem of litter in our waterways. Litter Trap is the ideal in-stream solution for floatables where combined sewer overflows are concerned.

### **B) Bubble Curtain**

Bubble curtains will create a barrier to prevent the nuisance of floating weeds and debris such as plastic bags and empty bottles from entering harbours, marinas, and public beaches. These fine bubbles (also called micro bubbles) which rise slowly from the floor of a wastewater treatment plant or the bottom of waterways and canals, ponds, lakes or lagoons, provide substantial and efficient mass transfer of oxygen to the water. The combination of this oxygen with the food source, sewage or sediment, allows the bacteria to produce enzymes which help to break down the waste or the sediment made out of accumulated organic matter



**Figure 5: Bubble curtain to trap floating solids from drains**

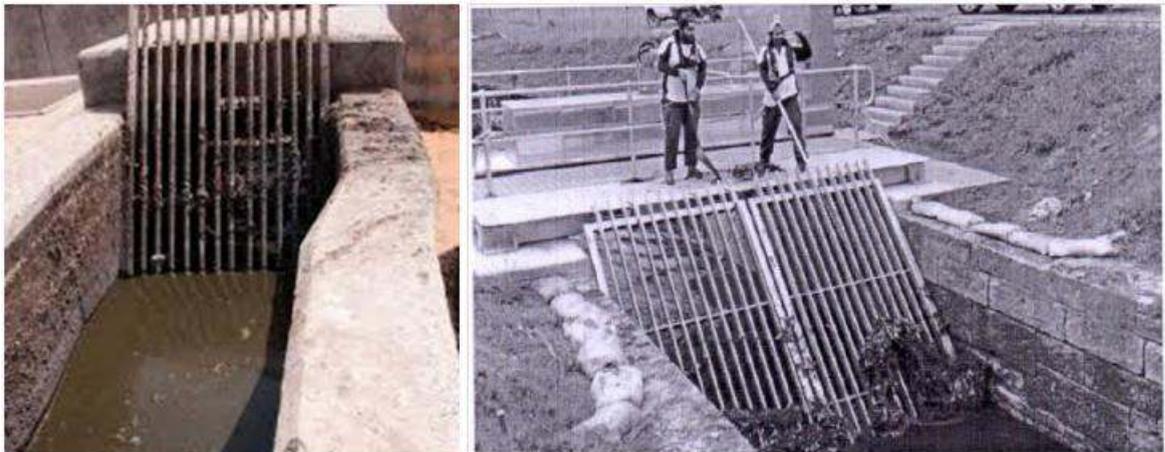
### **Applications:**

- Aeration sewage lagoons, wastewater treatment process plants, leachate ponds.
- Earthen ponds, dugouts, lakes.
- Waterways and channels.
- Storm water retention ponds.

- Septic systems
- Aquaculture
- Deicing docks, power plant water intake, marina slips, shoreline and/or water retention structures, industrial ship docking, ocean freight & maritime transport, pumping operations and nuclear power generating plants.
- Efficient Bottom-to-Top Water Circulation and Mixing for water treatment, deicing, and other applications.
- Pathogen Reduction, the bubbles lift deeper waters to the surface for UV exposure.

### C) Screens

A screening device comprising of flats of rectangular or trapezoidal section placed vertically, inclined or curved and spaced at close and equal intervals across a channel through which water flows, for removal of wood, floating debris, frigs, rags etc found in storm water. Bar screens are the simple and effective method to arrest and remove floating materials which are mainly sachets, plastic sheets/bits, leaves, fibres, rags etc. The manually operated screens are preferred for installation in smaller drains due to ease of operation & maintenance, easily available and can be fabricated locally.



**Figure 6: Manual Screen to arrest floating solids**

- It is recommended to install screens in storm water drains for removal of wood, floating debris, leaves, frigs, rags etc found in storm water.
- These manually cleaned screens can be fixed in each drain 2-3 meters before junction of the following drain, at an angle of 45 to 60 degrees to the horizontal.
- The suspended/floating material will be trapped at the screen and can be removed manually by the sweeping and trash is to be transferred to the dunning yard by using municipal solid waste collection infrastructure.

## STEP II- SILT ARREST SYSTEM

### A) Weir Arrangement to arrest silt

As we understand that the solids do contribute to the BOD to the drains wastewater along with attached consortium of bacteria. It is the priority that solids shall be removed from the wastewater. Subsequently BOD associated with the primary solids will also be removed from the wastewater. In order to remove the solids the weirs we shall be employed to arrest the organic solids/silt. Further this organic solids/silt can be either digested using bacteria culture or shall be removed using the dredgers.

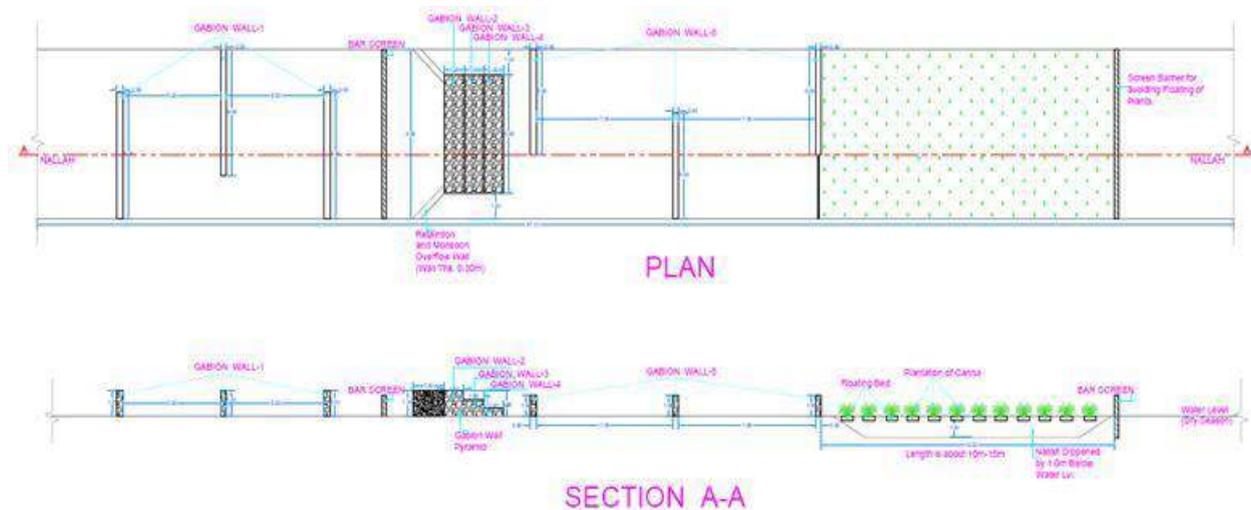


Figure 7: Drawing Representing a weir arrangement to arrest silt

### B) Geo-Textile bags

Geo-textile bags are tubular-shaped containers fabricated by multiple pieces of engineered woven fabrics with excellent filtration characteristics. It can be used in various sludge dewatering applications such as municipal and industrial wastewater treatments, mining tailings, agricultural animal waste containments and environmental dredging, etc.

The slurry laden with solids will be subjected to geo textile bags wherein chemical coagulation dosing will be done for dewatering of solids. The dewatering of the geotextile once filled will be allowed to dewater the same for seven days. The solids accumulated in the geotextile bags will be given to nearby STP wherein there is a facility for sludge digestion or else facilities will

be created on the bank of the drain for digestion of accumulated primary solids in the geotextile bags.

Or otherwise the slurry being accumulated in the geotextile bags will be dosed with lime to make the pH alkaline so that it can get digested in the bags itself & the bags can be used for embankment of the drain upon which the green cover can be grown.



**Figure 8: Geo-Textile bags for sludge dewatering**

### **STEP III- BIOLOGICAL ACTION**

#### **A) Floating Phytoremediation**

Applicability of System for drain water treatment

- > Width of Drain: 5-15 m
- > Depth of Drain: 1-3 m
- > Organic loading: BOD: <100 mg/l
- > Hydraulic loading: < 20 MLD
- > Treatment scheme: In-Situ

Floating Phytoremediation is an eco-friendly biological treatment method suitable for treatment of wastewater in flowing drains. In this method contaminants are removed by macrophytes. Plants absorb the pollutants along with water and other nutrients. The contaminant mass is not destroyed but ends up in the plant shoot and leaves. It is a natural wastewater treatment method and cost effective. Phytoremediation technology has been widely applied for sewage treatment, pollution control and environmental improvement. The removal of extra nutrients and pollutants from wastewater occurs through various processes such as reduction, precipitation, filtration, settling, oxidation, sedimentation, nitrification, adsorption and denitrification. It acts as a biological filter by removing pollutants such as organic materials and nutrients from the wastewater.

**Mechanism**

**Phytoextraction:** In this processes plants uptake the contaminants by the root and translocate it to the above parts of the plants by absorbing, concentrating and precipitating the pollutant from contaminated zone.

**Phytodegradation:** In this metabolic process breakdown the pollutants in the soil. Microorganisms consume nutrients from the organic substances.

**Phytovolatilization:** Plants absorb pollutants from water as well as soil and then release or supply to the atmosphere in the form of vapour at low concentrations through the leaves.

**Rhizofiltration:** Removal of the pollutants in surface water by precipitation and adsorption using plant roots.

**Phytostabilization:** Plants immobilize or solidify the pollutants in the water and soil through accumulation and absorption in plant.

**Phytotransformation:** The use of plant to the uptake and transformation of contaminant from soil. The plants release natural enzymes that cause fast chemical reaction to take place. Break down contaminated by metabolic processes.

**Hydraulic control:** To control the water table. Dense root large volume of water absorbs and reduces infiltration of precipitation.



**Figure 9: Process of Phytoremediation in a floating bed**

**Table 18: Performance of various plant species for Wastewater Treatment**

Sr. No.	Author	Plants	Media	HRT	Results
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Sr. No.	Author	Plants	Media	HRT	Results
1	Namratha, Harshini, Hamsalekha, et. al	Canna	Sand and gravel	3 days	COD-90.6% BOD-87.9%, NH <sub>3</sub> -N-66.7% TN-63.4% TP- 92.6%
2	A.V. Chopra et al.	Typha	Sand, soil	-	TDS-15% TN-40% BOD-65%
3	Sara G. Abdelhakeem, Samir A. Aboulroos	Phragmites Australis	Gravel	-	COD- 75% BOD- 84% TSS- 75% NH <sub>4</sub> - 32% TP- 22%
4	Samson O. Ojoawo, Gaddale, Udaya kumar	Reed	Gravel	3hrs	Turbidity -30 NTU to 20NTU, Nitrate-51.9% Phosphate –8.9% Phenolic compounds- 1.0 %
5	Mega Anggraeni, et. al	Canna Indica and Cyperus	Gravel and Sand	12days	In gravel bed BOD-0.45 COD-0.36 Ammonia-0.49 Nitrate 0.60 in sand bed BOD-0.16 COD-0.09 Ammonia -0.20 Nitrites- 0.45
6	Yadav S. B. et al	Eichhornia Crassipes		1 day	BOD-95.89% COD-97% TSS-82% Phosphate-50%

### Advantages

- Floating Phytoremediation is economical as compare to other treatment methods.
- It is a natural process not harmful to the environment.
- It is effective on low strength contaminants.
- It is very easy method to operate.
- It is more effective method for removal of hazardous pollutants.
- It is effective for removing dissolved nutrients.

### Limitations

- It is required large area for installation.
- Highly toxic materials can effect on aquatic plant.
- When the high concentrated pollutants present in wastewater than Pretreatment processes is necessary.
- Repeated cleaning processes are necessary.
- The type of plants are also affects the Phytoremediation process.
- Depth of plant root is affects the potential of plant for uptake.

- Climatic conditions is also affected the Performance of Phytoremediation technology.

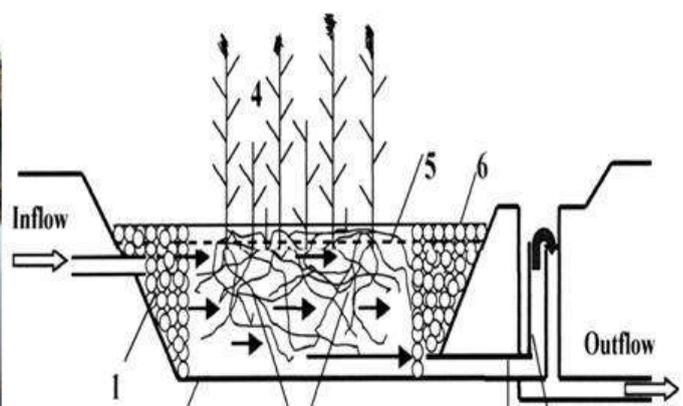
## B) Constructed Wetland System

Applicability of System for drain water treatment

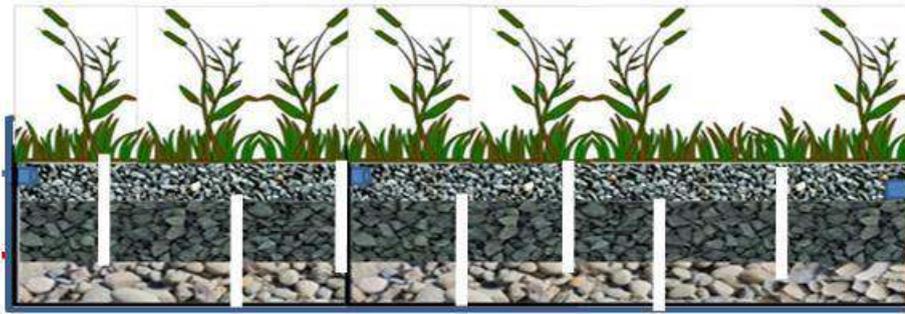
- Width of Drain: 5-15 m
- Depth of Drain: 1-3 m
- Organic loading: BOD: <100 mg/l
- Hydraulic loading: < 20 MLD
- Treatment scheme: In-Situ/Ex-Situ

Constructed Wetland Systems have been used extensively for domestic waste-water and storm water treatment and are being used increasingly. Currently, most applications are focusing on large-scale systems; however they are also being used in small-scale applications e.g. on-site treatment for individual houses and small communities.

Two types of Constructed Wetland systems have been developed for wastewater treatment: (1) free water surface (FWS) systems and (2) subsurface flow systems (SFS). When used to provide a secondary level or advanced levels of treatment, FWS systems typically consist of parallel basins or channels with relatively impermeable bottom soil or subsurface barrier, emergent vegetation, and shallow water depths. Pretreated wastewater is normally applied continuously to such systems, and treatment occurs as the water flows slowly through the stems and roots of the emergent vegetation. Free water surface systems may also be designed with the objective of creating new wildlife habitats or enhancing nearby existing natural wetlands. Such systems normally include a combination of vegetated and open water areas and land islands with appropriate vegetation to provide waterfowl with breeding habitats. Subsurface flow systems are designed with an objective of secondary or advanced levels of treatment. These systems have also been called "root zone" or "rock-reed filters" and consist of channels or trenches with relatively impermeable bottoms filled with sand or rock media to support emergent vegetation.



**Figure 10: Free surface and sub surface water system**



**Mechanism**

- 1) Biochemical Oxidation of organics
- 2) Nitrification/ denitrification
- 3) Phosphate uptake  
Anaerobic treatment zones at bottom

**Figure 11: Constructed Wetland Bed**

Mechanism for treatment is as follows;

***Organic Matter:***

Degradable organic matter in wastewater, whether soluble or suspended, is removed through microbial degradation. The microbes responsible for the degradation are generally associated with slimes or films that develop on the surfaces of gravels. In general, systems are designed and operated to maintain aerobic conditions so that aerobic microorganisms perform degradation predominantly, because aerobic decomposition tends to be more rapid and complete than anaerobic decomposition; therefore, potential odors associated with anaerobic degradation are avoided. The capacity of natural treatment systems to degrade organic matter aerobically is based on rate of oxygen transfer to the system for a given organic matter (BOD loading rate).

***Nitrogen:***

The transformation and removal of nitrogen in Phytoid systems involves a complex set of processes and reactions. The mechanisms involved in the removal of nitrogen from wastewater depend on the form in which the nitrogen is present—nitrate, ammonia, or organic nitrogen. Nitrogen is usually in the form of ammonia or organic nitrogen except in the case of wastewaters that have undergone nitrification as a result of advanced wastewater treatment.

***Organic nitrogen:***

Organic nitrogen associated with suspended solids in wastewater is removed by sedimentation and filtration, as described above. Solid phase organic nitrogen may be incorporated directly into soil humus, which consists of very large, complex organic molecules containing complex carbohydrates, proteins, protein-like substances, and lignin. Some organic nitrogen is hydrolyzed to soluble amino acids that may undergo further breakdown to release ionized ammonia (NH<sub>4</sub>).

***Ammonia nitrogen:***

Ammonia nitrogen may follow several pathways in natural systems. Soluble ammonia can be removed by volatilization directly into the atmosphere as ammonia gas. This removal pathway is relatively minor (< 10 percent) except in the case of stabilization ponds where long detention times and large pH swings combine to produce substantial volatilization of ammonia. Most of the influent and converted ammonia in a natural system is adsorbed temporarily on layer of charged organic particles on gravels. Adsorbed ammonia is available for uptake by vegetation and microorganisms or for conversion to nitrate nitrogen through biological nitrification under aerobic conditions.

***Nitrate nitrogen:***

Nitrate may be taken up by vegetation, uptake occurs in the vicinity of the root zone during active growing periods. To actually achieve nitrogen removal from the system by plant uptake, the vegetation must be harvested and removed from the system. Nitrate is also removed by biological de-nitrification and subsequent release of gaseous nitrous oxide and molecular nitrogen into the atmosphere.

***Phosphorus:***

The major phosphorus removal processes in natural treatment systems are chemical precipitation and adsorption, plants do take up as well.

**Advantages**

- Works on gravity
- Operation and maintenance expenses are negligible
- Very less electric power requirement
- Treatment efficiencies for the removal of BOD, COD and fecal coliform are in the range of 80-95%

- Nutrients such as N and P are removed up to 80%, which is greater than the traditional chemical methods
- It is a very cost effective technology when compared with the conventional wastewater treatment methods
- Subsurface flow avoiding any mosquitoes or odour
- Facilitates recycle and reuse of water
- Works at lower as well as higher flows without failure
- Since it utilizes natural vegetation and rhizosphere microorganisms, it is eco-friendly method of treating sewage.
- An important factor to be considered is the aesthetic improvement that is provided by this methodology.

### C) Bio Ropes

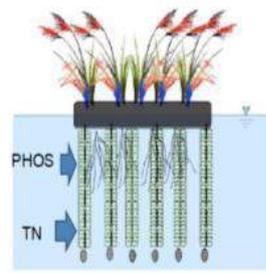
Applicability of System for drain water treatment

- Width of Drain: 5-15 m
- Depth of Drain: 1-3 m
- Organic loading: BOD: <100 mg/l
- Hydraulic loading: < 20 MLD
- Treatment scheme: In-Situ

The ecological treatment effect of Bio ropes refers to the decomposition of organic pollutants through the biological contact oxidation. Fixed film bacteriological consortium of bacteria will be provided in the insitu drain by the help of bioropes. & to enhance the removal of organic load along with TN & P removal selected plants will be allowed to grow on the cages being put in the drain. The bioropes installation can be horizontal or vertical depending on the depth of the water in the drain. Biofilm grows on any surface where water and nutrient are present nature only has a limited amount of surface area for biofilm to develop.

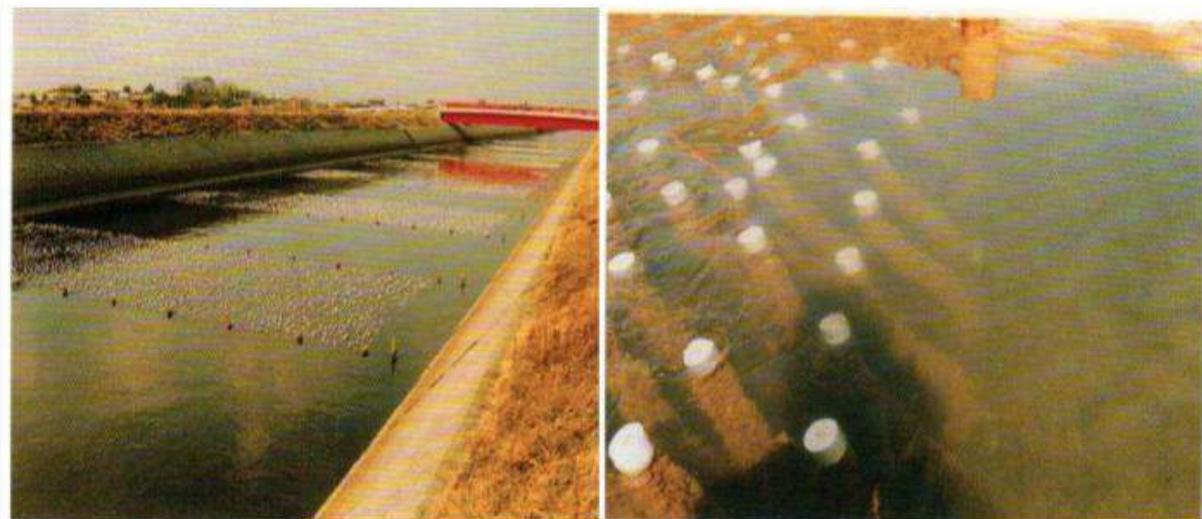


**Figure 12: Bio-Ropes**



- Phosphorus is broken down by the biofilm and absorbed by the aquatic plants and the biofilm
- Nitrogen undergoes nitrification/denitrification in the Biofilm, converts to nitrogen gas
- Organic matter which is contributing to BOD & COD is digested by consortium of attached growth biofilms

**Figure 13. Development of Bacteria on Bio-ropes working**



**Figure 14: Installation of Bio-Ropes along the stretch of a drain**

#### **D) Bio-Remediation**

Applicability of System for drain water treatment

- Width of Drain: 5-15 m
- Depth of Drain: 1-3 m
- Organic loading: BOD: <100 mg/l
- Hydraulic loading: < 20 MLD
- Treatment scheme: In-Situ/Ex-Situ
- Bio-remediation is an Environment friendly biochemical process involving specific microorganisms (principally bacteria) where in the consortia is so designed to breakdown the target pollutant under check, that leads to partial or complete mineralization of the pollutant, eventually reducing the BOD, COD and biological nutrient load in the waste water.

- These biochemical reactions are brought about by the enzymes released by these bacteria.
- The intervention of micro-organisms prevents or reduces the flow of pollutants, organic matter and xenobiotic from the land surrounding the water body into the water.
- This activity of microbes acts as a bio-filter in natural water bodies.
- This process could be further enhanced by immobilizing these microbes on fibers or on other solid support surfaces
- Microbial bioremediation could be intrinsic (within the drain using natural consortia of microorganisms) or in vitro (using an engineered treatment system).

The pollutants which can and cannot be treated by Bio-remediation/ adopting ecologically sensitive and sustainable technology are as below:

- Heavy metals including cadmium, chromium, lead and uranium are elements cannot be biodegraded.
- pH, Turbidity, DO, BOD, TSS, Kjeldahi Nitrogen, Amonical Nitrate Nitrogen, Total Phosphorus, Orthophosphate, Fecal Coliform, Total Coliform can be treated.

**Other Alternate Technology for drain Treatment:**

In combination with primary treatment in some cases ozonation has been used at treatment process for drains. The reported efficiency for BOD=80% (with BOD initial in 100-115 mg/L), COD=90% (with COD initial in 300-400 mg/L), TSS=90% (with TSS initial in 350-450 mg/L). Technology can be implemented ex-situ and requires appropriate space. However, there is need of chemicals usage and high power consumption. In some specific cases with contamination by industrial waste the technology can be considered as solution.



**Figure 15: Chemical Addition Unit & Ozonation plant**

**Summary of Comparison of Technologies for Phytoremediation/ Bioremediation:**

Summarized comparison of biological steps and Alternate Technologies for Management of Waste water in drains is reported in Table 19. All these technologies are combinations of filtration, phytoremediation/microbial oxidation, uptake of nutrients, etc. A report “Alternate

Technologies for Management of waste water in drains” prepared by CPCB and submitted to YMC has been studied. It may be noted that there are various demonstrations and applications in real-life situations of technologies. However, some these technologies do not have enough years of experience for conclusion on O&M and efficacy aspects. Also the technologies proposed are generally combination of unit process as stated above therefore while application in drains in SDMC generic specifications are required to be tendered and not technology specific.

## 5.0 Technology Comparison for treatment of wastewater In Situ Techniques

**Table 19: Technology Comparison for treatment of wastewater In Situ Techniques**

Sr. No.	Technology	Process	Type of treatment	Removal Efficiency	Variants reported	Treatment capacity (MLD)	Area required per MLD (m <sup>2</sup> )	Power Requirement
1	<b>Phytoremediation (fixed bed)</b>	It uses various types of plants to remove, transfer, stabilize and destroy contaminants in the wastewater. BOD reduction takes place by Bio-chemical oxidation process. Organic matter is brought in contact with hydrophytes.	In-Situ/ Ex-Situ	BOD: 85-95% COD: 85-95% TSS: 80-85%	Constructed Wetlands, Phytoid, Root Zone	1-10	1400-1500	Low to Moderate
2	<b>Phytoremediation (floating)</b>	In-situ treatment using floating plantation beds. However many time limitation is physical and biological operations in the aerobic and facultative environment to degrade sewage	In-Situ	BOD: 45-50% COD: 50-60%	Floating bed Bio-ropes	1-3	1000-1200	Low
		Horizontal eco-filtration using phytoremediation in different configurations	In-Situ	BOD: 40-70% COD: 40-70% TSS: 40-80%	Floating bridges	Upto 50 MLD	500-600	High
3	<b>Microbial Bioremediation</b>	A Biotechnical process which use microorganisms to remove pollutants from wastewater	In-Situ/ Ex-Situ	BOD: 75-80% COD: 85-95% TSS: 80-85%	Bioremediation	1-10	N.A.	Low
4	<b>Soil Based Technology</b>	systems for processing of both solid organic wastes and wastewater treatment using bacteria, earthworms and mineral additives in a garden-like setup	Ex-Situ	BOD: 80-85% COD: 75-85% TSS: 80-85%	SBT, Sand filters etc.	0.5-5	1000-1200	High
7	<b>Oxidation Pond</b>	Designed to treat wastewater through the interaction of sunlight, bacteria and algae.	In-Situ	BOD: 45-50% COD: 40-50%	WSP	1-20	4500-5000	Low

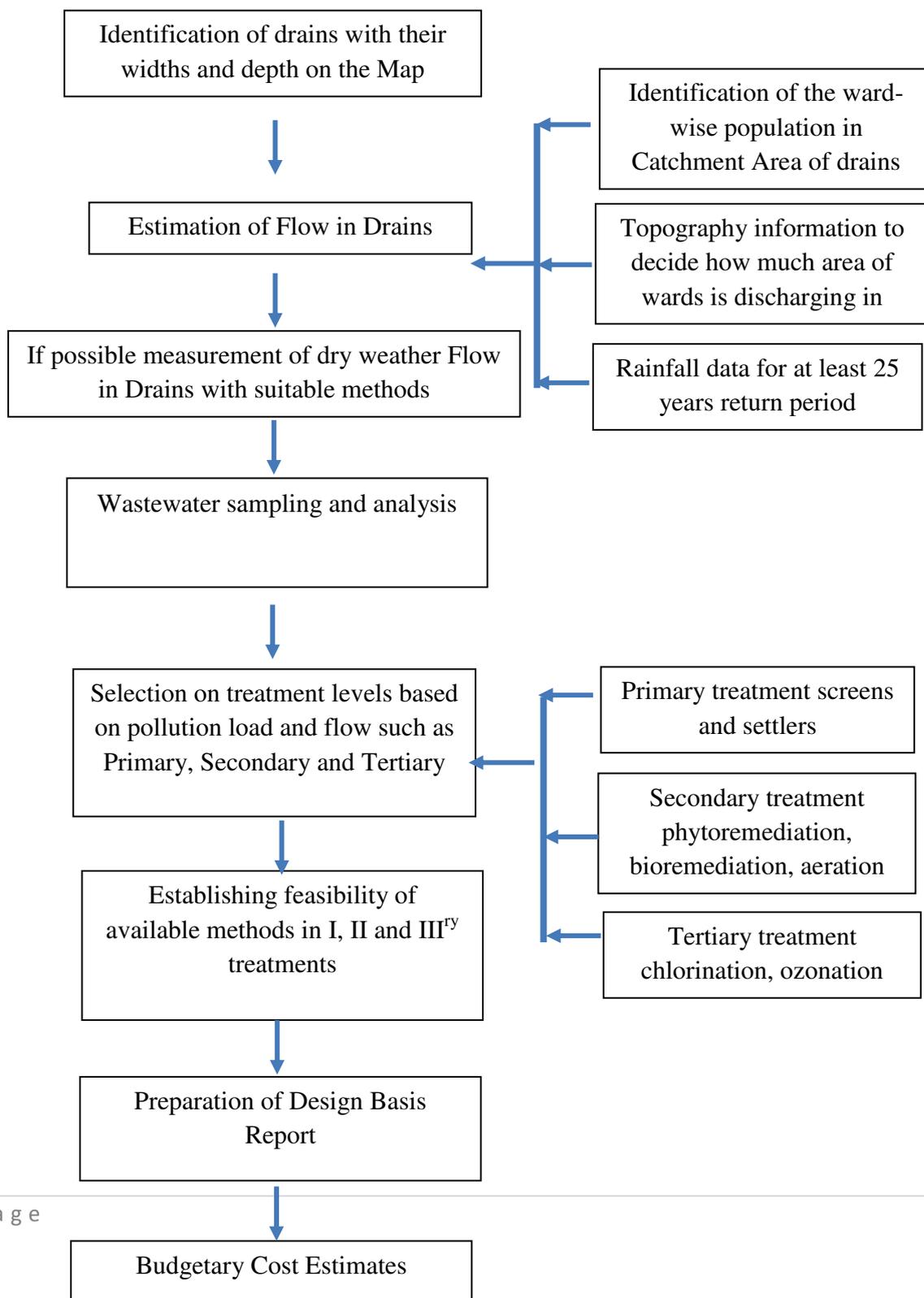
## 6.0 Comparison of various technologies for Sewage Treatment

**Table 20: Comparison of various technologies for sewage treatment**

Sr. No.	Parameter	Unit	ASP	MBBR	SBR	MBR	WSP	CWS
1.	Total Capital cost (Secondary +Tertiary)	Lacs/MLD	138	140.4	168	390	81.9	240
2.	Civil Works %	%	60	40	30	20	90	70
3.	E & M Works	%	40	60	70	80	10	30
4.	Total Area required per MLD	m <sup>2</sup>	1000	550	550	450	6100	1200
5.	Total Daily Power Requirement (avg)	kWh/d	185.7	223.7	153.7	302.5	5.7	38
6.	daily Power Cost (@ Rs. 8 per kWh)	Rs./MLD/h	61.9	74.6	51.2	100.8	1.9	12.7
7.	Yearly Power Cost	lacs pa/MLD	5.4	6.5	4.5	8.8	0.2	1.1
8.	Annual Repairs cost (Per MLD)	lacs pa/MLD	3.1	2.5	2.4		2.3	1
9.	Total Annual O&M costs	Lacs pa	21	21	22	58	10	12
10.	Installed Capacities	MLD	5-300	1-100	1-300	1-50	5-200	1-10

- ASP : Activated Sludge Process
- MBBR : Moving Bed Biological Reactor
- SBR : Sequential Batch Reactor
- MBR : Membrane Bio Reactor
- WSP : Waste Stabilization Pond
- CWS: Constructed Wetland Systems

## 7.0. Methodology on proposing Drain treatment in SDMC



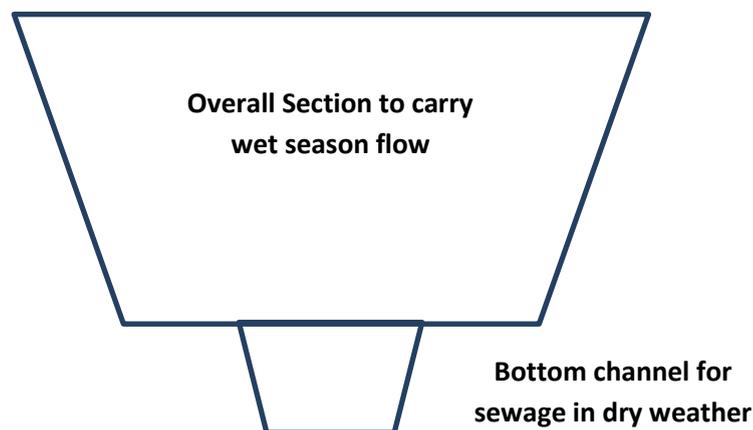
### **Figure 16: Methodology for treatment of drains**

The methodology followed for preparing action plan for treatment of drains in SDMC area is as depicted in eight step process as shown in Figure 16.

The methodology consist of (A) getting the baseline data of the drains, (B) decision on treatment levels required, (C) Feasibility of treatment methods available, (D) Design basis report, (E) Budgetary or line estimates preparation. The detail discussions on the parts and steps of methodology are given below;

#### **A) Baseline data:**

In most of the drains the sewage and storm water is flowing together. These drains are designed for the entire flow and in most of the cases in SDMC area are lined. The design of lining is as shown in the figure 17. There is a central bottom channel designed with capacity to carry the sewage in dry weather season and overall drain capacity to carry the entire sewage and storm water during monsoon period. The amount of wastewater and or storm water flowing through the drain depends on the catchment area and small drains discharging into the major drains.



**Figure 17: Typical design of lining of drains**

Therefore, the first step is to measure (in case of dry weather) or estimate the flow coming from catchment area. The same can be completed using ward wise population, water supply and topography as shown in step 2 of the figure 16.

Another baseline data which can be used is collection of wastewater sampling and its analysis in terms of pH, BoD, CoD, TSS, TDS, N, P, DO etc. Pollution load using concentrations of pollutants and flow can be estimated for each stretch and joining small drains.

## B) decision on treatment levels required

There different requirements for treatment of drains to desired output quality of water. We have considered four prong approach here,

- **Type I Drains:** For the drains which directly discharging into river Yamuna and carrying significant amount of pollution load (width > 9 m) to be treated through primary, secondary and tertiary stages, NGT discharge standards to be achieved.
- **Type II Drains:** For the drains not directly discharging into river Yamuna but are first order drains to major drain basins (width 4 m to 9 m) to be treated through primary, secondary stages, MoEF discharge standards to be achieved.
- **Type III Drains:** For drains which are discharging into first order drains ( width 1 m to 4 m), it was considered to use primary/secondary treatment for reducing pollution load to the major drains but not to meet any standards.
- **Type IV Drains:** For drains width < 1 m, it was considered to use primary treatment

The drains are categories according to width upto 1 m and above 1 m. Table 21 shows category wise drains in different zone of SDMC while table 22 shows category wise details of drains in Nazafgarh and Barrapulla basin. A tentative action plan as per the type of drains and norms to be achieved is presented in table 23. Treatment methods available have been studied and details are given for appropriate technologies in the primary, secondary and tertiary treatments in the further sections.

**Table 21: Categorization of drains Zone wise report**

S. No.	Width of the drain (in meters)	Nos.	Length (m)	Nos.	Length (m)	Nos.	Length (m)	Nos.	Length (m)	Nos.	Length (m)
		Central		South		West		NGZ		Total	
1	<1	10	8830	26	12471	65	41061	26	15830	127	78192
2	1-4	27	18290	30	14495	4	4717	42	26871	103	64373
3	4-9	10	10613	4	3860	1	1150	0	0	15	15623
4	>9	6	6320	7	8215	3	5112	0	0	16	19647

		53	44053	67	39041	73	52040	68	42701	261	177835
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**Table 22: Categorization of drains Basin wise report**

S. No.	Width of the drain (in meters)	Barapullah Basin (m)		Nazafgarh Basin (m)	
		Nos.	Length	Nos.	Length
1	<1	36	21301	91	56891
2	1-4	57	32785	46	31588
3	4-9	14	14473	1	1150
4	>9	13	14535	3	5112
		<b>120</b>	<b>83094</b>	<b>141</b>	<b>94741</b>

### C) Feasibility of treatment methods available

Considering the details of the treatment methods available and the features of the methods a matrix was prepared as indicated in section 5, table 18 of this report. Wherein listing have been done according to following;

- Type of treatment (in-situ or ex-situ)
- Pollutant removal efficiencies, for BoD, CoD, TSS, TDS, N, P etc.
- Variants of similar kind of technologies/solutions reported
- Capacities at which the treatments are implemented (in terms of MLD)
- Area required per MLD of flow to be treated
- Power requirement

For a typical drain minor or major, based on availability of space and order of treatment required, a feasibility is worked out mapping the drain data and features of the treatment process.

### D) Design basis report

Once technology mapping has been created, a detailed map need to be prepared for drainage system including first, second, and third order drains and also identified the stretches where drain is open and closed (particularly is the case in drains in Delhi). A mapping of the treatment methods and its feasibility need to be worked out of entire stretch of drain including the upstream network of small joining drains. Subsequently, designs of the treatment

devices/process were carried out. A typical design basis report for Chirag Delhi Drainage system including first order drain is given in this report. Design basis report includes detailed dimensions of the treatment systems proposed to be implemented in different stretch of the drains. At each step of DBR feed concentrations of pollutants and resulting outlet parameters based on the efficiency of the method are estimated. The design basis report will provide the guide for detailed design during implementation and preparation of BOQ

### E) Budgetary or line estimates preparation

Based on the dimension and BOQ detailed cost estimates can be prepared for implementation and also for annual O&M. However, for the scope of this report a budgetary cost is worked out for the treatment methods considering typical costs per MLD and per km in the capacity range. Budgetary cost per km for selected types of drains is given in table no. 23.

**Table 23: Budgetary cost per kilometer for four categories of drains**

Sr. No.	Type of Drain and width	Considered average width of Drain (m)	Effective avg. Depth of Drain considered (m)	Treatment Scheme	Components	Cost of treatment per km length (lakhs)
1	Type-IV (<1 m)	1	0.5	Primary	Screening	15
2	Type-III (1-4 m)	2.5	1.25	Primary + Secondary	Screening, Silt trap, Floating bed	85
3	Type-II (4-9 m)	6	3	Primary +Secondary	Screening, Silt trap, Gabion filter, Floating bed	155
4	Type-I (>9 m)	11	3.5	Primary + Secondary + Tertiary	Screening, Silt trap, Gabion filter, Floating bed, Disinfection	200

### 7.2 Discharge Standards

Discharge standards of Municipal STPs notified by MoEF& CC are shown in table 24. Further NGT made more stringent norms for STPs especially for metro cities. Standards laid down by NGT are presented in table 25. In view of the directives of the NGT discharge norms for Mega and Metropolitan Cities were chosen for the in situ treatment of the Chirag Delhi Defense colony Nallah.

**Table 23: Discharge standards of Municipal STPs**

Sr. No	Parameters	Old Norms 1986	Draft Norms Nov., 15	MoEF & CC Notification October 2017
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1.	Biochemical Oxygen Demand (BOD) (mg/L)	<30	<10	<30 and <20 (metro cities)
2.	Chemical Oxygen Demand (COD) (mg/L)	<250	50	No limit
3.	Total Suspended Solids (TSS) (mg/L)	<100	<20	<100 and <50 (metro cities)
4.	Total Nitrogen (mg/l)	<100	<10	No limit
5.	Ammonical Nitrogen (mg/L)	<50	<5	No limit
6.	Total Phosphorus (mg/L)	No limit	No limit	No limit
7.	Fecal Coliform MPN/100 mL	No limit	<100	<1000

**Table 24: NGT Standards (Sewage Treatment Plant's)**

Sr. No	Parameters	Standards (Applicable to all mode of disposal)			
		Mega and Metropolitan Cities	Class I Cities	Others	Deep Marine Outfall
1.	pH	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
2.	Bio- Chemical Oxygen Demand (BOD)	10	20	30	30
3.	Total Suspended Solids (TSS)	20	30	50	50
4.	Chemical Oxygen Demand (COD)	50	100	150	150
5.	Nitrogen-Total	10	15	-	-
6.	Phosphorus-Total (For Discharge into Ponds, Lakes)	1	1	1	-
7.	Fecal Coliform(FC) (Most Probable Number per 100 mL MPN/100ml)	Desirable-100 Permissible-230	Desirable-230 Permissible-1000	Desirable-1000 Permissible-10000	Desirable-1000 Permissible-10000

- i. *Mega-Metropolitan Cities have population more than 1 crore, Metropolitan Cities- Population more than 10 Lakhs and Class-1 Population more than 1 Lakh.*
- ii. *All value in mg/l except for pH and Fecal Coliform.*
- iii. *These standards will be applicable for discharge into water bodies as well as for land disposal/applications.*
- iv. *These Standards shall apply to all new STPs for which construction is yet to be initiated.*
- v. *The existing/under construction STPs shall achieve these standards within 07 years from the date of notification.*
- vi. *In case where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100m away from discharge point, then norms for deep sea marine discharge shall be applied.*
- vii. *Reuse/Recycling of treated effluent shall be encouraged.*

viii. *State Pollution Control Boards/Pollution Control Committees may make these norms more stringent taking into account the local conditions.*

### 7.3. Drain Specific Feasibility of Treatment

Considering various aspects of the technology applicability and discharge norms to achieve a drain-wise feasibility of treatment process for 10 selected type I drains, after discussion with SDMC officials (table 26) is prepared and presented in table 27. Further a detailed action plan (design basis report) for Chirag Delhi Nallah is also presented in subsequent section.

**Table 25: List of ten identified drains of South and central zone for major intervention**

Sr. No.	Drain Name	Length (m) (approx)	Width (m)		
			Max	Min	Avg.
1.	Chirag Delhi to Defense Colony Nallah	3700	60.0	1.0	17.3
2.	Nallah no. 12 from Tilak Bridge to Yamuna River	1590	24.8	15.0	19.9
3.	Mathura road to Outfall in Yamuna	1050	19.5	1.0	10.8
4.	Nallah no. 14 from Gate no. 5 Pragati Maidan to Yamuna River	1950	19.0	10.5	15.1
5.	Panthnagar Nallah - L.S.R Collage to Barapulla Nallah	3700	13.5	7.5	10.9
6.	National Park Nallah	610	12.5	1.0	7.1
7.	Taimoor Nagar C V Raman Marg to Block F	890	10.5	4.2	7.7
8.	Okhla Phase-1 to Sarita Vihar	3200	10.1	4.7	6.9
9.	Nallah no. 15 from Railway Track to Yamuna River	1200	10.0	1.0	6.6
10.	Z Block Nallah (Kohl Phase-II) X	3000	6.0	1.0	1.7

**Table 26: Drain-Wise Feasibility of Treatment Process**

Sr. No.	Drain name	Length (m) (Approx)	Width (m)			Primary Treatment	Secondary Treatment	Remarks
			Max	Min	Avg.			
1.	Chirag Delhi To Defense Colony Nallah	3700	60	1	17.31	Simple Screens can be used for floating material removal near culverts with a narrow width.	A weir arrangement can be done to arrest the silt/sludge and increase turbulence, followed by Floating Phytoremediation for decomposition of organic compounds and nutrients.	High TSS 655 mg/L, High Ammonical nitrogen 45 mg/L need to be considered while application of technology. Flow rate is also high and could be limitation to bioremediation (in view of minimum residence time required).
2.	Chirag Delhi Village Nallah From Chirag Delhi Culvert To Outer Ring Road	1230	30.3	16.6	23.2	Use of litter trap/bubble curtains shall be done to remove floating materials	A weir arrangement can be done to arrest the silt/sludge and increase turbulence followed by constructed wetland/bio ropes for biological action	
3.	Mathura Road to Outfall in Yamuna	1050	19.5	1	10.8	Simple manual Screens can be used for floating material removal at locations of narrow width.	Floating beds are recommended for organic decomposition	
4.	Nallah 13A Mathura Road to Outfall in Yamuna	260	9.7		9.7			Drain No. 13 A is an extended part of Mathura Road drain. Treatment of both drains can be done combined.

Sr. No.	Drain name	Length (m) (Approx)	Width (m)			Primary Treatment	Secondary Treatment	Remarks
			Max	Min	Avg.			
5.	Nallah No.- 12 From Tilak Bridge To Yamuna River	1590	24.8	15	19.9	Use of litter trap/bubble curtains shall be done to remove floating materials	Phytoremediation/ Bio ropes mechanism can be used for treatment. Cascade with a gentle slope from overflow of Phytoremediation to increase DO levels.	
6.	Nallah No.- 14 From Gate No.-5 Pargati Maidan To Yamuna River	1950	19	10.5	15.1	Use of litter trap/bubble curtains shall be done to remove floating materials	Phytoremediation/ Bio ropes mechanism can be used for treatment. Cascade with a gentle slope from overflow of Phytoremediation to increase DO levels.	
7.	NallahNo.- 15 From Railway Track To Yamuna River	1200	10	1	6.62	Manual Screens are recommended to trap and remove floating solids	Treatment can be done either by in-situ floating Phytoremediation or ex-situ constructed wetland /soil biotechnology if required space is available near to the drain.	
8.	Sunhari Nallah	365	50	45	47.5	Since initial part of drain is covered, screens can be used near culverts to remove solids.	Phytoremediation/bio ropes can be used for biological treatment of wastewater.	

Sr. No.	Drain name	Length (m) (Approx)	Width (m)			Primary Treatment	Secondary Treatment	Remarks
			Max	Min	Avg.			
9.	Taimoor Nagar - C V Raman Marg To Block F	890	10.5	4.2	7.72	Simple Screens can be used for floating material removal	Treatment can be done either by in-situ floating Phytoremediation or ex-situ constructed wetland /soil biotechnology if required space is available adjacent to the drain.	Drain is located in the vicinity of residential area. Accordingly treatment scheme shall be adopted.
10.	Z Block Nallah (Kohl Phase-II)	3000	6	0.95	1.72	Due to narrow width, simple Screens can be used for floating material removal.	Both In-Situ and Ex-Situ treatment can be done using Phytoremediation technique.	

## 7.4. Action Plan for Treatment of Wastewater in Drains (Chirag Delhi Drain – Case Study)

Detailed action plan is prepared for Chirag Delhi drainage system as a case study. Drainage system includes first order open drains of Chirag Delhi main drain. The first data set used herein is profile of drain with top level and invert level. Using wastewater quality and efficiencies of treatment process a matrix is created for feasibility of the primary and secondary treatment process. Possible locations for the intervention are identified using google map. Figure 18 shows the location for Chirag Dehi Nallah In this report Drain-wise

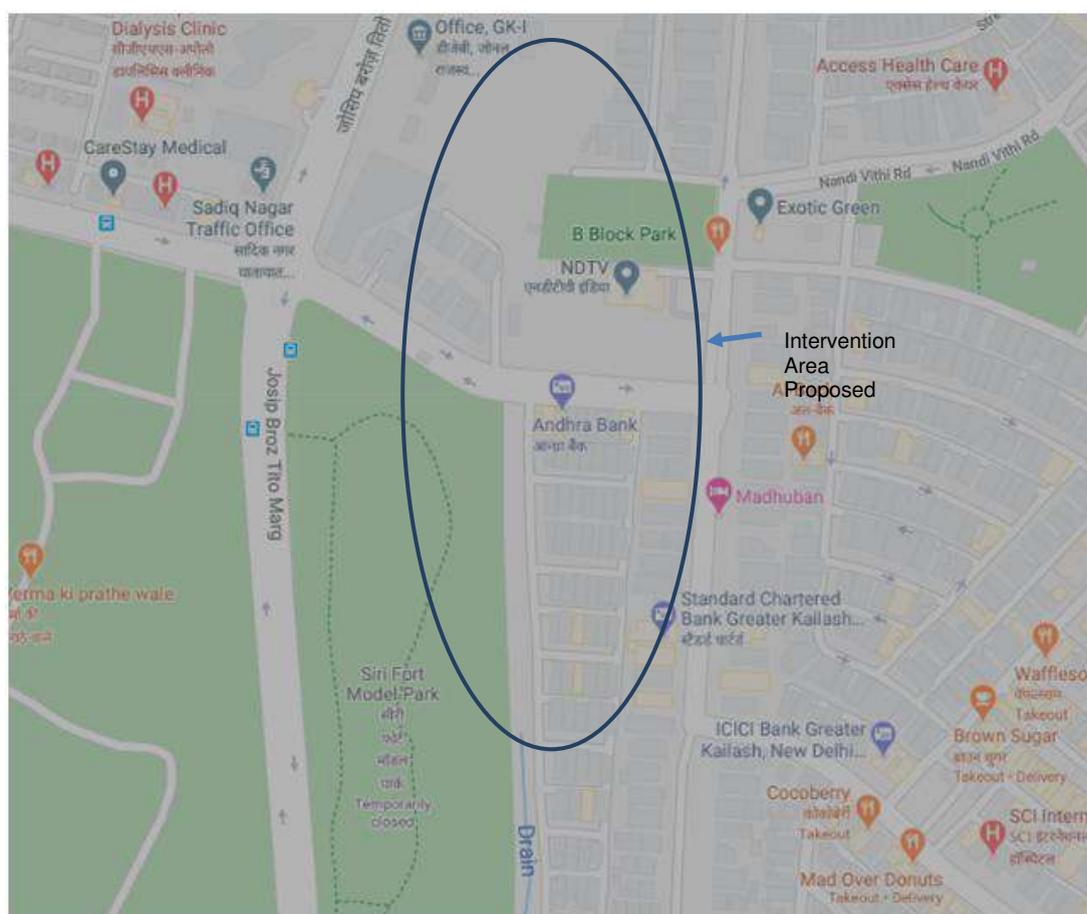


Figure 18: Satellite image representing Chirag Delhi drain

### 7.4.1 Chainage of Chirag Delhi Drain

Chirag Delhi Nallah has three segments starting from press enclave area till confluence in barrapullah in between it confluence with three first order drains with respect to itself. These first order drains also carry load from second, third and other higher order drains. Total length of Chirag Delhi system is approximately 17.2 Km and carries sewage mainly from Chirag

Delhi, Pushp Vihar, Saket, Shah Pur Jat, Panchsheel, and GK-1. Details of chainage of Chirag Delhi drain is presented in table 28 along with layout in figure 19. Table 29 shows that action plan for the in situ treatment in the Chirag Delhi drain and its three major first order drains of Chirag. Pollution load for its confluence drains is given in table 30. This load is used to prepare DBR.

**Table 27: Details of Chirag Delhi Drain**

Sr. No.	Nallah	Approx. Length	Avg Width
<b>Three Segments of Chirag Delhi Drain</b>			
1.	Chirag Delhi to Defense Colony	3.5 km	17 m
2.	Pushpvihar main Nallah from MB Road to Press Enclave Road (RHS-LHS)	1.9 km	25 m
3.	GK Nallah from Chirag Delhi Flyover to link road culvert near Central School	2.0 km	23 m
<b>First Order drains wrt Chirag Delhi Drain</b>			
4.	Push Vihar Mani Nallah	1.8 km	18 m
5.	Jagdamba Camp Nallah From Jagadamba Camp To Chirag Delhi Nallah	0.3 km	8 m
6.	R&S Block GK-1 from S-363 To B Block Nallah	1.4 km	3 m
7.	Nallah along August Kranti Marg from Panchsheel Club to Kamla Nehru College	1.5 km	2.4 m
8.	Sant Nagar Covered drain	0.6 km	1.8 m
<b>Second and higher Order drains wrt Chirag Delhi Drain and first and higher order with respect to Pushp Vihar Main Nallah</b>			
4.1.	RPS Nallah	1.0 km	4.1 m
4.1.1	Bhumiya Nallah	0.43 km	0.8 m
4.2	D/S Virat drain from BRT Corridor to main Nallah Pushp Vihar Sector - 4	0.4 km	3.2 m
4.2.1	Central Market Madangir	0.6 km	
4.2.1.1	Nallah from culvert near Mount Columbus	0.57 km	1.7 m
4.3	Chambered DDA flats Madan Gir Gali no 28	0.88 km	0.8 m
<b>Second and higher Order drains wrt Chirag Delhi Drain and first and higher order with respect to Nallah along August Kranti Marg</b>			
7.1	Shapur Jat drain from DDA office to August Kranti Marg Nallah	0.3 km	0.85 m

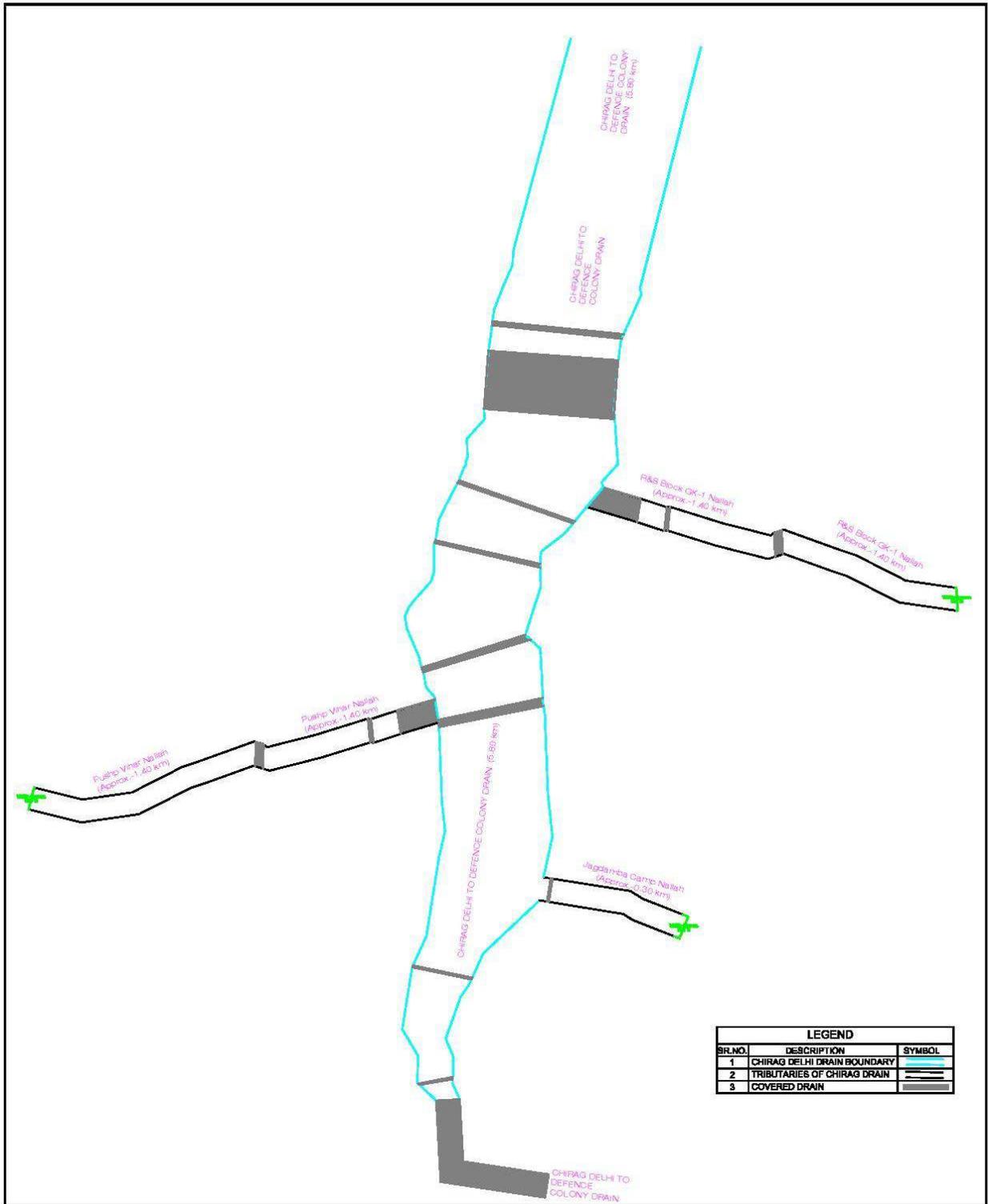


Figure 19: Layout representation of Chirag Delhi drain

**Table 28: Action plan for treatment of Chirag Delhi drain**

Name of Drain	Co-ordinates	Approx. Length (m)	Avg. Width (m)	Type of treatment	Components	Expected outcome	Remarks
<b>Chirag Delhi to Defense Colony</b>	28.517086, 77.226323 to 28.520166, 77.224578	500	11	Primary	Coarse screen, Fine screen & grit trap	Removal of floating solids, silt trapping	Manual cleaning of screens to be done on regular basis
	28.521682, 77.225418 to 28.540070, 77.226125	2000	11	Secondary treatment	Gabion filter	Increase in residence time & increase in dissolved oxygen due to turbulence.	Partially treated water for Pushp vihar, Jagdamba camp and R&S Block GK-1 drain will meet and further treated in this region
	28.547149, 77.228411 to 28.577620, 77.236015	2300	11	Secondary treatment	Floating bed phytoremediation	Biological decomposition of organic pollutants resulting into reduction in pollutant load	Partially treated water for Pushp vihar, Jagdamba camp and R&S Block GK-1 drain will meet and further treated in this region
	28.577895, 77.236106 to 28.579424, 77.236349	150	11	Tertiary treatment	Hypochlorite dosing	Disinfection of treated sewage & treatment of Fecal coliform	Combined tertiary treatment of major drain and minor outfalls
<b>Pushp vihar drain</b>	28.521146, 77.227047 to 28.521390, 77.226353	60	5-6	Primary	Coarse screen, Fine scree & grit trap	Removal of floating solids, silt trapping	Manual cleaning of screens to be done on regular basis
	28.521390, 77.226353 to 28.521713, 77.225435	100	5-6	Secondary treatment	Floating bed phytoremediation	Biological decomposition of organic pollutants resulting into reduction in pollutant load	Due to limited space availability partial secondary treatment Is proposed

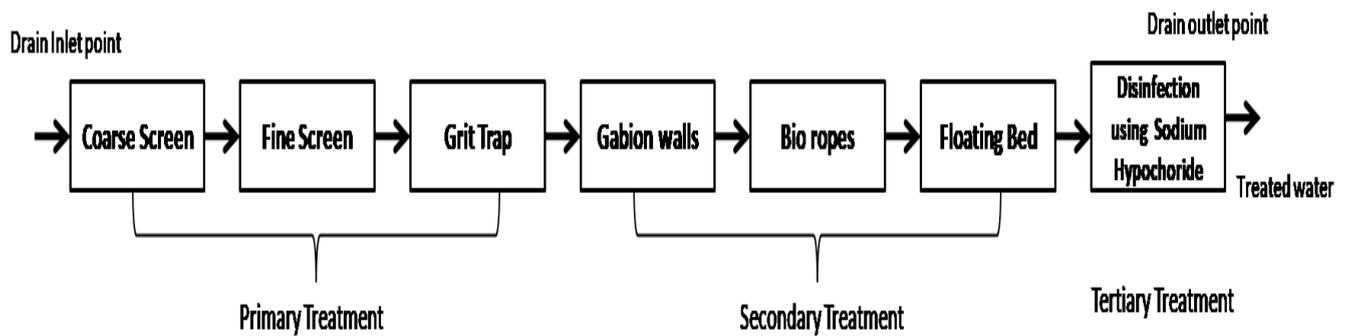
Name of Drain	Co-ordinates	Approx. Length (m)	Avg. Width (m)	Type of treatment	Components	Expected outcome	Remarks
<b>Jagdamba camp Nallah</b>	28.524235, 77.207416 to 28.524128, 77.210875	300	5-6	Primary	Coarse screen, Fine scree & grit trap	Removal of floating solids, silt trapping	Manual cleaning of screens to be done on regular basis
	28.524128, 77.210875 to 28.525770, 77.215382	500	5-6	Secondary treatment	Gabion filter	Increase in residence time & increase in dissolved oxygen due to turbulence.	
	28.525770, 77.215382 to 28.527344, 77.223348	900	5-6	Secondary treatment	Floating bed phytoremediation	Biological decomposition of organic pollutants resulting into reduction in pollutant load	Partial secondary treatment using floating beds is proposed due to limited space availability
<b>R&amp;S block GK-1 Nallah</b>	-	150	5-6	Primary	Coarse screen, Fine scree & grit trap	Removal of floating solids, silt trapping	Manual cleaning of screens to be done on regular basis
	28.553125, 77.230353 to 28.553112, 77.232024	250	5-6	Secondary treatment	Floating bed phytoremediation	Biological decomposition of organic pollutants resulting into reduction in pollutant load	

**Table 29: Pollution load estimation for Chirag Delhi Drain**

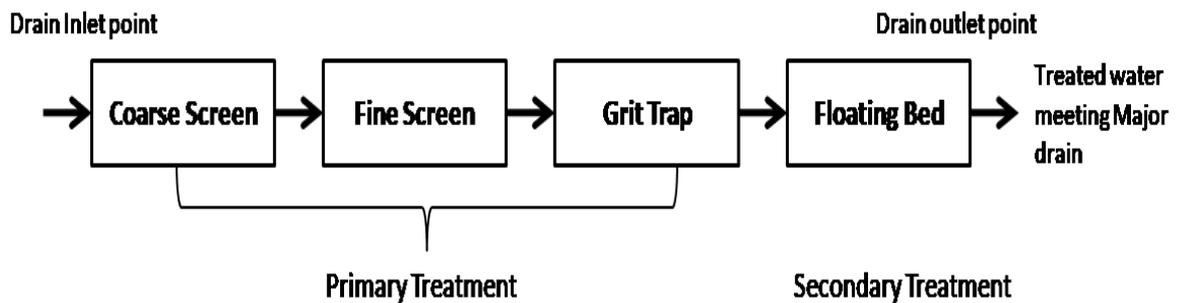
Sr. No.	Nallah Name	Approx length (km)	Avg. Width (m)	Avg. Depth (m)	volumetric flow rate MLD	BOD (mg/l)	COD (mg/l)	Desired BOD (mg/l)	Desired COD (mg/l)	BOD load (ton/day)	COD load (ton/day)
1.	Chirag Delhi to Defense colony	3.5	11.6	3.2							
2.	Pushpvihar main Nallah from MB Road to Press Enclave Road (RHS-LHS)	1.2	25	4.75	20	80	240	10	50	1.40	4.80
3.	GK Nallah from Chirag Delhi Flyover to link road culvert near Central School	0.8	23	4.75							
4.	Push Vihar Nallah	1.8	18	3							
5.	Jagdamba Camp Nallah From Jagadamba Camp To Chirag Delhi Nallah	0.3	8	3	1	80	250	10	50	0.07	0.25
6.	R&S Block GK-1 from S-363 To B Block Nallah	1.4	3	3	1	80	250	10	50	0.07	0.25

### 7.4.2 Treatment Scheme:

In order to reduce pollutant load on Chirag Delhi drain and to meet desired norms, following treatment scheme is proposed. Major drain will follow primary, secondary and tertiary treatment whereas drains meeting major drain will follow primary and secondary treatment. Details flow diagram of treatment scheme is as shown in figure 20 & 21.



**Figure 20: Treatment methodology for Major drain (Chirag Delhi to Defense colony)**



**Figure 21: Treatment scheme for drains meeting Major drain (Pushp Vihar Nallah, Jagdamba Camp Nallah From Jagadamba Camp To Chirag Delhi Nallah & R&S Block GK-1 from S-363 To B Block Nallah).**



### 7.4.3 Design Basis Report:

#### A) Chirag Delhi Drain:

##### Proposed Treatment Scheme

##### First Stage: Primary Treatment

- Floatable Solids removal using a bar screen
- Fine solids removal using a bar screen
- Grit trap to arrest grit//silt.

##### Second Stage: Biological Treatment

- Gabion walls to increase turbulence & residence time.
- Floating Phytoremediation

##### Third Stage: Tertiary Treatment

- Disinfection by chlorine dosing

#### a) Design aspect for Chirag Delhi to Defense Colony drain

**Table 30: Design aspect for Chirag Delhi to Defense Colony Drain**

<b>PRIMARY TREATMENT</b>		
<b>BAR SCREEN (COARSE) (MECHANICAL)</b>		
Treatment characteristics		Removal of large floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	14000 cum/day
	:	583.3 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	20 mm
Size provided for Coarse Screen	:	(10 W x 3 D x 0.025 t)
Quantity	:	One No.
<b>BAR SCREEN CHAMBER (FINE) (MANUAL)</b>		
Treatment characteristics		Removal of fine floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	583.3 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	10 mm
Size provided for Coarse Screen	:	(10 W x 3 D x 0.025 t)
Quantity	:	One No.

<b>SECONDARY TREATMENT</b>		
<b>GABION FILTER</b>		
Treatment characteristics		Increase aeration and residence time
Type	:	Boulders, pebbles embedded in iron mesh
Spacing between gabion wall	:	8-10 m
Channel opening	:	25 %
Typical Dimension	:	7-8 m (L) x 0.5m (t) x 2-3m (D) (depth upto water level)
Numbers of gabion wall	:	5-7 Nos.
<b>FLOATION WETLAND</b>		
Treatment characteristics	:	Biological treatment of organic pollutants
MOC	:	Floating raft with plants, typically in 1m x 1m raft area
Feed Flow (Q)	:	20000 cum/Day
Average Flow	:	833.3 cum/hr
Inlet BOD (Ci)	:	80 ppm
Outlet BOD (Co)	:	10 ppm
Organic Load as BOD removal	:	0.98 ton/Day
Temperature constant (Kt) $Kt = K20 \times \theta^{(Tw-20)}$	:	1.21
Temperature constant at 20 degrees (K <sub>20</sub> )	:	0.678
Temperature coefficient (Θ)	:	1.06
Porosity (n)	:	0.75
Depth of a Nallah (d)	:	3.2 m
Width of drain (w)	:	11 m
Temperature of Nallah water (Tw)	:	30 degree C
Area required for Floating Phytoremediation (A) $A = \frac{Q \ln\left(\frac{Ci}{Co}\right)}{Kt \times d \times n}$	:	14256 m <sup>2</sup> ( <i>Reed S.C., Natural systems for waste management and treatment</i> )
Length Required	:	1296 m
Area Dimensions	:	1296 m(L) x 11 m (W)
Retention time (t) $t = \frac{A \times d \times n}{Q}$	:	2.2 days
Hydraulic loading rate H=Q/A	:	17.1 m/day
<b>TERTIARY TREATMENT</b>		
<b>DISINFECTION</b>		
Type	:	Sodium hypochlorite dosing
Average flow (Including confluence drains)	:	20000 m <sup>3</sup> /day ( <i>combined flow for tertiary treatment</i> )
Max. Chlorine Dose	:	5 mg/l
Strength of Hypochlorite soln.	:	10 %
Hypochlorite dose required per day	:	1000 l/day
Dosing rate	:	45.5 l/hr

**b) Design Aspect for partial treatment in Pushp Vihar Drain:**

**Table 31: Design Aspect for partial treatment in Pushp vihar Drain**

<b>PRIMARY TREATMENT</b>		
<b>BAR SCREEN (COARSE) (MECHANICAL)</b>		
Treatment characteristics		Removal of large floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	4000 cum/day
	:	166.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	20 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t))
Quantity	:	One No.
<b>BAR SCREEN CHAMBER (FINE) (MANUAL)</b>		
Treatment characteristics		Removal of fine floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	166.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	10 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t) )
Quantity	:	One No.
<b>SECONDARY TREATMENT</b>		
<b>GABION FILTER</b>		
Treatment characteristics		Increase aeration and residence time
Type	:	Boulders, pebbles embedded in iron mesh
Spacing between gabion wall	:	8-10 m
Channel opening	:	25 %
Typical Dimension	:	3 m (L) x 0.5m (t) x 2-3m (D) (depth upto water level in drain)
Numbers of gabion wall	:	5-7 Nos.
<b>FLOATION WETLAND</b>		
Treatment characteristics	:	Biological treatment of organic pollutants
MOC	:	Floating raft with plants, typically 1m x 1m raft area
Feed Flow (Q)	:	4000 cum/Day
Average Flow	:	166.6 cum/hr
Inlet BOD (Ci)	:	80 ppm
Outlet BOD (Co)	:	10 ppm

Organic Load as BOD removal	:	0.28 ton/Day
Temperature constant (Kt) $Kt = K20 \times \theta^{(Tw-20)}$	:	1.21
Temperature constant at 20 degrees (K <sub>20</sub> )	:	0.678
Temperature coefficient (Θ)	:	1.06
Porosity (n)	:	0.75
Depth of a nallah (d)	:	3 m
Width of drain (w)	:	5-6 m
Temperature of nallah water (Tw)	:	30 degree C
Area required for Floating Phytoremediation (A) $A = \frac{Q \ln\left(\frac{C_i}{C_o}\right)}{Kt \times d \times n}$	:	3055 m <sup>2</sup>
Length Required	:	509 m
Area Dimensions	:	509 m (L) x 6 m (W)
Retention time (t) $t = \frac{A \times d \times n}{Q}$	:	1.7 days
Hydraulic loading rate H=Q/A	:	1.3 m/day

**c) Design Aspect for partial treatment in Jagdamba Camp Nallah from Jagadamba Camp To Chirag Delhi Nallah:**

**Table 32: Design Aspect for partial treatment in Jagdamba Camp Nallah from Jagadamba Camp to Chirag Delhi Nallah**

<b>PRIMARY TREATMENT</b>		
<b>BAR SCREEN (COARSE) (MECHANICAL)</b>		
Treatment characteristics		Removal of large floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	1000 cum/day
	:	41.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	20 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t))
Quantity	:	One No.
<b>BAR SCREEN CHAMBER (FINE) (MANUAL)</b>		
Treatment characteristics		Removal of fine floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	41.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	10 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t) )
Quantity	:	One No.
<b>SECONDARY TREATMENT</b>		

<b>GABION FILTER</b>		
Treatment characteristics		Increase aeration and residence time
Type	:	Boulders, pebbles embedded in iron mesh
Spacing between gabion wall	:	8-10 m
Channel opening	:	25 %
Typical Dimension	:	3 m (L) x 0.5m (t) x 2-3m (D) (depth upto water level in drain)
Numbers of gabion wall	:	5-7 Nos.
<b>FLOATION WETLAND</b>		
Treatment characteristics	:	Biological treatment of organic pollutants
MOC	:	Floating raft with plants, typically 1m x 1m area
Feed Flow (Q)	:	1000 cum/Day
Average Flow	:	41.6 cum/hr
Inlet BOD (Ci)	:	80 ppm
Outlet BOD (Co)	:	10 ppm
Organic Load as BOD removal	:	70 kg/Day
Temperature constant (Kt) $Kt = K_{20} \times \theta^{(T_w-20)}$	:	1.21
Temperature constant at 20 degrees (K <sub>20</sub> )	:	0.678
Temperature coefficient (Θ)	:	1.06
Porosity (n)	:	0.75
Depth of a nallah (d)	:	3 m
Width of drain (w)	:	5-6 m
Temperature of nallah water (Tw)	:	30 degree C
Area required for Floating Phytoremediation (A) $A = \frac{Q \ln\left(\frac{C_i}{C_o}\right)}{Kt \times d \times n}$	:	763.7 m <sup>2</sup>
Length Required	:	152 m
Area Dimensions	:	509 m (L) x 5 m (W)
Retention time (t) $t = \frac{A \times d \times n}{Q}$	:	1.7 days
Hydraulic loading rate H=Q/A	:	1.3 m/day

It can be seen from above calculations the in view to achieve desired standards laid by NGT, length required in most of the drains for In-situ treatment is found insufficient. Therefore only partial treatment at these drains is possible. Although treatment may be done in batches at different sections. In order to meet prevailing norms a parallel treatment can be done via electromechanical intervention after checking the feasibility.

d) Design aspects for R&S Block GK-1 from S-363 To B Block Nallah

Table 33: Design aspects for R&S Block GK-1 from S-363 To B Block Nallah

<b>PRIMARY TREATMENT</b>		
<b>BAR SCREEN (COARSE) (MECHANICAL)</b>		
Treatment characteristics		Removal of large floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	1000 cum/day
	:	41.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	20 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t))
Quantity	:	One No.
<b>BAR SCREEN CHAMBER (FINE) (MANUAL)</b>		
Treatment characteristics		Removal of fine floating solids
Type	:	Rectangular iron mesh (rake type)
MOC	:	S.S/M.S
Average Flow	:	41.6 cum/hr
Velocity	:	0.5m/sec
Bar Opening	:	10 mm
Size provided for Coarse Screen	:	(5-6 m (W) x 3m (D) x 0.025m (t) )
Quantity	:	One No.
<b>SECONDARY TREATMENT</b>		
<b>GABION FILTER</b>		
Treatment characteristics	:	Increase aeration and residence time
Type	:	Boulders, pebbles embedded in iron mesh
Spacing between gabion wall	:	8-10 m
Channel opening	:	25 %
Typical Dimension	:	3 m (L) x 0.5m (t) x 2-3m (D) (depth upto water level in drain)
Numbers of gabion wall	:	5-7 Nos.
<b>FLOATION WETLAND</b>		
Treatment characteristics	:	Biological treatment of organic pollutants
MOC	:	Floating raft with plants, typically 1m x 1m area
Feed Flow (Q)	:	1000 cum/Day
Average Flow	:	41.6 cum/hr

Inlet BOD (Ci)	:	80 ppm
Outlet BOD (Co)	:	10 ppm
Organic Load as BOD removal	:	70 kg/Day
Temperature constant (Kt) $Kt = K20 \times \theta^{(Tw-20)}$	:	1.21
Temperature constant at 20 degrees (K <sub>20</sub> )	:	0.678
Temperature coefficient (Θ)	:	1.06
Porosity (n)	:	0.75
Depth of a nallah (d)	:	3 m
Width of drain (w)	:	5-6 m
Temperature of nallah water (Tw)	:	30 degree C
Area required for Floating Phytoremediation (A) $A = \frac{Q \ln\left(\frac{Ci}{Co}\right)}{Kt \times d \times n}$	:	763.7 m <sup>2</sup>
Length Required	:	152 m
Area Dimensions	:	509 m (L) x 5 m (W)
Retention time (t) $t = \frac{A \times d \times n}{Q}$	:	1.7 days
Hydraulic loading rate H=Q/A	:	1.3 m/day

#### 7.4.4 Budgetary cost estimate for Chirag Delhi drain

**Table 34: Budgetary cost estimate for treatment of Chirag Delhi drain (Approximately 17 km and 20 MLD sewage)**

Sr. No	Particulars	In-Situ Treatment Cost
1	Engineering Services including drawing, design and technical services (Rs.)	25,00,000
2	Capital cost including site preparation, civil works, Electro-Mechanicals, floating bed etc. (Rs.)	8,50,00,000
3	<b>Total Capital Cost (Rs.)</b>	<b>8,75,00,000</b>
4	Annual Operation & Maintenance cost (Rs.)	1,98,71,000
5	Per day Power Requirement (kWh)	3
6	Annual Cost of Electricity (Rs.)	10,000
7	<b>Grand Total including Taxes (3+4+7) (Rs.)</b>	<b>10,73,81,000</b>

#### 7.5 Final Action Plan for SDMC

It may be seen from the design basis report discussed in section 7.4.3 that to achieve desired level of treatment typical volume of treatment system is needed. However the volume will also vary with variation in influent quality. The calculation performed in section 7.4.3 is based on the present water quality.

Given the ground situation width and depth of the drains are fixed therefore the volume of treatment system can be varied by varying length of treatment only. As an action plan following strategy is proposed for the management of wastewater in drains under SDMC jurisdiction.

1. Pollution load should be reduced in the drains by stopping the flow of sewage into storm water drains. It is suggested that SDMC should approach DJB to implement zero sewage to storm water drain plan.
2. Load of solid waste in the drains needed to be reduced. Heavy load of solid waste in the drains increases the pollution load of the drains. For this purpose screens should be installed at all the culverts.
3. In the drains < 1 m width it is proposed to have primary treatment system after 300 m. Regular cleaning of trapped floating solids shall be done and its further contribution to the pollution load can be reduced.
4. For the proper in situ treatment and also for proper flow measurement drains emarkments should be pitched properly. Presently it is found brioke at many places.
5. As Type IV, Type III are conflucencing Type II drains which coflucence Type I drain which ultimately discharge wastewater to Yamuna River. Pollution load of these drains can be reduced by sequential treatment as shown in table 23. Further treatment of these drains will be carried out after confluence in Type I drain. It may be noted that if higher order drains are treated in situ than load of first orede and second order drains will be reduced significantly and requirement of treatment length will be reduced significantly.
6. Treatment is proposed in Type I, II, and III drains near to the out fall on the length which is available.

For estimating the cost for in situ treatment in SDMC drains, treatment cost based on per km treatment system (presented in table 23) is used. As mentioned above the critical parameter for the designing the in situ treatments system in drains under SDM jurisdiction is length, therefore the cost presently is calculated on the basis of per km treatment length. Treatment can also be done in a particular drain in multiple batches. Category wise tentative cost for drains in SDMC jurisdiction and also basin wise is shown in table 36 and 37 respectively

**Table 36: Drain category wise budgetary cost**

Sr. No.	Type of Drain and width	Considered average width of Drain (m)	Effective avg. Depth of Drain considered (m)	Treatment Scheme	Components	Cost of treatment per km length (lakhs)	Total length in SDMC region (km)	Total Cost of treatment (cr.)
1	Type-IV (<1 m)	1	0.5	Primary	Screening	15	78.19	11.73

2	Type-III (1-4 m)	2.5	1.25	Primary + Secondary	Screening, Silt trap, Floating bed	85	64.37	54.72
3	Type-II (4-9 m)	6	3	Primary +Secondary	Screening, Silt trap, Gabion filter, Floating bed	155	15.62	24.22
4	Type-I (>9 m)	11	3.5	Primary + Secondary + Tertiary	Screening, Silt trap, Gabion filter, Floating bed, Disinfection	200	19.65	39.29
<b>Total</b>							<b>177.84</b>	<b>130</b>

**Table 37: Drain category wise budgetary cost abstract for Barapullah and Najafgarh Basin**

S. No.	Width of the drain (in meters)	Barapullah Basin			Nazafgarh Basin		
		Nos.	Length (km)	Cost (Cr.)	Nos.	Length (km)	Cost (Cr.)
1	<1	36	21.3	3.2	91	56.9	8.5
2	1-4	57	32.8	27.9	46	31.6	26.8
3	4-9	14	14.5	22.4	1	1.2	1.8
4	>9	13	14.5	29.1	3	5.1	10.2
<b>Total</b>		<b>120</b>	<b>83.1</b>	<b>82.6</b>	<b>141</b>	<b>94.7</b>	<b>47.4</b>

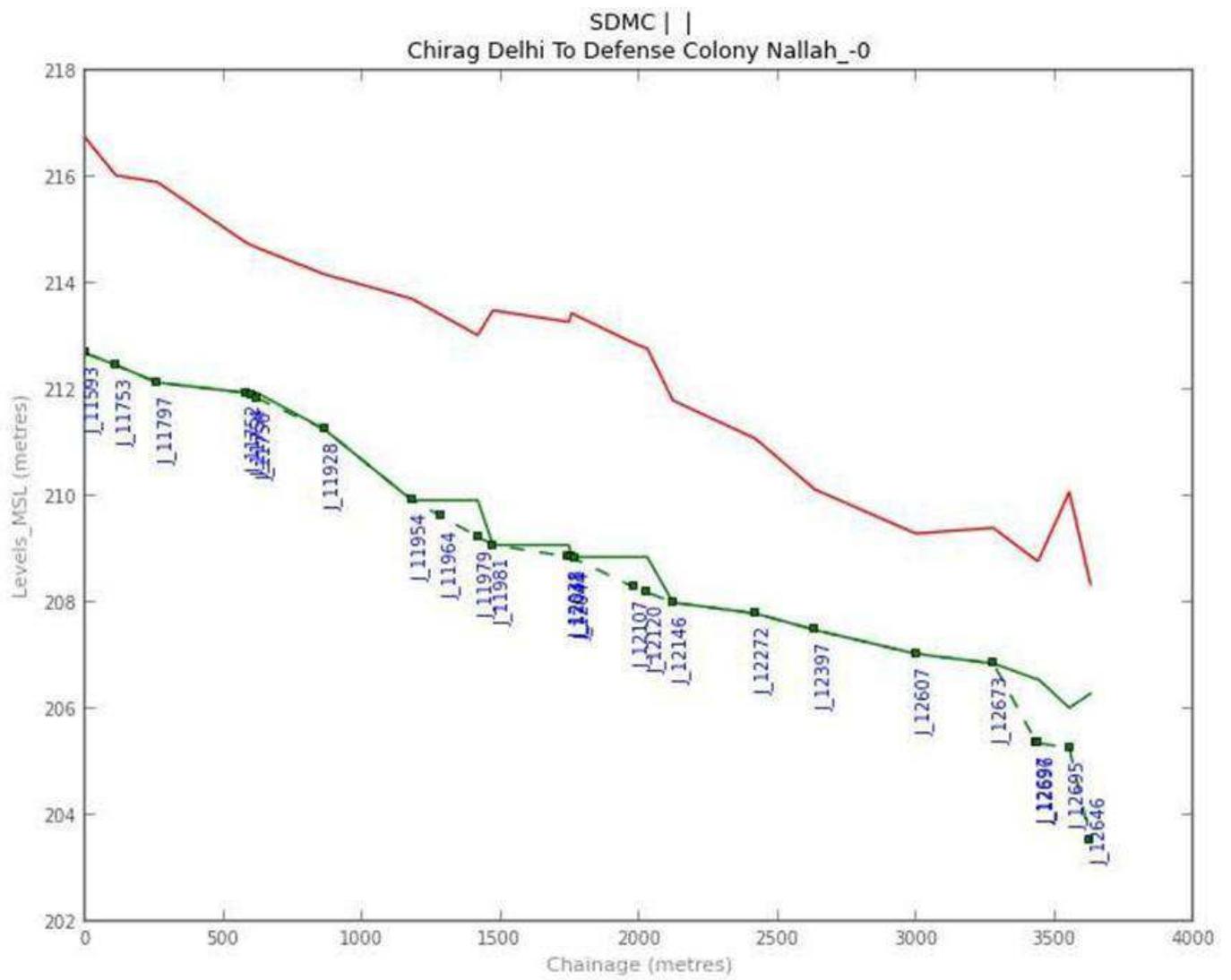
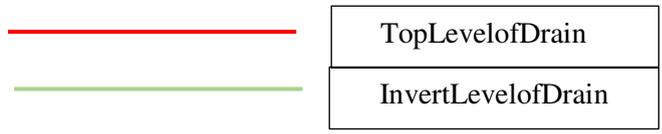
## 8.0. References

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2. [https://greentribunal.gov.in/sites/default/files/news\\_updates/Third%20Interim%20Report%20of%20Yamuna%20Monitoring%20Committee%20in%20OA%20No.%2006%20of%202012.pdf](https://greentribunal.gov.in/sites/default/files/news_updates/Third%20Interim%20Report%20of%20Yamuna%20Monitoring%20Committee%20in%20OA%20No.%2006%20of%202012.pdf)
3. <https://yamuna-revival.nic.in/wp-content/uploads/2019/02/Sewage-Management-in-Delhi.pdf>
4. <https://yamuna-revival.nic.in/wp-content/uploads/2019/02/Interim-Progress-Report-of-Yamuna-Monitoring-Committee.pdf>
5. [http://www.sulabhervis.nic.in/Database/STST\\_wastewater\\_2090.aspx](http://www.sulabhervis.nic.in/Database/STST_wastewater_2090.aspx)
6. [http://www.indiaenvironmentportal.org.in/files/file/Sewerage\\_Master\\_Plan%20for%20Delhi%202031.pdf](http://www.indiaenvironmentportal.org.in/files/file/Sewerage_Master_Plan%20for%20Delhi%202031.pdf)
7. <https://sandrp.in/2017/09/23/decentralized-stps-in-the-delhi-capital-region/>

# 9.0. Appendix

## APPENDIX-I

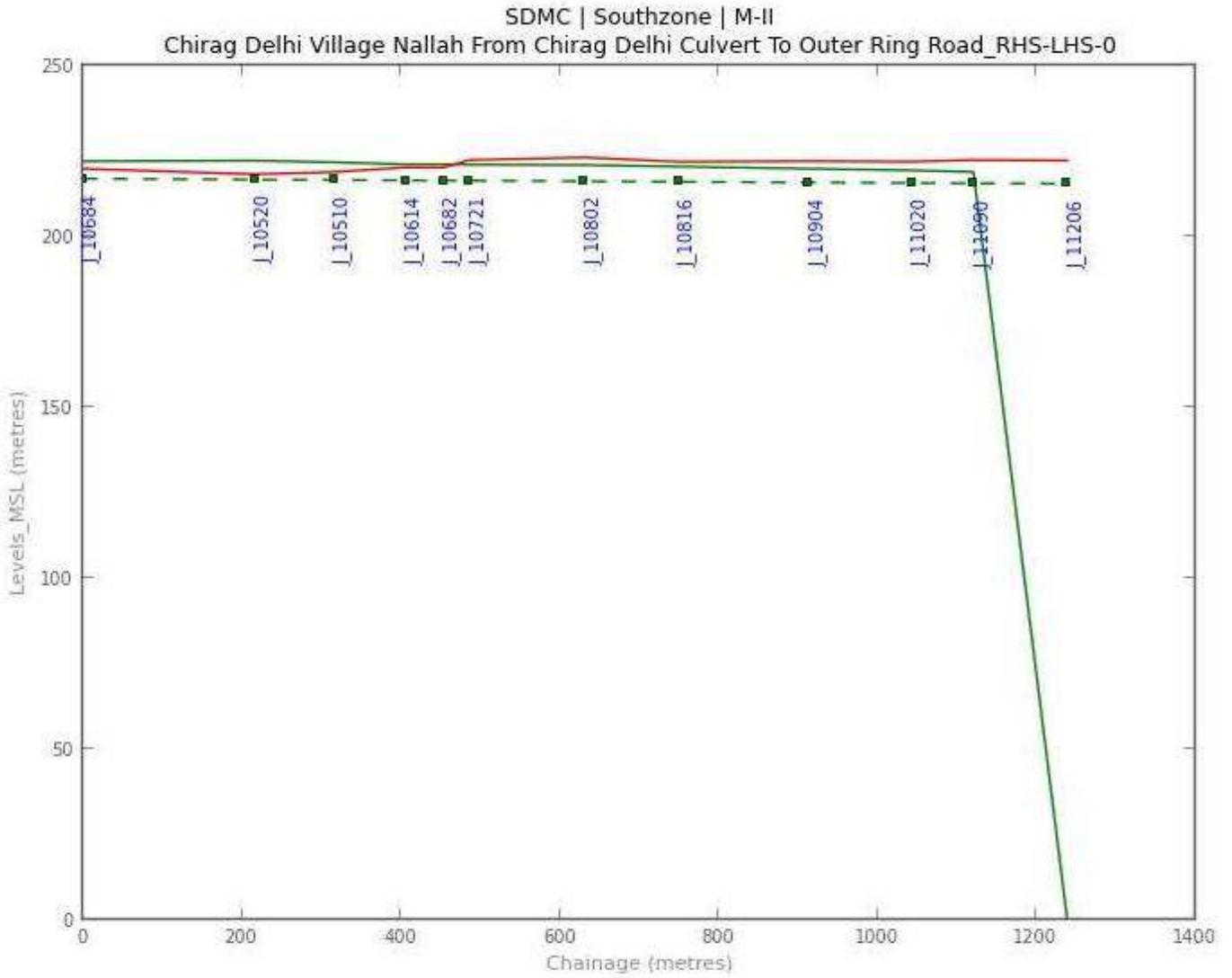
### Longitudinal Profiles of drains in Barapullah basin



<b>Chirag Delhi ToDefenseColonyNallah_-0</b>			
<b>JunctionID</b>	<b>Top_Level_MSL(m)</b>	<b>OldInvertlevel_MSL</b>	<b>NewInvert level_MSL(m)</b>
J_11593	216.735	212.687	212.687
J_11753	216.028	212.462	212.462
J_11797	215.904	212.135	212.135
J_11752	214.77	211.943	211.943
J_11754	214.724	211.943	211.897
J_11756	214.671	211.943	211.844
J_11928	214.17	211.256	211.256
J_11954	213.711	209.923	209.924
J_11964	213.405	209.923	209.618
J_11979	213.027	209.923	209.24
J_11981	213.492	209.081	209.081
J_12038	213.274	209.081	208.863
J_12041	213.439	208.855	208.855
J_12044	213.406	208.855	208.822
J_12107	212.874	208.855	208.29
J_12120	212.774	208.855	208.19
J_12146	211.798	208.0	208.0
J_12272	211.081	207.793	207.793
J_12397	210.127	207.485	207.485
J_12607	209.298	207.036	207.036
J_12673	209.402	206.854	206.854
J_12697	208.791	206.56	205.363
J_12696	208.786	206.56	205.358
J_12695	210.078	206.019	205.266
J_12646	208.344	206.289	203.532

<b>Chirag Delhi To Defense Colony Nallah</b>						
<b>DRAIN ID</b>	<b>INLET</b>	<b>OUTLET</b>	<b>WIDTH m</b>	<b>DEPTH m</b>	<b>DIA m</b>	<b>LOCATION</b>
C_923	J_11593	J_11753	33.0	4.048	0.0	Start point (open drain) – Near Chirag Delhi
C_924	J_11753	J_11797	19.0	3.566	0.0	Startof covered drain
C_925	J_11797	J_11752	15.0	3.769	0.0	
C_1002	J_11752	J_11754	15.0	2.827	0.0	Nearbridge GK-I
C_1003	J_11754	J_11756	15.0	2.827	0.0	Nearbridge GK-I
<b>C_926</b>	J_11756	<b>J_11928</b>	<b>15.0</b>	<b>2.827</b>	<b>0.0</b>	<b>Nearbridge GK-I</b>

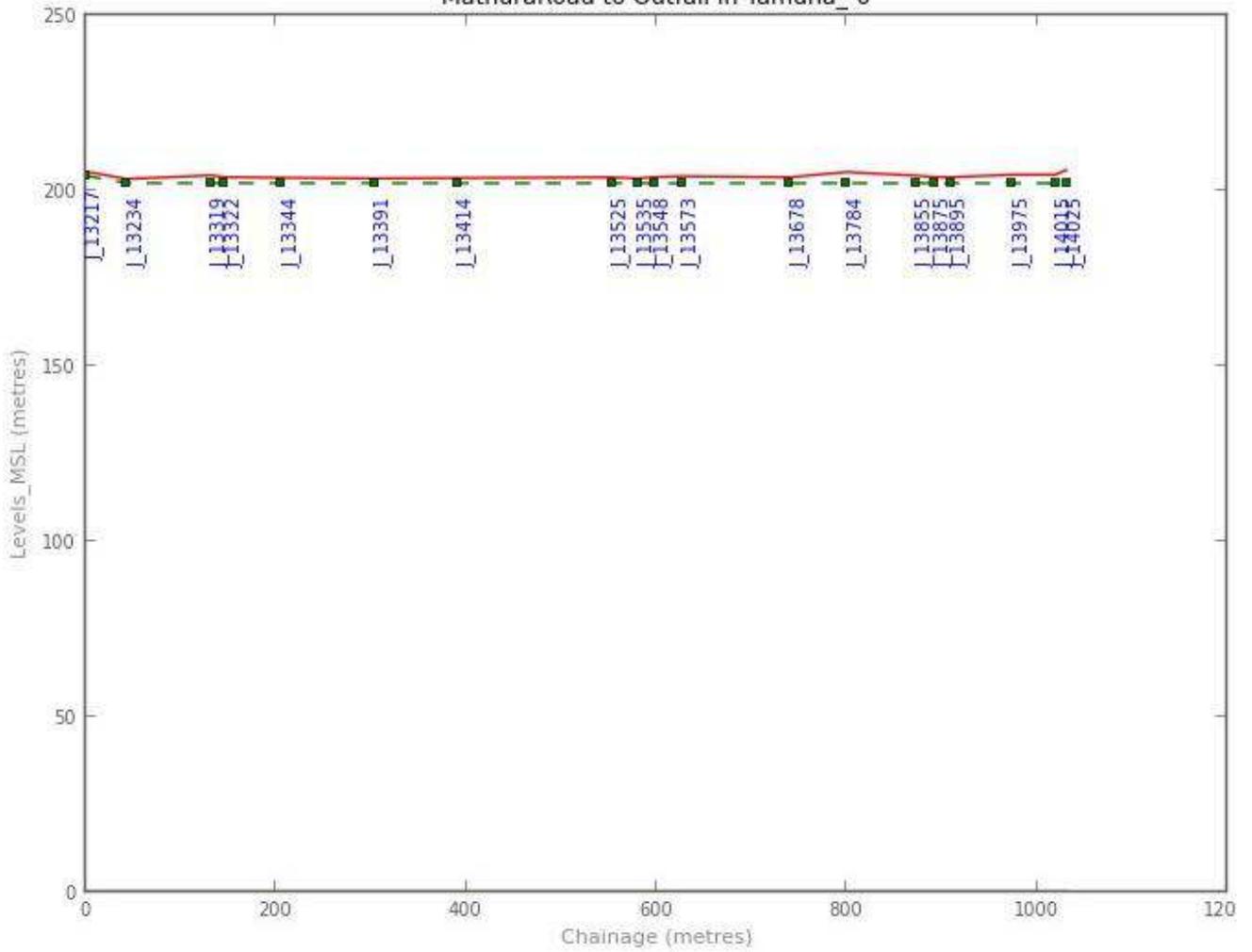
Chirag Delhi To Defense Colony Nallah						
DRAIN ID	INLET	OUTLET	WIDTH m	DEPTH m	DIA m	LOCATION
C_927	J_11928	J_11954	1.0	2.914	0.0	Backof archini enclave
C_1057	J_11954	J_11964	17.5	3.787	0.0	
C_928	J_11964	J_11979	17.5	3.787	0.0	
C_1058	J_11979	J_11981	17.5	3.787	0.0	
C_929	J_11981	J_12038	1.0	4.411	0.0	Bridgeon BRT road neer mool chand
C_1025	J_12038	J_12041	1.0	4.411	0.0	Bridgeon BRT road neer mool chand
C_1024	J_12041	J_12044	1.0	4.584	0.0	Bridgenear Andruj ganj
C_930	J_12044	J_12107	1.0	4.584	0.0	Bridgenear Andruj ganj
C_1001	J_12107	J_12120	1.0	4.584	0.0	Bridge near Andruj ganj
C_1000	J_12120	J_12146	1.0	4.584	0.0	Bridge near Andrujganj
C_931	J_12146	J_12272	22.0	3.798	0.0	Bridge on ring road
C_932	J_12272	J_12397	24.0	3.288	0.0	Defense Colony
C_933	J_12397	J_12607	24.0	2.642	0.0	
C_934	J_12607	J_12673	24.0	2.262	0.0	
C_935	J_12673	J_12697	24.0	2.548	0.0	
C_9029	J_12697	J_12696	33.0	3.428	0.0	Start of open drain
C_936	J_12696	J_12695	33.0	3.428	0.0	Start of open drain
C_937	J_12695	J_12646	60.0	4.812	0.0	Out fall point khushak Nallah



Chirag Delhi Village Nallah From Chirag Delhi Culvert To Outer Ring Road_RHS-			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_M SL (m)	New_Invert level_MSL(m)
J_10684	219.763	221.944	216.855
J_10520	218.141	222.142	216.595
J_10510	218.783	221.642	216.476
J_10614	220.156	221.047	216.367
J_10682	220.099	221.047	216.31
J_10721	222.296	220.953	216.27
J_10802	223.06	220.853	216.096
J_10816	221.785	220.388	215.953
J_10904	221.979	219.775	215.757
J_11020	221.834	219.289	215.601
J_11090	222.31	218.819	215.507
J_11206	222.168	0.0	215.365

Chirag Delhi VillageNallahFromChirag DelhiCulvertToOuterRingRoad_RHS-LHS-0							
DRAIN_I	DRAIN_TYP	INLET	OUTLE	WIDTH_	DEPTH_	DIA_	LOCATION
C_850	RECT_CLOS	J_10684	J_10520	30.34	2.908	0.0	
C_849	RECT_CLOS	J_10520	J_10510	22.34	1.546	0.0	
C_848	RECT_CLOS	J_10510	J_10614	23.97	2.307	0.0	
C_847	RECT_CLOS	J_10614	J_10682	24.17	3.789	0.0	
C_1020	RECT_CLOS	J_10682	J_10721	24.17	3.789	0.0	
C_846	RECT_CLOS	J_10721	J_10802	21.53	6.026	0.0	
C_845	RECT_CLOS	J_10802	J_10816	16.64	6.964	0.0	
C_844	RECT_CLOS ED	J_10816	J_10904	20.9	5.832	0.0	CHIRAGDELHI
C_843	RECT_CLOS	J_10904	J_11020	25.54	6.222	0.0	
C_842	RECT_CLOS	J_11020	J_11090	20.5	6.233	0.0	
C_841	RECT_CLOS ED	J_11090	J_11206	25.05	6.803	0.0	OUTERRING ROAD

SDMC | CentralZone | M-1  
MathuraRoad to Outfall in Yamuna \_0

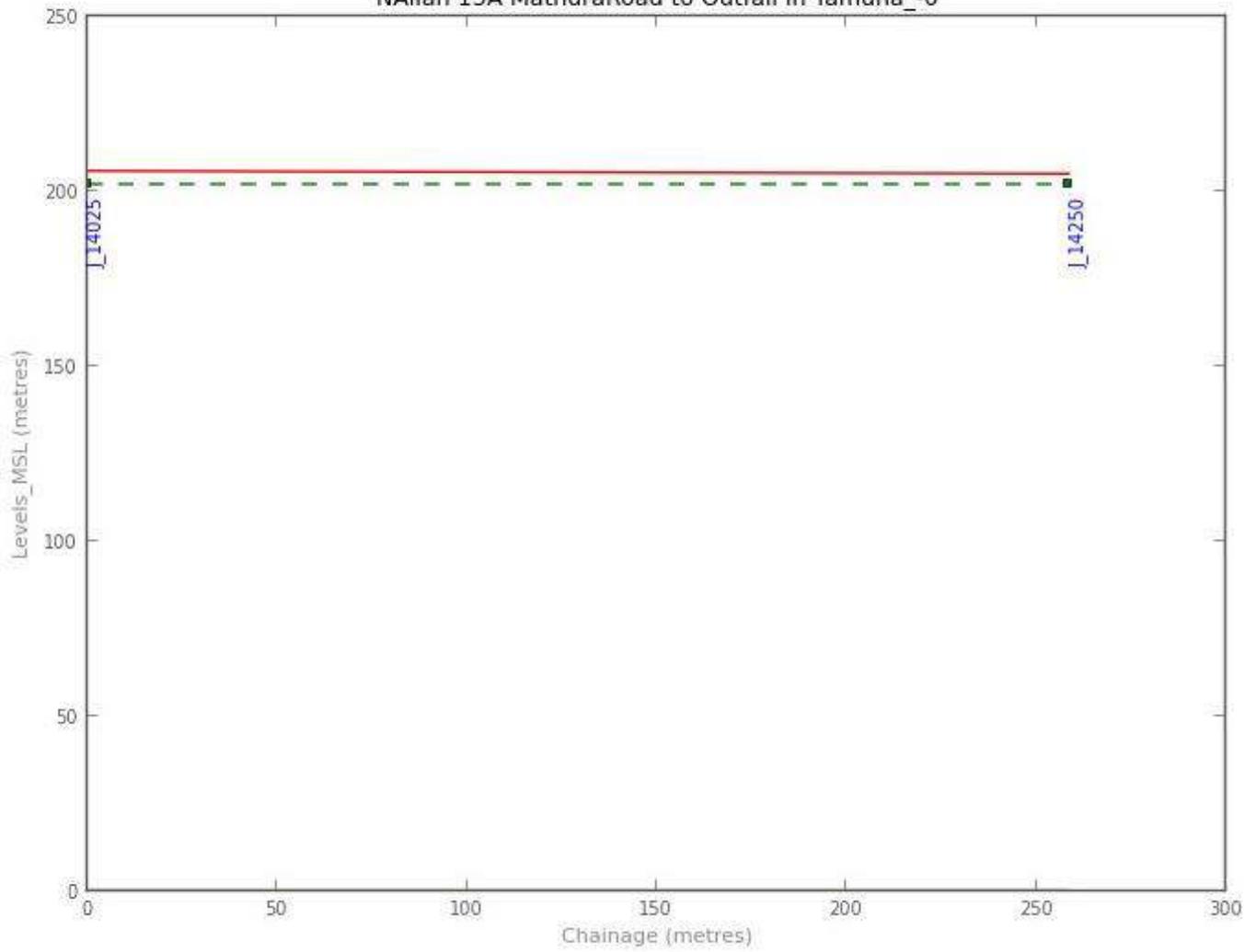


MathuraRoadtoOutfall inYamuna			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL (m)	New_Invert level_MSL(m)
J_13217	205.398	0.0	204.211
J_13234	203.3	0.0	202.113
J_13319	204.336	0.0	202.112
J_13322	203.832	0.0	202.111
J_13344	203.66	0.0	202.11
J_13391	203.438	0.0	202.108
J_13414	203.588	0.0	202.106
J_13525	203.773	0.0	202.102
J_13535	203.464	0.0	202.101
J_13548	203.855	0.0	202.101
J_13573	204.085	0.0	202.1
J_13678	203.801	0.0	202.097
J_13784	205.28	0.0	202.095
J_13855	204.243	0.0	202.093
J_13875	203.875	0.0	202.092

<b>MathuraRoadtoOutfall inYamuna</b>			
<b>JunctionID</b>	<b>Top_Level_MSL(m)</b>	<b>Old_Invertlevel_MSL (m)</b>	<b>New_Invert level_MSL(m)</b>
J_13895	203.814	0.0	202.092
J_13975	204.512	0.0	202.09
J_14015	204.511	0.0	202.089
J_14025	205.841	0.0	202.089

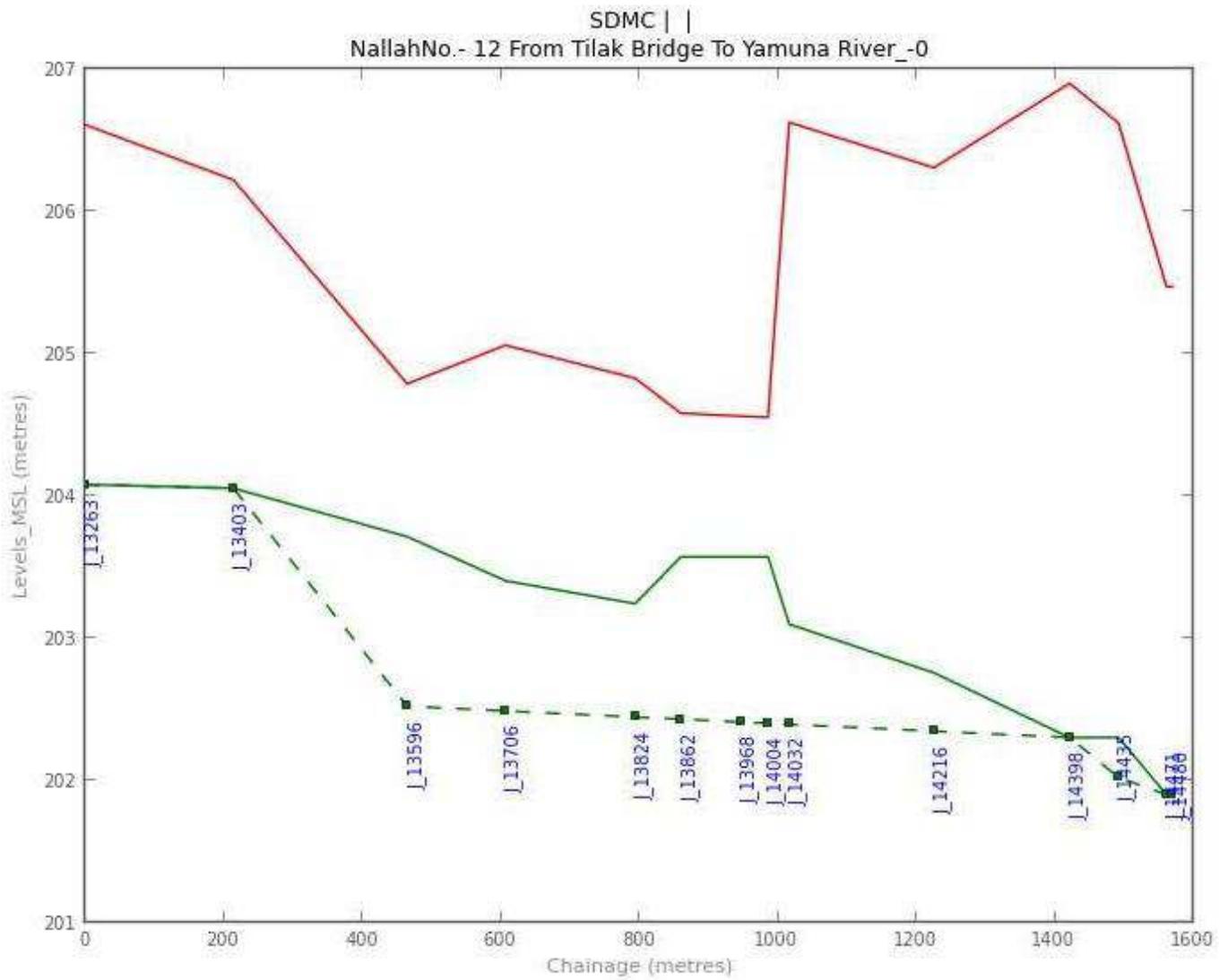
<b>Mathura RoadtoOutfall inYamuna</b>							
<b>DRAIN_ID</b>	<b>DRAIN_TYPE</b>	<b>INLET</b>	<b>OUTLET</b>	<b>WIDTH_m</b>	<b>DEPTH_m</b>	<b>DIA._m</b>	<b>LOCATION</b>
C_14895	RECT_CLOSE	J_132	J_13234	11.0	1.187	0.0	
C_14896	RECT_CLOSE	J_132	J_13319	11.0	1.187	0.0	
C_14897	RECT_CLOSE	J_133	J_13322	7.0	2.224	0.0	
C_14898	RECT_CLOSE	J_133	J_13344	6.6	1.721	0.0	
C_14899	RECT_CLOSE	J_133	J_13391	6.6	1.55	0.0	
C_14884	RECT_CLOSE	J_133	J_13414	8.42	1.33	0.0	
C_14885	RECT_CLOSE	J_134	J_13525	8.42	1.482	0.0	
C_14886	RECT_CLOSE	J_135	J_13535	1.0	1.671	0.0	
C_14887	RECT_CLOSE	J_135	J_13548	9.91	1.363	0.0	
C_14888	RECT_CLOSE	J_135	J_13573	10.0	1.754	0.0	
C_14889	RECT_CLOSE	J_135	J_13678	10.0	1.985	0.0	
C_14890	RECT_CLOSE	J_136	J_13784	11.61	1.704	0.0	
C_14891	RECT_CLOSE	J_137	J_13855	12.27	3.185	0.0	
C_14892	RECT_CLOSE	J_138	J_13875	19.5	2.15	0.0	
C_14893	RECT_CLOSE	J_138	J_13895	10.0	1.783	0.0	
C_14903	RECT_CLOSE	J_138	J_13975	15.34	1.722	0.0	
C_14900	RECT_CLOSE	J_139	J_14015	17.84	2.422	0.0	
C_14904	RECT_CLOSE	J_140	J_14025	17.84	2.422	0.0	

SDMC | CentralZone | M-1  
 Nallah 13A MathuraRoad to Outfall in Yamuna\_-0



Nallah13AMathuraRoadtoOutfall inYamuna			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_M SL (m)	New_Invert level_MSL(m)
J_14025	205.841	0.0	202.089
J_14250	205.043	0.0	202.082

Nallah13A MathuraRoadtoOutfall inYamuna							
DRAIN_ID	DRAIN_TY PE	INLET	OUTLE T	WIDTH_m	DEPTH_m	DIA_m	LOCATION
C_14901	RECT_CLOS	J_14025	J_14250	9.7	3.752	0.0	

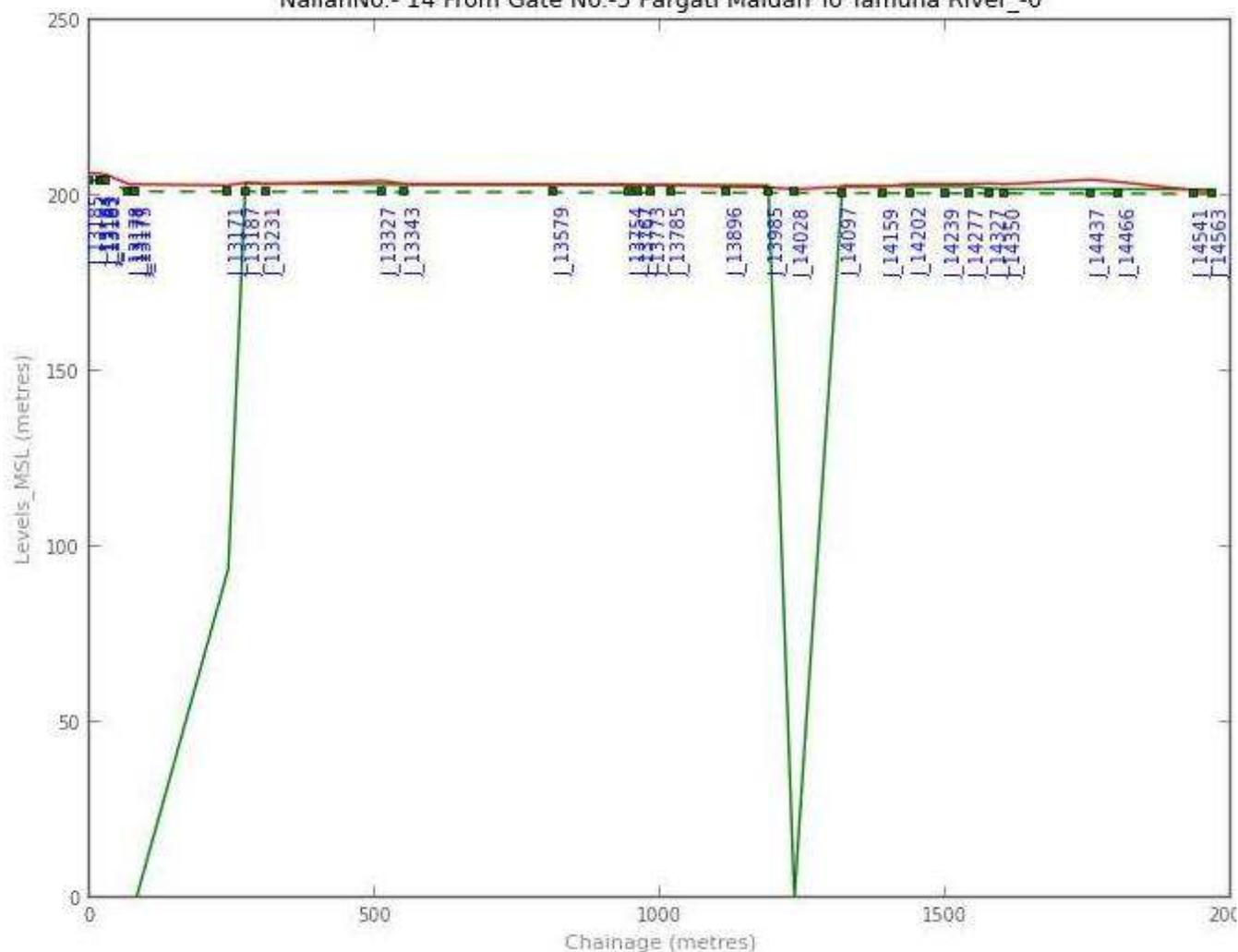


NallahNo.- 12FromTilakBridgeToYamunaRiver			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL(m)	New_Invert level_MSL(m)
J_13263	206.607	204.079	204.079
J_13403	206.22	204.053	204.053
J_13596	204.787	203.713	202.521
J_13706	205.058	203.403	202.488
J_13824	204.826	203.242	202.445
J_13862	204.58	203.571	202.43
J_13968	204.56	203.571	202.41
J_14004	204.551	203.571	202.401
J_14032	206.624	203.098	202.394
J_14216	206.306	202.756	202.346
J_14398	206.899	202.301	202.301
J_14435	206.619	202.301	202.021
J_14471	205.47	201.9	201.9
J_14480	205.47	201.9	201.9

**NallahNo.- 12FromTilakBridgeToYamunaRiver**

<b>DRAIN_ID</b>	<b>DRAIN_TYPE</b>	<b>INLET</b>	<b>OUTLET</b>	<b>WIDTH_m</b>	<b>DEPTH_m</b>	<b>DIA_m</b>	<b>LOCATION</b>
C_14853	RECT_CLOSED	J_13263	J_13403	15.0	2.528	0.0	Startpoint-TILAK BRIDGE
C_14854	RECT_CLOSED	J_13403	J_13596	24.84	2.167	0.0	
C_14855	RECT_CLOSED	J_13596	J_13706	15.64	2.266	0.0	
C_14856	RECT_CLOSED	J_13706	J_13824	18.0	2.57	0.0	
C_14857	RECT_CLOSED	J_13824	J_13862	17.82	2.381	0.0	
C_14858	RECT_CLOSED	J_13862	J_13968	19.5	2.15	0.0	Turningpoint
C_14883	RECT_CLOSED	J_13968	J_14004	19.5	2.15	0.0	Turningpoint
C_14882	RECT_CLOSED	J_14004	J_14032	19.5	2.15	0.0	Turningpoint
C_14859	RECT_CLOSED	J_14032	J_14216	21.23	4.23	0.0	Bridgenear ring road
C_14860	RECT_CLOSED	J_14216	J_14398	22.23	3.96	0.0	
C_14861	RECT_CLOSED	J_14398	J_14435	22.7	4.598	0.0	
C_14905	RECT_CLOSED	J_14435	J_14471	22.7	4.598	0.0	
C_14862	RECT_CLOSED	J_14471	J_14480	20.0	3.57	0.0	nearyamuna river

## NallahNo.- 14 From Gate No.-5 Pargati Maidan To Yamuna River\_-0



## NallahNo.- 14FromGateNo.-5Pargati MaidanToYamunaRiver

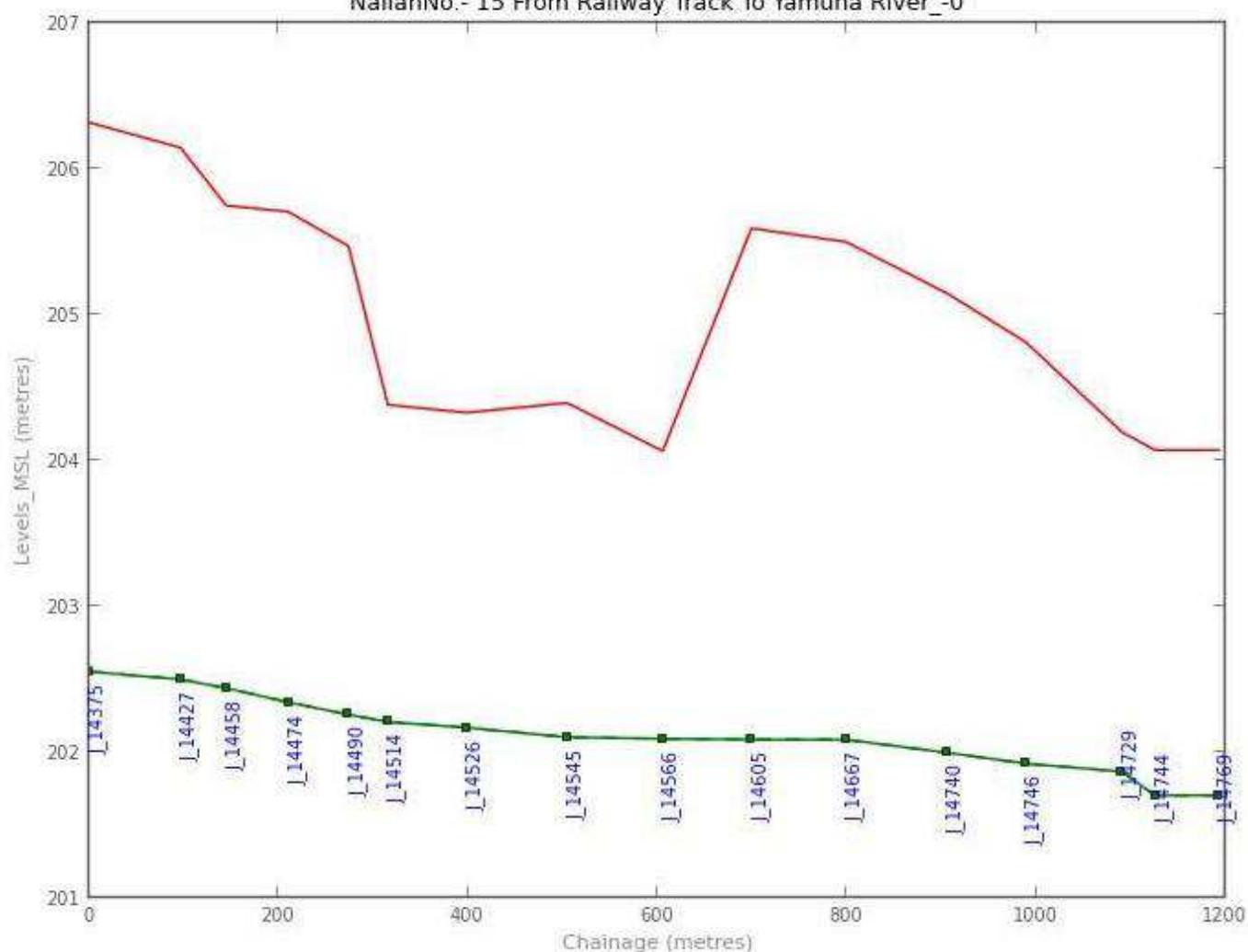
JunctionID	Top_Level_MSL( m)	Old_Invertlevel_MS L (m)	New_Invert level_MSL(m)
J_13185	206.4	0.0	204.39
J_13184	206.28	0.0	204.27
J_13183	206.15	0.0	204.14
J_13181	206.03	0.0	204.02
J_13178	203.254	0.0	201.244
J_13177	203.251	0.0	201.241
J_13175	203.249	0.0	201.239
J_13171	202.964	93.61	201.178
J_13187	203.727	203.473	201.167
J_13231	203.309	203.47	201.153
J_13327	204.22	203.192	201.076
J_13343	203.354	203.185	201.061
J_13579	203.254	203.145	200.962
J_13754	203.215	203.097	200.912
J_13767	203.013	203.08	200.906
J_13773	203.005	203.08	200.898

NallahNo.- 14FromGateNo.-5Pargati MaidanToYamunaRiver			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL(m)	New_Invert level_MSL(m)
J_13785	202.992	203.08	200.885
J_13896	202.547	203.073	200.848
J_13985	202.411	202.972	200.821
J_14028	201.804	0.0	200.804
J_14097	202.573	202.941	200.772
J_14159	202.622	202.909	200.745
J_14202	203.376	202.648	200.727
J_14239	203.354	202.648	200.705
J_14277	203.339	202.648	200.69
J_14327	203.476	202.102	200.676
J_14350	203.253	201.922	200.667
J_14437	204.571	201.901	200.61
J_14466	203.893	201.874	200.591
J_14541	201.542	201.806	200.542
J_14563	201.542	201.806	200.542

NallahNo.- 14FromGateNo.-5Pargati MaidanToYamunaRiver							
DRAIN_ID	DRAIN_TYPE	INLET	OUTLET	WIDTH_m	DEPTH_	DIA_m	LOCATION
C_17139	RECT_CLOSE D	J_1318 5	J_1318 4	19.0	2.01	0.0	StartPoint
C_17140	RECT_CLOSE D	J_1318 4	J_1318 3	19.0	2.01	0.0	StartPoint
C_17141	RECT_CLOSE D	J_1318 3	J_1318 1	19.0	2.01	0.0	StartPoint
C_17142	RECT_CLOSE D	J_1318 1	J_1317 8	19.0	2.01	0.0	StartPoint
C_17143	RECT_CLOSE D	J_1317 8	J_1317 7	19.0	2.01	0.0	StartPoint
C_17144	RECT_CLOSE D	J_1317 7	J_1317 5	19.0	2.01	0.0	StartPoint
C_14833	RECT_CLOSE D	J_1317 5	J_1317 1	19.0	2.01	0.0	StartPoint
C_14834	RECT_CLOSE D	J_1317 1	J_1318 7	14.43	1.786	0.0	Culvert
C_14835	RECT_CLOSE D	J_1318 7	J_1323 1	15.0	2.56	0.0	Turningpoint
C_14836	RECT_CLOSE D	J_1323 1	J_1332 7	13.22	2.156	0.0	
C_14837	RECT_CLOSE D	J_1332 7	J_1334 3	18.3	3.144	0.0	Culvert
C_14838	RECT_CLOSE D	J_1334 3	J_1357 9	13.63	2.293	0.0	

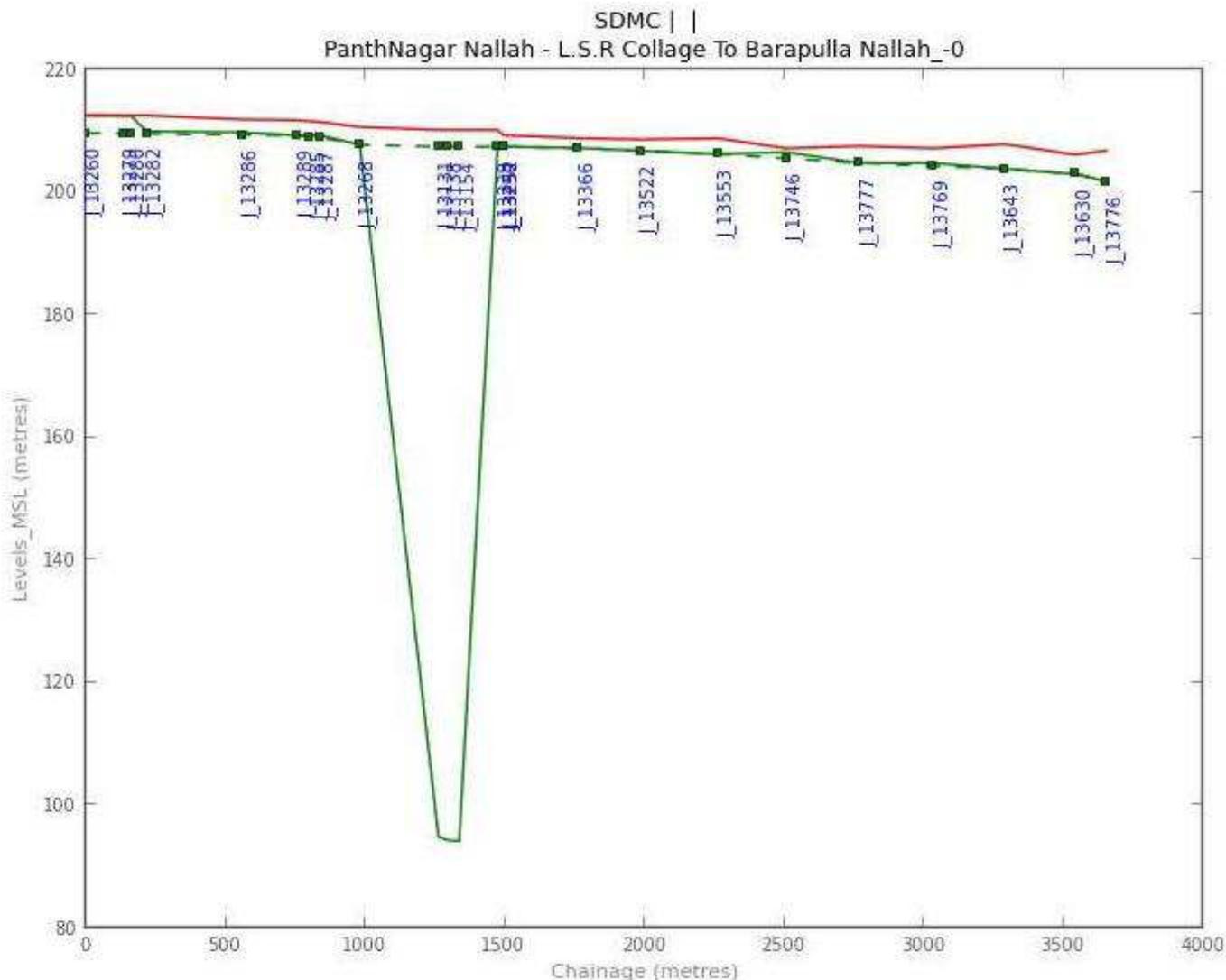
NallahNo.- 14FromGateNo.-5Pargati MaidanToYamunaRiver							
DRAIN_I D	DRAIN_TYPE	INLET	OUTLE T	WIDTH_ m	DEPTH _	DIA_ m	LOCATION
C_14839	RECT_CLOSE D	J_1357 9	J_1375 4	12.23	2.292	0.0	
C_14840	RECT_CLOSE D	J_1375 4	J_1376 7	10.51	2.303	0.0	Turningpoint
C_14880	RECT_CLOSE D	J_1376 7	J_1377 3	14.72	2.107	0.0	Bridgecrossin g bhairoroad
C_14881	RECT_CLOSE D	J_1377 3	J_1378 5	14.72	2.107	0.0	Bridgecrossin g bhairoroad
C_14841	RECT_CLOSE D	J_1378 5	J_1389 6	14.72	2.107	0.0	Bridgecrossin g bhairoroad
C_14842	RECT_CLOSE D	J_1389 6	J_1398 5	13.2	1.699	0.0	
C_14843	RECT_CLOSE D	J_1398 5	J_1402 8	13.46	1.59	0.0	Turningpoint
C_14844	RECT_CLOSE D	J_1402 8	J_1409 7	13.46	2.129	0.0	Turningpoint
C_14845	RECT_CLOSE D	J_1409 7	J_1415 9	12.0	1.801	0.0	Nearrailway bridge
C_14846	RECT_CLOSE D	J_1415 9	J_1420 2	12.61	1.877	0.0	Turningpoint
C_14878	RECT_CLOSE D	J_1420 2	J_1423 9	16.92	2.649	0.0	Turningpoint
C_14847	RECT_CLOSE	J_1423	J_1427	16.92	2.649	0.0	Turningpoint
C_14879	RECT_CLOSE	J_1427	J_1432	16.92	2.649	0.0	Turningpoint
C_14848	RECT_CLOSE	J_1432	J_1435	14.3	2.8	0.0	NearRing road
C_14849	RECT_CLOSE	J_1435	J_1443	14.3	2.586	0.0	Turningpoint
C_14850	RECT_CLOSE	J_1443	J_1446	14.3	3.961	0.0	Turningpoint
C_14851	RECT_CLOSE	J_1446	J_1454	14.3	3.302	0.0	
C_14852	RECT_CLOSE D	J_1454 1	J_1456 3	14.3	0.0	0.0	Endpoint

## NallahNo.- 15 From Railway Track To Yamuna River\_-0



NallahNo.- 15FromRailwayTrackToYamunaRiver			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MS L (m)	New_Invert level_MSL(m)
J_14375	206.316	202.552	202.552
J_14427	206.144	202.498	202.498
J_14458	205.748	202.439	202.439
J_14474	205.704	202.341	202.341
J_14490	205.469	202.257	202.257
J_14514	204.381	202.207	202.207
J_14526	204.327	202.168	202.168
J_14545	204.394	202.102	202.102
J_14566	204.064	202.091	202.091
J_14605	205.591	202.086	202.086
J_14667	205.498	202.085	202.085
J_14740	205.146	201.996	201.996
J_14746	204.81	201.921	201.921
J_14729	204.194	201.866	201.866
J_14744	204.071	201.703	201.703
J_14769	204.071	201.703	201.703

<b>NallahNo.- 15FromRailwayTrackToYamunaRiver</b>							
<b>DRAIN_I D</b>	<b>DRAIN_TY D</b>	<b>INLET</b>	<b>OUTLET</b>	<b>WIDTH m</b>	<b>DEPTH m</b>	<b>DIA m</b>	<b>LOCATION</b>
C_14863	RECT_CLOSE D	J_1437 5	J_1442 7	10.0	3.764	0.0	Start point Railway ytrack(open drain)- Railway track(near nizamuddinrail washing )
C_14864	RECT_CLOSE D	J_1442 7	J_1445 8	4.5	3.646	0.0	Opendrain
C_14865	RECT_CLOSE D	J_1445 8	J_1447 4	4.5	3.309	0.0	Opendrain
C_14866	RECT_CLOSE D	J_1447 4	J_1449 0	4.5	3.363	0.0	opendrain
C_14867	RECT_CLOSE D	J_1449 0	J_1451 4	4.0	3.212	0.0	Culvar tonring road
C_14868	RECT_CLOSE D	J_1451 4	J_1452 6	3.0	2.174	0.0	opendrain
C_14869	RECT_CLOSE D	J_1452 6	J_1454 5	3.0	2.159	0.0	opendrain
C_14870	RECT_CLOSE D	J_1454 5	J_1456 6	3.0	2.292	0.0	opendrain
C_14871	RECT_CLOSE D	J_1456 6	J_1460 5	1.0	1.973	0.0	opendrain
C_14872	RECT_CLOSE D	J_1460 5	J_1466 7	3.0	3.505	0.0	opendrain
C_14873	RECT_CLOSE D	J_1466 7	J_1474 0	3.0	3.413	0.0	opendrain
C_14874	RECT_CLOSE D	J_1474 0	J_1474 6	3.0	3.15	0.0	opendrain
C_14875	RECT_CLOSE D	J_1474 6	J_1472 9	3.0	2.889	0.0	opendrain
C_14876	RECT_CLOSE D	J_1472 9	J_1474 4	3.0	2.328	0.0	opendrain
C_14877	RECT_CLOSE D	J_1474 4	J_1476 9	3.0	2.368	0.0	opendrain-OUT FALLPOINT YAMUNA RIVER



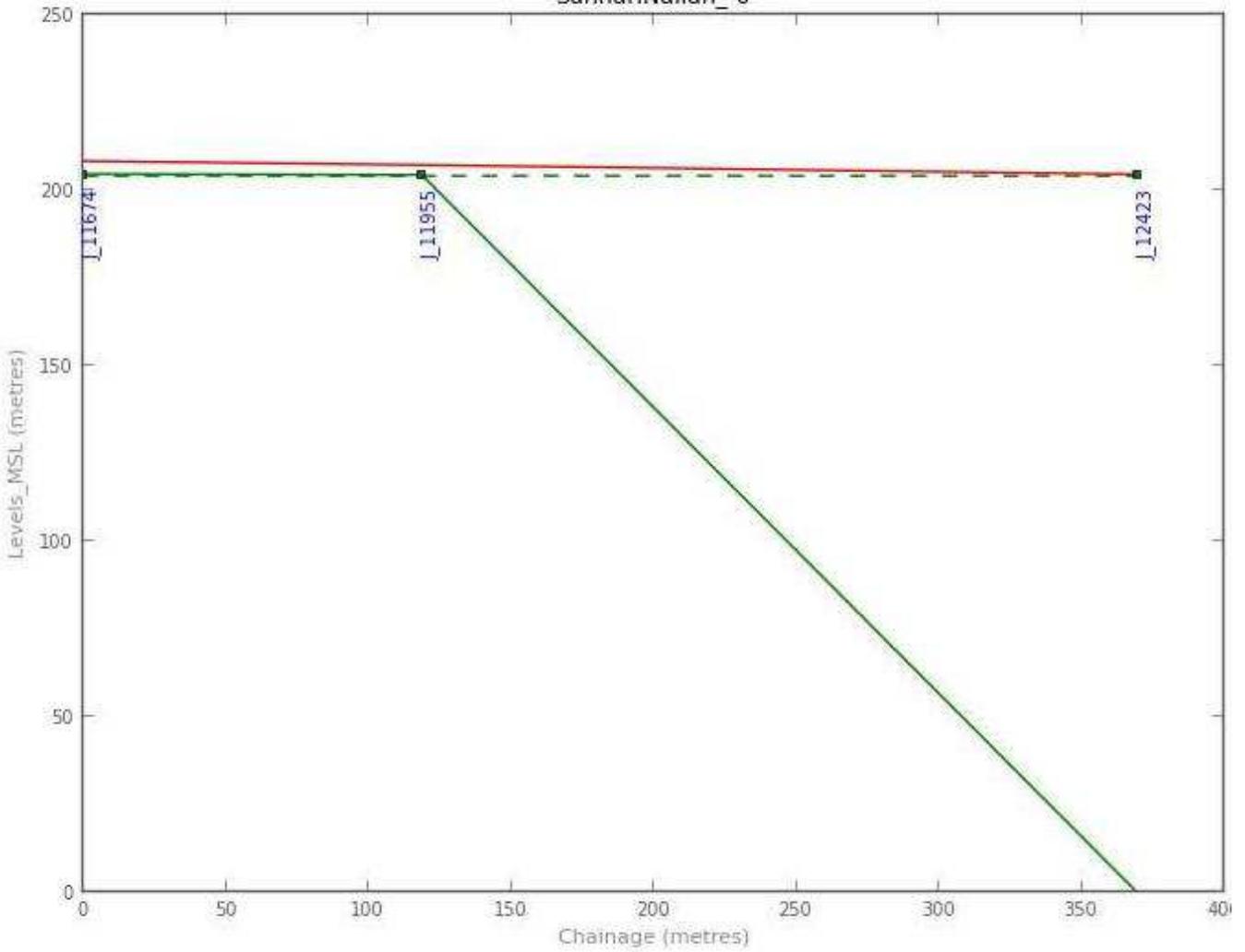
PanthNagarNallah- L.S.R Collage To Barapulla Nallah			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL (m)	New_Invert level_MSL(m)
J_13260	212.586	212.485	209.639
J_13279	212.513	212.485	209.566
J_13280	212.499	212.485	209.552
J_13282	212.514	209.914	209.52
J_13286	211.845	209.745	209.334
J_13289	211.732	209.227	209.227
J_13285	211.558	209.227	209.053
J_13287	211.415	209.227	208.91
J_13268	210.624	207.727	207.727
J_13131	210.131	94.87	207.405
J_13138	210.13	94.312	207.404
J_13154	210.128	94.168	207.402
J_13239	210.121	207.405	207.395
J_13250	209.279	207.394	207.394
J_13252	209.278	207.394	207.393
J_13366	208.788	207.201	207.201
J_13522	208.584	206.71	206.71
J_13553	208.761	206.209	206.209

PanthNagarNallah- L.S.RCollageToBarapullaNallah			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL (m)	New_Invert level_MSL(m)
J_13746	207.127	206.506	205.501
J_13777	207.511	204.74	204.74
J_13769	207.14	204.75	204.25
J_13643	207.818	203.775	203.775
J_13630	206.089	202.954	202.954
J_13776	206.755	201.737	201.737

PanthNagarNallah- L.S.RCollageToBarapullaNallah							
DRAIN_ID	DRAIN_TYPER	INLET	OUTLET	WIDTH	DEPTH	DIA_m	LOCATION
C_766	RECT_CLOSE D	J_13260	J_13279	13.5	2.947	0.0	Startpoint (opendrain)- L.S.RCollage
C_1027	RECT_CLOSE D	J_13279	J_13280	13.5	2.947	0.0	Startpoint (opendrain)- L.S.RCollage
C_1026	RECT_CLOSE D	J_13280	J_13282	13.5	2.947	0.0	Startpoint (opendrain)- L.S.RCollage
C_767	RECT_CLOSE D	J_13282	J_13286	7.5	2.994	0.0	
C_768	RECT_CLOSE D	J_13286	J_13289	10.5	2.511	0.0	neargurudwar alajpath nagar-IV
C_1035	RECT_CLOSE D	J_13289	J_13285	12.37	2.505	0.0	nearing road
C_1034	RECT_CLOSE D	J_13285	J_13287	12.37	2.505	0.0	nearing road
C_769	RECT_CLOSE D	J_13287	J_13268	12.37	2.505	0.0	nearing road
C_770	RECT_CLOSE D	J_13268	J_13131	8.0	2.897	0.0	Lajpathnager- III
C_994	RECT_CLOSE D	J_13131	J_13138	8.0	2.726	0.0	nearfizer gandhi margh Lajpathnager- III
C_995	RECT_CLOSE D	J_13138	J_13154	8.0	2.726	0.0	nearfizer gandhi margh Lajpathnager- III
C_771	RECT_CLOSE D	J_13154	J_13239	8.0	2.726	0.0	nearfizer gandhi margh Lajpathnager- III

PanthNagarNallah- L.S.RCollageToBarapullaNallah							
DRAIN_I D	DRAIN_TYP E	INLET	OUTL ET	WIDTH	DEPTH	DIA_ m	LOCATION
C_996	RECT_CLOSE D	J_1323 9	J_1325 0	8.0	2.726	0.0	nearfizer gandhi margh Lajpathnager- III
C_997	RECT_CLOSE D	J_1325 0	J_1325 2	11.5	1.885	0.0	Lajpathnager- II near central market
C_772	RECT_CLOSE D	J_1325 2	J_1336 6	11.5	1.885	0.0	Lajpathnager- II near central market
C_773	RECT_CLOSE D	J_1336 6	J_1352 2	11.5	1.587	0.0	
C_774	RECT_CLOSE D	J_1352 2	J_1355 3	11.0	1.874	0.0	
C_775	RECT_CLOSE D	J_1355 3	J_1374 6	11.0	2.552	0.0	
C_776	RECT_CLOSE D	J_1374 6	J_1377 7	11.0	1.626	0.0	
C_777	RECT_CLOSE D	J_1377 7	J_1376 9	11.0	2.771	0.0	Bridgenear jangpura
C_778	RECT_CLOSE D	J_1376 9	J_1364 3	11.0	2.89	0.0	Bridgenear pantnagar
C_779	RECT_CLOSE D	J_1364 3	J_1363 0	11.0	4.043	0.0	
C_780	RECT_CLOSE D	J_1363 0	J_1377 6	11.0	3.135	0.0	outfall point barapullaNallah earshiv temple

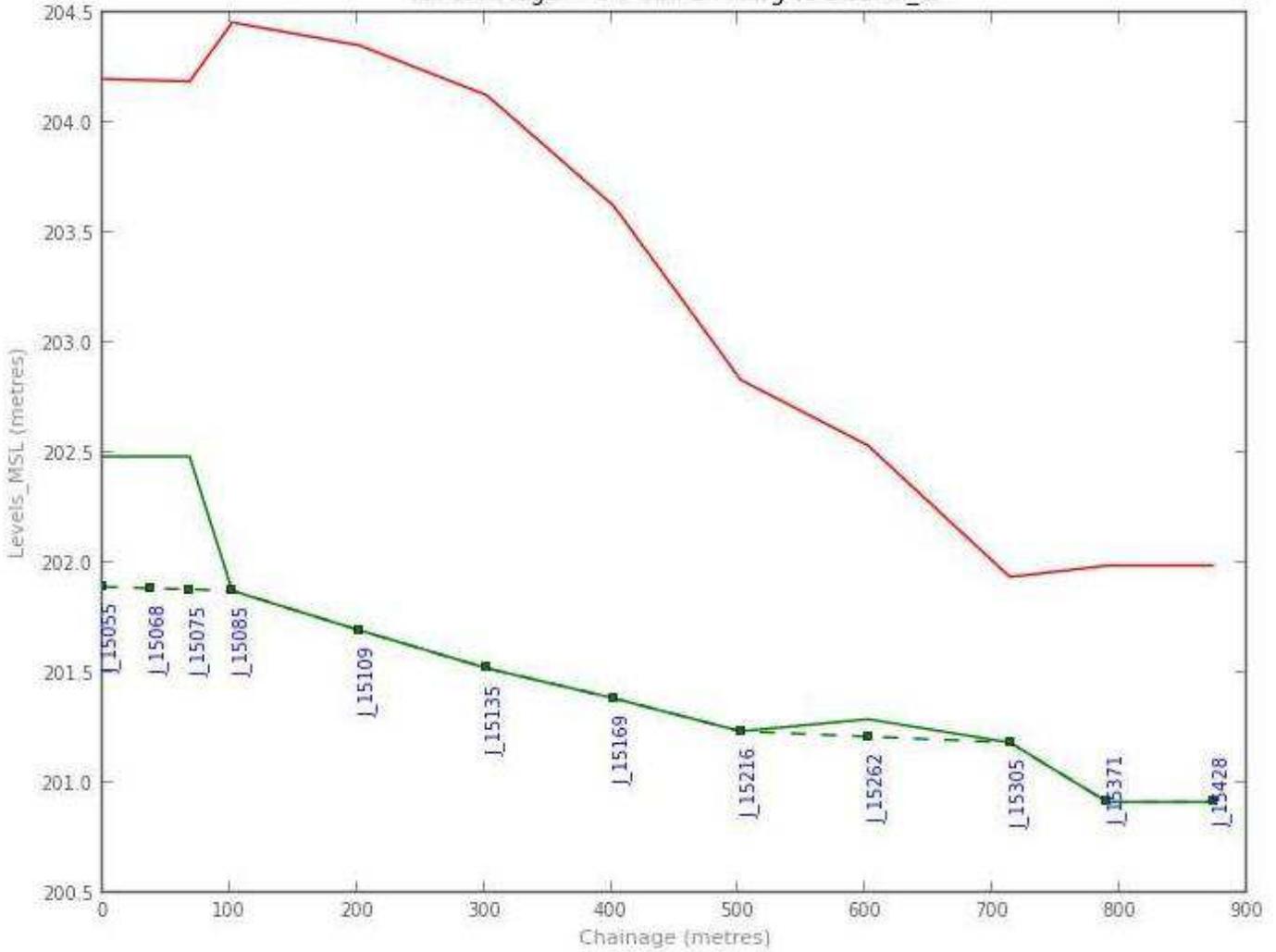
SDMC | | M-4  
SunhariNallah -0



SunhariNallah			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MS L	New_Invert level_MSL(m)
J_11674	208.268	204.612	204.063
J_11955	207.159	204.311	204.059
J_12423	204.5	0.0	204.05

SunhariNallah							
DRAIN_ I	DRAIN_TY PE	INLET	OUTL E	WIDTH	DEPTH	DIA_ m	LOCATION
C_9023	RECT_CLOS E D	J_1167 4	J_1195 5	45.0	4.205	0.0	Startpoint(CoveredN allah)-DAYAL SINGHCOLLAGE
C_9024	RECT_CLOS E	J_1195 5	J_1242 3	50.0	3.1	0.0	

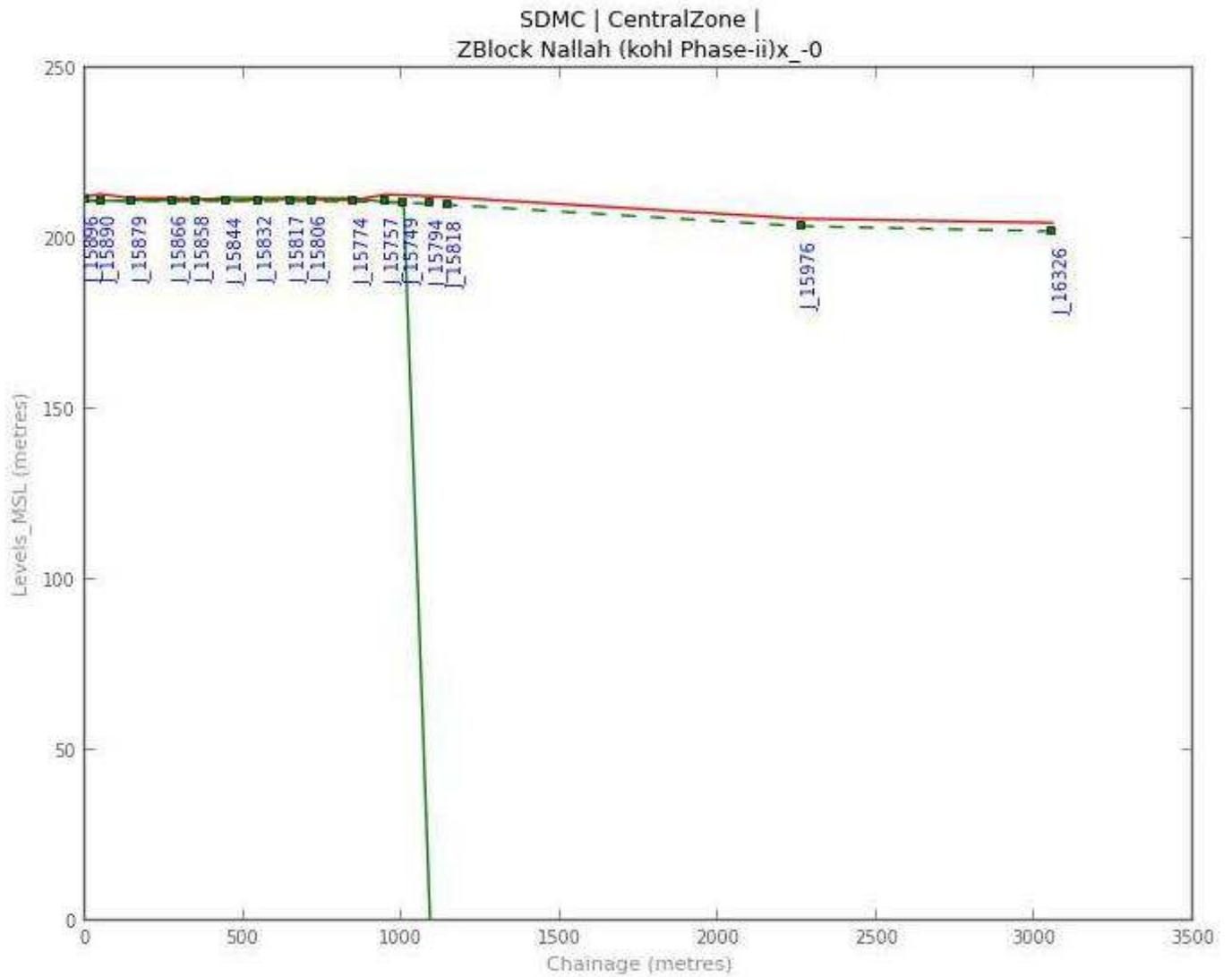
SDMC | CentralZone | M-3  
TaimoorNagar - C V Raman Marg To Block F\_-0



TaimoorNagar-C VRamanMargToBlockF			
JunctionID	Top_Level_MSL(m)	Old_Invertlevel_MSL (m)	New_Invert level_MSL(m)
J_15055	204.199	202.483	201.891
J_15068	204.192	202.483	201.884
J_15075	204.187	202.483	201.879
J_15085	204.455	201.873	201.873
J_15109	204.351	201.693	201.693
J_15135	204.125	201.521	201.521
J_15169	203.622	201.384	201.384
J_15216	202.831	201.234	201.234
J_15262	202.533	201.289	201.21
J_15305	201.935	201.183	201.183
J_15371	201.987	200.913	200.913
J_15428	201.987	200.913	200.913

**TaimoorNagar -C VRamanMargToBlockF**

<b>DRAIN_I</b>	<b>DRAIN_TYP E</b>	<b>INLET</b>	<b>OUTL ET</b>	<b>WIDTH_</b>	<b>DEPTH_</b>	<b>DIA_</b>	<b>LOCATION</b>
C_1054	RECT_CLOS E	J_1505	J_1506	7.1	2.308	0.0	PARK
C_1055	RECT_CLOS E	J_1506	J_1507	7.1	2.308	0.0	PARK
C_975	RECT_CLOS E	J_1507	J_1508	7.1	2.308	0.0	PARK
C_976	RECT_CLOS E	J_1508	J_1510	8.6	2.582	0.0	CALVERT
C_977	RECT_CLOS E	J_1510	J_1513	8.0	2.658	0.0	RESIDENTAL ARE
C_978	RECT_CLOS E	J_1513	J_1516	10.5	2.604	0.0	CALVERT
C_979	RECT_CLOS E	J_1516	J_1521	7.3	2.238	0.0	RESIDENTAL ARE
C_980	RECT_CLOS E	J_1521	J_1526	7.5	1.597	0.0	RESIDENTAL ARE
C_981	RECT_CLOS E	J_1526	J_1530	10.0	1.323	0.0	RESIDENTAL ARE
C_982	RECT_CLOS E	J_1530	J_1537	7.5	0.752	0.0	RESIDENTAL ARE
C_983	RECT_CLOS E	J_1537	J_1542	4.2	1.074	0.0	CALVERT



<b>ZBlockNallah(kohl Phase-ii)x</b>			
<b>JunctionID</b>	<b>Top_Level_MSL(m)</b>	<b>Old_Invertlevel_MSL (m)</b>	<b>New_Invert level_MSL(m)</b>
J_15896	212.235	210.998	211.269
J_15890	213.012	211.032	211.181
J_15879	211.815	211.158	210.997
J_15866	211.814	211.158	210.996
J_15858	211.689	211.253	210.995
J_15844	211.123	211.984	210.994
J_15832	211.395	211.843	210.993
J_15817	211.489	211.938	210.992
J_15806	211.443	211.865	210.987
J_15774	211.207	211.817	210.814
J_15757	212.896	210.684	210.684
J_15749	212.705	210.684	210.493
J_15794	212.42	0.0	210.22
J_15818	212.113	0.0	209.913
J_15976	205.805	0.0	203.605
J_16326	204.607	0.0	202.107

<b>ZBlockNallah(kohlPhase-ii)x</b>							
<b>DRAIN_I</b>	<b>DRAIN_TYP</b>	<b>INLET</b>	<b>OUTLET</b>	<b>WIDTH</b>	<b>DEPTH</b>	<b>DIA_m</b>	<b>LOCATION</b>
C_683	RECT_CLOSED	J_15896	J_15890	0.95	0.966	0.0	CONTAINERCORPORATIONLTD. INDIA
C_682	RECT_CLOSED	J_15890	J_15879	1.2	1.831	0.0	
C_681	RECT_CLOSED	J_15879	J_15866	1.2	0.818	0.0	SLUM
C_1062	RECT_CLOSED	J_15866	J_15858	1.2	0.818	0.0	SLUM
C_680	RECT_CLOSED	J_15858	J_15844	1.2	0.694	0.0	
C_679	RECT_CLOSED	J_15844	J_15832	1.25	0.129	0.0	SLUM
C_678	RECT_CLOSED	J_15832	J_15817	2.0	0.402	0.0	SLUM
C_677	RECT_CLOSED	J_15817	J_15806	2.8	0.497	0.0	
C_676	RECT_CLOSED	J_15806	J_15774	1.95	0.456	0.0	
C_675	RECT_CLOSED	J_15774	J_15757	2.2	0.393	0.0	BUILDING
C_1060	RECT_CLOSED	J_15757	J_15749	1.2	2.212	0.0	RAILWAYRRACK
C_674	RECT_CLOSED	J_15749	J_15794	1.2	2.212	0.0	RAILWAYRRACK
C_986	RECT_CLOSED	J_15794	J_15818	4.0	2.2	0.0	
C_1032	RECT_CLOSED	J_15818	J_15976	6.0	2.2	0.0	
C_4110	RECT_CLOSED	J_15976	J_16326	6.0	2.2	0.0	

**DELHI DEVELOPMENT AUTHORITY**  
**OFFICE OF THE CHIEF ENGINEER (HQ/QAC)**  
**VIKAS SADAN, INA, NEW DELHI**

F73(240)2018/CE/QAC/Pt.-II/88

Dated: 24-06-2020

To,

✓ Sh. Nikhil Kumar  
Member Secretary (IDMC)  
CEO, Delhi Jal Board  
Varunalaya, Ph-II, Karol Bagh  
New Delhi-110005

**Sub : Integrated Drain Management Cell (IDMC) for remediation and drain management of all drains of Delhi, Chaired by the Chief Secretary, Govt. of NCT of Delhi constituted on the direction of Hon'ble NGT dated 05.03.20 OA no. 06/2012 in the matter of Manoj Mishra v/s Union of India & others.**

**Ref. : (i) Minutes of Fourth Meeting of IDMC issued vide letter CEO/IDMA/2020-D-328 Dated 17.06.20.  
(ii) NGT order dated 05.03.2020 in O.A. no. 6/2012.**

Reference is made to fourth MOM of IDMC circulated on 17.06.20. DDA has been asked to submit detailed action plan along with time lines to it within 10 days. An interim report in the matter is as under:

**(1) Construction of 9 nos. wetlands :-**

DDA is constructing 9 nos. wetlands in the area between DND flyover (Ring road) to Dhobi Ghat Jamia Nagar on the following existing drains.

- (a) Kilokari Drain
- (b) Maharani Bagh Drain
- (c) White House Drain
- (d) Zakir Bagh Drain
- (e) Vacant Place Wetland
- (f) Moti Masjid and Batla Drain
- (g) Mini Batla Drain
- (h) Over a cluster of wetland of Batla Drain
- (i) Dhobi Ghat Drain

Although all these drains are being maintained by SDMC, But at outlet of these drains wet lands have been created over a period of time. The untreated water from these drains flows through DDA land and enters in Yamuna River. Under this project raw sewage will be treated through a network of constructed wetlands that will make sewage as clean as that of river water.

Out of these 9 drains, some portion of Drain at SI No. 2 i.e. Maharani Bagh drain (about 400 m length) which flows through DDA land at present but this portion will be reduced to 50-100 mtr. only after construction of wetland at its outlet before entering its water into River Yamuna.

These wetlands will be constructed upto October 2020.

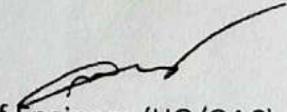
**(2) Engagement of Consultant**

It has been decided to engage an expert to do the feasibility as per the technologies of remediation suggested by the CPCB, so that the pollution of River Yamuna is mitigated to the maximum extent possible for the drain under the jurisdiction of DDA. It is expected that the expert will give his report within 6 weeks.

**(3) Construction of 4 nos. Sewerage Treatment Plant in Dwarka :**

To trap the sewage from nearby area of Palam Village, Bagdola Village, Matiala Village and other adjoining unauthorized colonies, tender for construction of 3 nos. STP's (9.5 MLD, 5 MLD and 5 MLD capacities) on trunk drain no. 2 (TD-2) & one no. STP of 7 MLD capacity on trunk drain no. 5 (TD-5) in Dwarka have been called and technical bids are likely to be received within June, 2020. The STPs will be completed in two years.

This issues with the approval of Competent Authority.

  
Chief Engineer (HQ/QAC)

Copy to :

- (i) OSD to VC/DDA for kind information of the Latter.
- (ii) DD to EM/DDA for kind information of the Latter.
- (iii) CE(EZ)/DDA for information & necessary action.
- (iv) CE(Dwarka)/DDA for information & necessary action.

  
Chief Engineer (HQ/QAC)



## EAST DELHI MUNICIPAL CORPORATION

Office of Chief Engineer SHN/(EMS)/HQ  
419, Udyog Sadan Patpar Ganj Indl. Area,  
Delhi-110092 Phone No. 011-66667504  
Email – cehqedmc@gmail.com



No.: CE/EMS/HQ/SHN/2020/D- 437

Dated: 21.05.2020

To,

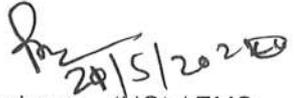
CEO, DJB  
Member Secretary, Integrated Drainage Management Cell (IDMC)  
Varunalaya, Jandewalan  
New Delhi

### **Subject:- Action Plan on Alternate Technologies for Management of Waste water in Drains**

Hon'ble NGT vide order dated 5.3.2020 in the matter of Manoj Mishra Vs Union of India in original application no 06/2012 wherein Hon'ble NGT directed IDMC may prepare and execute an action plan on Alternate Technologies for Management of Waste water in Drains after appropriate techno economic evaluation within three weeks after its constitution. Accordingly first meeting of IDMC was held on 5.5.2020 under the chairmanship of Chief Secretary wherein it was directed that "all drain owning agencies must ensure that action plan on Alternate Technologies for Management of Waste water in Drains under their jurisdiction is prepared and submitted to IDMC latest by 26.05.2020.

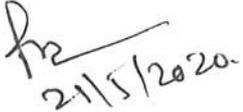
Accordingly, please find enclosed Action Plan on Alternate Technologies for Management of Waste water in the select Drains of EDMC.

Encl: As above

  
Chief Engineer – (HQ) / EMS

Copy to:-

1. Pr. Secy. UD for kind information
2. PS to Chief Secy. for kind information
3. OSD to Comm. for kind information to Commissioner
4. E-in-C for kind information

  
Chief Engineer – (HQ) / EMS



## **Action Plan on Alternate Technologies for Management of Waste water in Drains**

Hon'ble NGT in the matter of Manoj Mishra Vs Union of India in original application no 06/2012 vide order dated 5.3.2020 directed IDMC may prepare and execute an action plan on Alternate Technologies for Management of Waste water in Drains after appropriate techno economic evaluation within three weeks after its constitution. Accordingly first meeting of IDMC was held on 5.5.2020 under the chairmanship of Chief Secretary wherein it was directed that "all drain owning agencies must ensure that action plan on Alternate Technologies for Management of Waste water in Drains under their jurisdiction is prepared and submitted to IDMC latest by 26.05.2020.

**Accordingly EDMC has already taken up this task and status is as under:**

As per the presentation made by IDMC before Chief, Secretary, EDMC has only 140.63 Km length of drains which is only 3.27% of total length of drains in Delhi. EDMC has chosen following drains for remediation.

1. **Drains in AC 64 approximately 5.5 Km in length (Kazzorwali Drain, Drain from GT road to H Block Pump House and other drains in AC 64)**
2. **52 Cusec / Babarpur Drain approximately 4.5 Km in length.**
3. **Gokulpur Drain approximately 4.5 Km in length**
4. **Geeta Colony Kaccha Nalla approximately 2.0 Km in length**
5. **Kasturba Drain from Shivam Enclave to Drain No 1 approximately 2.0 Km**
6. **SSBL drain From SDN Hospital to Ashok Nagar Fhatak approximately 3.0 Km**

### **Remediation of drains in AC-64, Shahdara North Zone. ( already in Operation)**

Waste water of drains in Subhash Park Extension, Janata Colony, Rohtash Nager, Ulhan Pur, Panchsheel garden, a part of Naveen Shahdara is collected and brought at Shahadra Jheel through Chintamani Pond drain and a rising main from H Block sump well Naveen Shahdara. The approximate catchment area of residential colonies is 1.25 sqkm.



Layout of drain in AC 64

Waste water generated from above mentioned area is being treated at Shahdara jheel through 3 MLD Phytoid treatment technologies. The same was planned to recharge the ground water at the Jheel. The work of rejuvenation of Jheel is in progress and likely to be completed by end of this year. In the mean time this treated water approximately 2.50 MLD is being utilized for irrigation purpose by horticulture dept., for sprinkling on roads during peak air pollution and presently for sanitization of public placed as per the guidelines of COVID-19.



### **Plant layout with Phytoid Beds/ Jheel**



Inspection by Joint Secretary AMRUT GOI



Proposed Rejuvenation Plan of Shadra Jheel

**Action plan for drains**

1. 52 Cusec / Babarpur Drain
2. Gokulpur Drain
3. Geeta Colony Kaccha Nalla
4. Kasturba Drain
5. SSBL drain

The waste to wealth mission of Principal Scientific Advisor (GOI) in consultation with L.G has undertaken cleaning the above five drains in East Delhi by providing automated waste collection unit , waste treatment machine ( Plasma Pyrolysis ) and carbonization unit.

**This proposed project is being led by the Principal Science Advisor (PSA) to the Government of India and will be implemented in partnership with East Delhi Municipal Corporation (EDMC), IIT Delhi, DESMI, Denmark and Vertiver Pvt. Ltd. . IIT Delhi will be the technical lead of the project in partnership with DESMI EnviRO-Clean, a technology firm having expertise in remediation and removal of waste from water bodies including marine waste, rivers, canals etc.**

The main object of the project is to clean up/ remove floating debris from the drain and to prove the sustainability of the process with gasification technology to mitigate waste of mixed feedstock, collected from drains in Delhi.

**EnviRo-Enhancer concept.DESMI EnviRo-Rise**

**Environment friendly trash remover**

1. These are smart surface debris collection systems. These automated systems are designed to guide the marine debris for easy recovery with sequential belt designs. Serving the purpose to contain much of the floating surface debris, allowing the water to pass while allowing marine life to stay unharmed is a statement that defines EnviRo-Care systems.

2. It is equipped with electrically driven belt systems that lifts the debris out of the water draining away free water. RISE is based on conveyor technology powered by highly efficient electrical motors causing negligible CO2 emissions during its operation.

The operation of the R-series increases the efficiency of waste collection, in addition to, minimizing the time, which an operator may spend in the close proximity of the polluted waters. Hence, making the operation safer for the operators.

Advantages:

3. Ability to recover the waste sideways, Control box designed to be placed on either side based on the customer requirement, Independent system, requires 220 V electrical supply for operation, Belt speed can be varied from 0,3 to 1,3 m/sec.



**Environment friendly trash remover  
already installed at Babarpur Drain**



**Environment friendly trash remover  
already installed at Babarpur Drain**

The finger feeder and the conveyor are both running at a variable speed of 0.1 to 0.3 m/sec. the unit is electrically driven at 230 volt, 50 Hz. The frame of the unit is made up of marine grade aluminum and the buoyancy is created with two pontoons on each side. The conveyor belt on the unit can be mirrored which means that the unit is capable of lifting the waste to either right or left side. The rise units is designed to minimize the time that an operator can spend in the close proximity of the polluted waters. Hence, making the operation safe & easy for the operators. The process of the Rise unit streamlines the retrieval of waste thus increasing the efficiency of waste collection.

## **A BRIEF ON CARBONISATION PLANT**

### **THE BASIC TECHNOLOGY DETAIL.**

1. The input material is entered into the system via the funnel, with the screw inserted. The material is transported into the screw reactor via an electric motor driven by the rotary feeder. This also serves to burn back. In the reactor, the material is passed continuously through the reactor by an electric motor driven screw conveyor.
2. The input material is carbonized under inert conditions by electrical heating coils at temperatures up to 950°C. The inert conditions are produced via two nitrogen-introducing pipelines at the beginning and at the end of the reactor. \* Optionally, a steam activation can be carried out by adding water.
3. The solid phase falls into a coal / ash catcher at the end of the reactor and can be used for other purposes. The gaseous phase is transferred via a pipeline into the combustion chamber.
4. Above a burner working with combustion air and gas (e.g., propane / butane / natural gas), temperatures in excess of 950°C are reached. The resulting pyrolysis gases are completely burned here. The resulting exhaust gas is discharged via an exhaust fan and chimney.

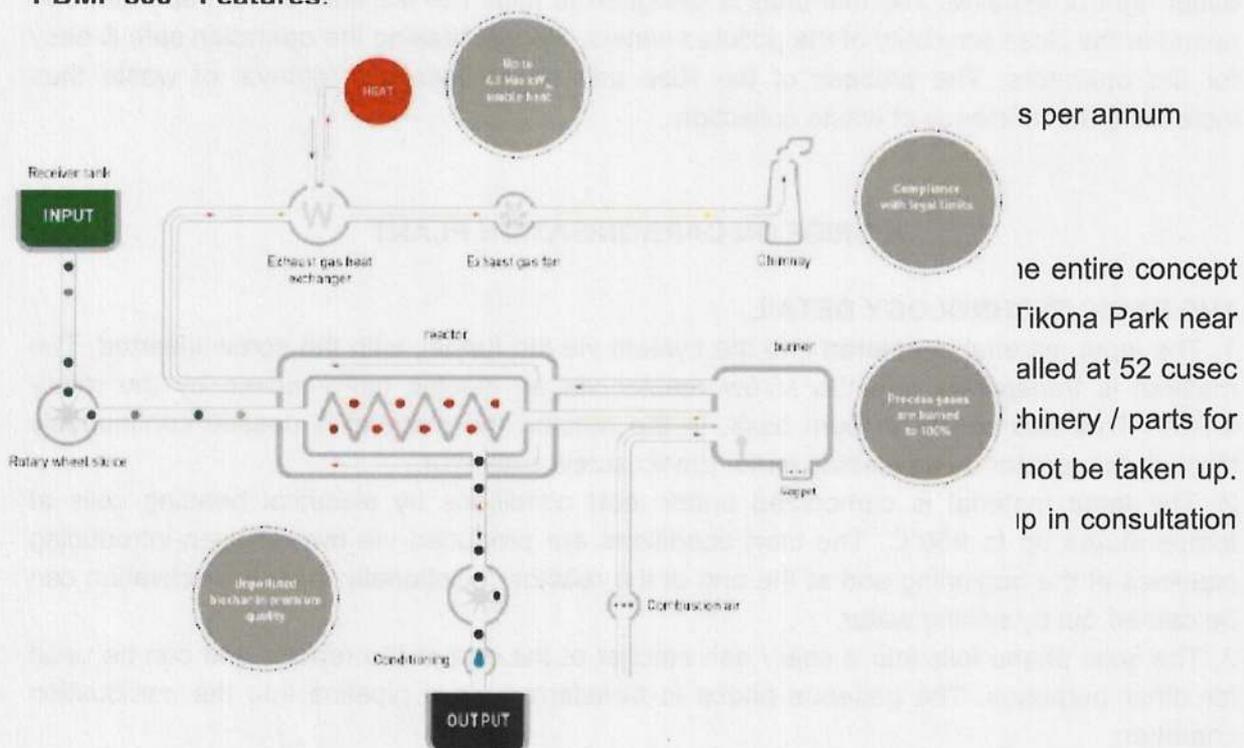
## 5. Materials & Products:

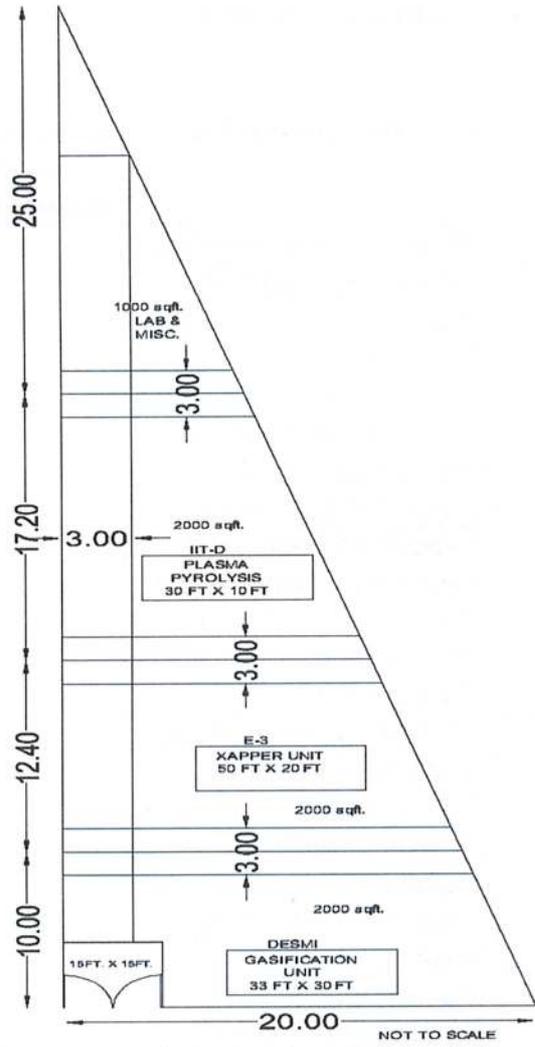
Input Material	Output Material
Biomass/ Organic material	Biochar
Biomass	Activated Carbon
Sewage Sludge	Phosphorous Fertilizer
Plastics	Activated Carbon

## 6. Important Features:

- Complete recycling of the INPUT substrate
- Consistent REFINEMENT of biomass: Obtaining clean, pollutant-free carbon products in defined quality grades
- The process produces no harmful by-products (free of tar, oil and soot)
- The carbonization process is active climate protection: Best energy management, low emission values, compliance with European environmental standards, obtaining a carbon negative product
- AUTOTHERMAL SYSTEM: Own waste heat (exhaust gas) is used to heat up the system
- HEAT UTILISATION up to 150 kWth/ 600 kWth per module, can be used for heating or drying purposes

## PDMF 500 - Features:





Tentative layout of Technology Park at Tikona Park

## Roles and responsibilities of various Institutions

Institution	Key Responsibilities	Deadlines to be finalised after lockdown
<b>Program Implementers</b>		
o/o PSA	Finalize Site Layout	
	Program Management	
EDMC	Construction of Perimeter wall	
	Construction of office/ lab and paving of paths inside the Perimeter	
	Support in water and electricity Connections/ Oversee functioning of all machines/ Program Management	
<b>Technology Partners</b>		
IIT Delhi	Apply for Electricity Connection	
	Recruit Guards	
	Install CCTV	
	Install Pyrolysis Plant	
DESMI	Install and Operationalize Enhancer in Tikona park	
	Install machines in 4 other drains	
E3	Install and Operationalize Xapper in Tikona Park	

Site identified for Enviro-Rise.

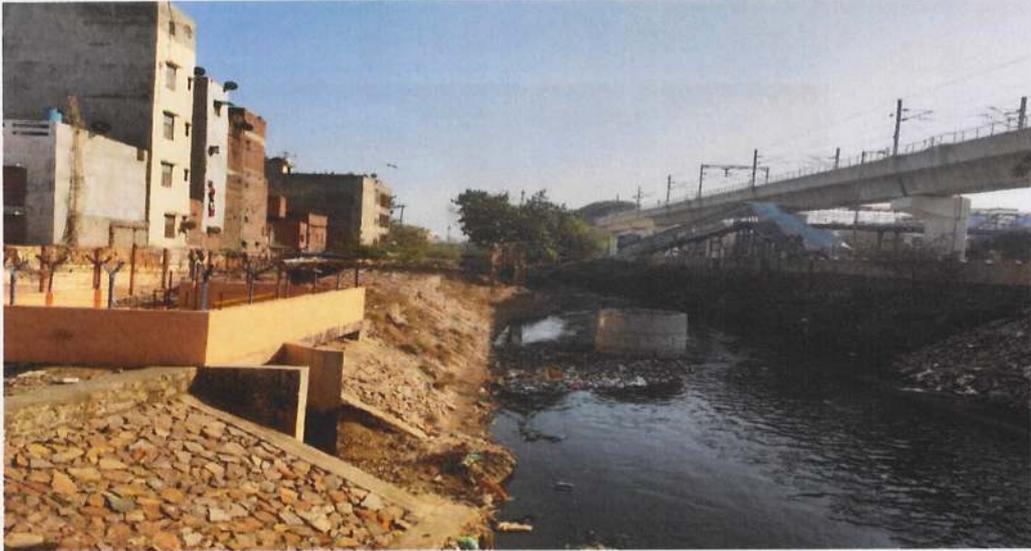
### 1.Gokulpur Drain



### 2.Geeta Colony Kaccha Nalla



### 3.Kasturba Drain



### 4.SSBL drain





# Various Treatment Technologies for Treatment of Wastewater in Drains in EDMC Area

Submitted by  
East Delhi Municipal Corporation





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## 2 INTRODUCTION: EDMC

EDMC is one the municipal corporation of Delhi with a total population of 4 million as per 2011 census. Total area under East Delhi is approx. 106 square km with population density of 41517 no.s per sq km. It is divided into 2 zones viz. Shahdara South and Shahdara North with total 64 wards. EDMC has approx.. 205 no. of drains of 3<sup>rd</sup> order and 4<sup>th</sup> order drains passing through it which ultimately meets in river Yamuna.

## 3 DRAINS AND DESCRIPTION

A scientific drainage system to catch the storm water is a long term need of the society, particularly in cities. Urbanization along with its impermeable structures is one of the major causes of flooding in urban areas. The rainfall intensity and characteristics of catchment area are the major factors for designing urban storm water drainage facilities. These facilities have a paramount advantage to safely dispose the generated floods to receiving system.

List of the drains under EDMC jurisdiction categorized according to width can be described below depicting length of the drain, Width of drain, Depth of drain, flow and organic loading entering the drain.

*Table: Drains in EDMC area*

### 3.1 CATEGORY A :- Drain width 0-1m

S. No.	Ward No.	Name of Drain	Length of Drain (in Mtr)	Width of Drain (in Mtr)	Depth of drain (in Mtr)	Flow (MLD)	Organic Loading (BOD)(mg/l)
1	21	Mahila Colony drain	400	0.90	1.30	Upto 5 MLD	<50 mg/l
2	21	Drain at Krishna nagar , Krishna Nagar	320	1.00	1.40	Upto 5 MLD	<50 mg/l
3	22	Hari Singh Gurdwara	570	0.60	1.50	Upto 5 MLD	<50 mg/l
4	23	Bhagat Singh Nalla	1460	1.00	2.00	Upto 5 MLD	<50 mg/l
5	24	6-12 Block Nalla (LHS)	400	0.75	1.35	Upto 5 MLD	<50 mg/l
6	24	6-12 Block Nalla (RHS)	400	0.75	1.35	Upto 5 MLD	<50 mg/l
7	25	Fish market drain	150	1.00	1.50	Upto 5 MLD	<50 mg/l
8	27	Raghubar pura drain LHS Lal	250	0.90	1.00	Upto 5 MLD	<50 mg/l
9	27	Raghubar pura drain RHS	250	0.90	1.00	Upto 5 MLD	<50 mg/l

10	27	Kashyap Mohalla drain	250	0.90	1.00	Upto MLD	5	<50 mg/l	
11	18E	Drain along Gharonda Apptt,	460	0.60	1.20	Upto MLD	5	<50 mg/l	
12		Nakul Gali drain Vishwas Nagar	483	0.90	1.50	Upto MLD	5	<50 mg/l	
13		Gali No.10, drain Vishwas Nagar	220	0.75	1.50	Upto MLD	5	<50 mg/l	
14		Gali No.3 drain Vishwas Nagar	402	0.90	1.50	Upto MLD	5	<50 mg/l	
15		18 Qtr. To New Vishwas Nagar drain		180	0.60	1.50	Upto MLD	5	<50 mg/l
				213	0.90	1.50	Upto MLD	5	<50 mg/l
				174	0.60	1.50	Upto MLD	5	<50 mg/l
				200	0.75	1.50	Upto MLD	5	<50 mg/l
16		19E	Gazipur Village drain	800	0.75	1.80	Upto MLD	5	<50 mg/l
17	31E	Pandav Road Nallah	450	0.65	1.20	Upto MLD	5	<50 mg/l	
18		Satgarh Nallah	400	0.75	0.10	Upto MLD	5	<50 mg/l	
19		Tikona Park Nallah	225	1.00	1.40	Upto MLD	5	<50 mg/l	
20		Bhola Nath Nagar Nallah	1100	1.00	1.50	Upto MLD	5	<50 mg/l	
21	001E	Nalla from Block No. 19 to 25 Central Road Trilokpuri.	950.00	0.75	1.25	Upto MLD	5	<50 mg/l	
22	001E	Drain from Mayur Vihar Pkt-II to Gurudward Chowk.	600.00	0.85	1.40	Upto MLD	5	<50 mg/l	
23	001E	Nalla from Block No. 14 to 13 Central Road Trilokpuri.	300.00	0.75	1.25	Upto MLD	5	<50 mg/l	
24	002E	Block No. 9 to 12 (L.H.S), Trilok Puri	700.00	0.90	1.25	Upto MLD	5	<50 mg/l	
25	002E	Block No. 9 to 12 (R.H.S), Trilok Puri	700.00	0.90	1.25	Upto MLD	5	<50 mg/l	
26	002E	Block No. 15 to 18 (Internal Road).	550.00	0.80	1.30	Upto MLD	5	<50 mg/l	
27	003E	Nalla from Block No. 26 to 30 Central Rd.	880.00	0.75	1.25	Upto MLD	5	<50 mg/l	
28	003E	Nalla from Block No. 26 to 30 Main Rd.	980.00	0.75	1.25	Upto MLD	5	<50 mg/l	
29	003E	Nalla from Block No. 31 to 36 Central Rd.	1000.00	0.75	1.25	Upto MLD	5	<50 mg/l	
30	003E	Nalla from Chilla Village to Chilla regulator	800.00	1.00	2.30	Upto MLD	5	<50 mg/l	
31	005E	Drain between D Block Gazipur Dairy Farm & SLF Gazipur	252.00	1.00	1.60	Upto MLD	5	<50 mg/l	
32	005E	Outfall nalla from New Ashok Nagar to P.S. Toll Tax Noida	500.00	0.75	1.25	Upto MLD	5	<50 mg/l	
33	008E	Drain of road from Block No. 19 to 21 Kalyan Puri L/R	1100.00	1.00	2.30	Upto MLD	5	<50 mg/l	
34	008E	Drain of road from Block No. 11	960.00	0.75	1.25	Upto MLD	5	<50 mg/l	

		to 13 Kalyan Puri L/R				MLD	
35	008E	Khichri Pur Nalla Block No. 9 to 10	150.00	0.75	1.25	Upto MLD 5	<50 mg/l
36	007E	F-Block, H. No. 130 to Sulabh Sauchalay, Kondli	70.00	1.00	1.40	Upto MLD 5	<50 mg/l
37	10-E	Drain from Sriram chowk to Aggarwal Sweets, C-Block West Vinod Nagar	480.00	0.90	1.20	Upto MLD 5	<50 mg/l
38	10-E	Drain from Sriram chowk to Jewellery Shop, D-Block West Vinod Nagar	290.00	0.75	1.20	Upto MLD 5	<50 mg/l
39	10-E	Drain on Shanti marg from Budha Marg to Narwana Road (Both Sides)	700.00	0.90	1.20	Upto MLD 5	<50 mg/l
40	09-E	Drain on Shanti Marg from RCC culvert, Mandawali Road to Budha Marg (Both Sides)	500.00	0.90	1.20	Upto MLD 5	<50 mg/l
41	09-E	Drain from Budha Marg to Sadbhavna Chowk	150.00	1.00	1.20	Upto MLD 5	<50 mg/l
42	09-E	Drain from Harijan Basti Rly. Colony to Pump House, Mayfair Apptt.	430.00	1.00	1.50	Upto MLD 5	<50 mg/l
43	09-E	Drains from Sriram Chowk to Rly. Colony on both sides of Kalyan Marg	1500.00	0.90	1.20	Upto MLD 5	<50 mg/l
44	09-E	Drain from Milenium Park to MC Pry School No.1 via Pandit Mohalla, Mandawali	500.00	0.90	1.20	Upto MLD 5	<50 mg/l
45	09-E	Drain from Railway Colony to Bhim Gali along Sonia Vihar Subzi Mandi	100.00	0.90	1.20	Upto MLD 5	<50 mg/l
46	11-E	Drain from Pump House Bus Stand near H. No. A/185 to outfall	305.00	0.90	1.20	Upto MLD 5	<50 mg/l
			300.00	0.90	1.20	Upto MLD 5	<50 mg/l
47	11-E	Pumphouse outfall nalla	330.00	1.00	1.20	Upto MLD 5	<50 mg/l
48	11-E	Drain in Mayur Vihar-II Pocket B from M.C. Pry School Pocket F to Sanjay Jheel.	425.00	1.00	1.25	Upto MLD 5	<50 mg/l
49	12-E	Drain from IFS App. To Fine Home App.	800.00	0.90	1.30	Upto MLD 5	<50 mg/l
50	12-E	Drain from Sahyog App. to Anand Lok Appt.	395.00	0.90	1.30	Upto MLD 5	<50 mg/l
51	12-E	Drain from Ahalcon Intl. School to Police App. Mayur Vihar	350.00	0.90	1.20	Upto MLD 5	<50 mg/l
52	12-E	Drain from Partap Nagar to Aggarwal Sweets in Mayur Vihar Ph. - I	510.00	1.00	1.20	Upto MLD 5	<50 mg/l
53	12-E	Drain in P-Block Pandav Nagar.	330.00	0.60	1.20	Upto MLD 5	<50 mg/l
54	12-E	Acharya Niketan Nalla from Maternity Home to Church.	500.00	0.60	1.20	Upto MLD 5	<50 mg/l
55	12-E	Samaspur Vill. Nalla from E-54 to Police Appt.	500.00	0.65	1.20	Upto MLD 5	<50 mg/l
56	12-E	Drain along Una Appt. to Mavila	260.00	0.60	1.20	Upto MLD 5	<50 mg/l

		apptt., Mayur Vihar -Ph-I				MLD	
57	13-E	Lalita park Nalla	450.00	0.90	1.30	Upto MLD 5	<50 mg/l
58	13-E	Gali No. 12 drain Lalita Park,	200.00	0.70	1.20	Upto MLD 5	<50 mg/l
59	13-E	Ramesh Park Community Centre Nalla	350.00	0.70	1.30	Upto MLD 5	<50 mg/l
60	13-E	Bank Enclave drain opp. H. No. 1	300.00	1.00	1.20	Upto MLD 5	<50 mg/l
61	13-E	Ramesh Park Police Stn. Drain	360.00	1.00	1.35	Upto MLD 5	<50 mg/l
62	14-E	Bank Enclave drain	200.00	0.70	1.25	Upto MLD 5	<50 mg/l
63	14-E	Kundan Nagar Nalla (Right Side)	200.00	0.75	1.20	Upto MLD 5	<50 mg/l
64	14-E	PD Vihar drain	400.00	0.70	1.20	Upto MLD 5	<50 mg/l
65	14-E	Laxmi Nagar Market Nalla	1900.00	0.85	1.20	Upto MLD 5	<50 mg/l
66	15-E	Shakarpur Market Nalla	795.00	0.80	1.20	Upto MLD 5	<50 mg/l
67	15-E	Drain from DDA Park to S 380 School Block Pandav Nagar	650.00	0.90	1.20	Upto MLD 5	<50 mg/l
68	16-E	Drain from Bhim Gali to Budha Marg	1000.00	0.90	1.20	Upto MLD 5	<50 mg/l
69	16-E	Hanuman Mandir road Pandav Nagar nalla	555.00	0.90	1.20	Upto MLD 5	<50 mg/l
70	16-E	D Park to 11/3 Pandav Nagar nalla	340.00	0.80	1.20	Upto MLD 5	<50 mg/l
71	16-E	C-68/4 to S-101 Pandav Nagar nalla	125.00	0.90	1.20	Upto MLD 5	<50 mg/l
72	35 E	Nallah along DDA park from MCD sotre to Q-Pkt. Drain in Dilshad Garden	310	1.00	1.60	Upto MLD 5	<50 mg/l
73	35 E	Nallah from Tahirpur Sarai to R-Pkt. Dilshad Garden	150	1.00	1.50	Upto MLD 5	<50 mg/l
74	35 E	Nallah from Gali No-8 Jagatpuri extn. Unauthorized colony	90	0.75	1.00	Upto MLD 5	<50 mg/l
75	35 E	Nallah along DDA park from P-15/A-4 to MCD Store Dilshad Garden	330	1.00	1.50	Upto MLD 5	<50 mg/l
76	34 E	Nalla in new seemapuri from E-blk to Machli Market	220	1.00	1.50	Upto MLD 5	<50 mg/l
77	34 E	Nalla in E-Block Jhuggi Nalla New Seemapuri	100	0.70	1.70	Upto MLD 5	<50 mg/l
78	34 E	Nalla in New seemapuri from Bhopal Pulia to Dhobi Ghat	110	0.80	1.50	Upto MLD 5	<50 mg/l
79	32 E	Internal nallas in D- block Nand Nagari from D-1/275 to D-1/231 to Upto D-3/355	190	0.60	1.30	Upto MLD 5	<50 mg/l
80	32 E	Nalla both side E block pump house nalla in Nand Nagari from E-4/160 to pump house including sump well	780	0.85	1.50	Upto MLD 5	<50 mg/l
81	32 E	Both side Nalla of Akhara park E -4 Block Nand Nagari	700	0.80	1.60	Upto MLD 5	<50 mg/l

82	32 E	Internal nallas in A-1/30 in A block Nand Nagari from A-2/30 to A-2 Block Nand Nagri	525	0.60	1.30	Upto MLD	5	<50 mg/l
83	32 E	Internal nallas in A-1/481 and Ujala Pulia to road No 68 towards cement godown both side	1200	0.90	1.45	Upto MLD	5	<50 mg/l
84	32 E	Nallah from Sr. Sec. School Raja Ravin Verma corner to B-5 Block Market Nand Nagri	375	0.9	1	Upto MLD	5	<50 mg/l
85	32 E	Nallah from B-5 Block Market Corner to road no-68	150	0.90	1.45	Upto MLD	5	<50 mg/l
86	33 E	Nalla along Murga Mkt. in G & H block Sunder Nagari from mandir to Upto pumphouse	589	0.75	1.30	Upto MLD	5	<50 mg/l
87	33 E	Nalla in L Block Sunder Nagari from police chowki to L-55 Sunder Nagari	478	0.95	1.50	Upto MLD	5	<50 mg/l
88	33 E	nalla in sunder nagari from M.C. Primary school to Sani bazar mandi along F2 sunder nagari	254	0.65	1.20	Upto MLD	5	<50 mg/l
89	52 E	nallah in Ambedkar Colony from main road Johripur to Drain no.1 in W.No.261 Shah.North Zone.	278	0.7	1.15	Upto MLD	5	<50 mg/l
90	52 E	nallah from main road Johari Pur along Johari pur Ext. to block, main road (both side) to Drain no.1 in W.No.261 Shah.North Zone.	560	0.5	1.30	Upto MLD	5	<50 mg/l
91	53 E	nallah along C-block, main road to Ganga Vihar W.No.261 Shah.North Zone.	540	0.6	2.00	Upto MLD	5	<50 mg/l
92	53 E	internal nallah A,B,C & D block to pump house to school block, Ambey Cycle to post office and Kaushik Garment to M.C. Pry. School B-block in Gokulpuri W.No.262 Shah.North Zone.	380	0.55	1.10	Upto MLD	5	<50 mg/l
93	53 E	nallah from Amar Colony to Loni road flyover in W.No.262 Shah.North Zone.	285	0.95	1.50	Upto MLD	5	<50 mg/l
94	53 E	nallah C-block, jhuggi area along main road up to Pump house W.No.262 Shah.North Zone.	508	0.65	1.30	Upto MLD	5	<50 mg/l
95	53 E	Nallah along main road Ganga Vihar from dhalao to drain no.1 along A,B,D & F block in Ganga Vihar W.No.262 Shah.North Zone.	600	0.6	1.00	Upto MLD	5	<50 mg/l
96	53 E	Nallah from main road Ganga Vihar to Gokulpur Village W.No.262 Shah.North Zone.	340	0.6	1.00	Upto MLD	5	<50 mg/l
97	54 E	Nalla from Shamshan Ghat to Saboli goan bada kuan (Rathore Cement Store)	1000	0.6	1.20	Upto MLD	5	<50 mg/l
98	55 E	Nalla on both side along Gali No	400	0.65	1.10	Upto MLD	5	<50 mg/l

		9 Bank Colony Harsh Vihar dividing road from Jail B/wall to Budh Vihar Chowk				MLD	
99	55 E	Nalla from P.W.D P/house Harsh Vihar to Jail Boundary wall	1370	0.90	2.10	Upto 5 MLD	<50 mg/l
100	55 E	Nalla on both side along bank colony Road from Wazirabad road to Kishan Lal Chowk	960	0.75	1.20	Upto 5 MLD	<50 mg/l
101	44-E	Drain Gamri road to Gokalpur drain	100.00	0.70	1.35	Upto 5 MLD	<50 mg/l
102	47-E	Drain Gali No. 12 X-Block Brahmpuri to Gokalpur drain	400.00	0.90	1.2	Upto 5 MLD	<50 mg/l
103	47-E	Drain from Gokalpur drain to Khaddey wali Masjid	1000.00	0.60	1.05	Upto 5 MLD	<50 mg/l
104	47-E	Drain from Gautam Vihar chowk to Gokalpur drain	400.00	0.60	1.05	Upto 5 MLD	<50 mg/l
105	46-E	Drain from Gamri road to Gali No. 1 Khaddey wali masjid (RHS)	900.00	0.60	1.05	Upto 5 MLD	<50 mg/l
106	46-E	Drain from Gamri road to Gali no. 1Brahmpuri (LHS)	600.00	0.60	1.05	Upto 5 MLD	<50 mg/l
107	45-E	Drain from Main market Bhajanpura gali no. 14 to Wazirabad road RHS	400	0.60	1.2	Upto 5 MLD	<50 mg/l
108	45-E	Drain from B-1 Block Yamuna Vihar to B-3 Block Yamuna Vihar	660	1.00	2	Upto 5 MLD	<50 mg/l
109	45-E	Drain from B-4 Block Dividing road to S.S. School Yamuna Vihar	650	1.00	1.8	Upto 5 MLD	<50 mg/l
110	45-E	Drain from Sachdeva Marriage home to Bhajanpura pump house	380	0.90	2.15	Upto 5 MLD	<50 mg/l
111	45-E	Drain from dividing road to C-10 Nursery Yamuna Vihar	535	0.60	1.1	Upto 5 MLD	<50 mg/l
112	45-E	Drain from Bhagat Singh Pump house to C-12, Yamuna Vihar Shiv Shakti mandir	692	0.90	2.5	Upto 5 MLD	<50 mg/l
113	56-E	Drain from Patel road from Patel chowk to Harizan Basti gali no. 1 Pucca road in ward no. 265	400	0.63	1.3	Upto 5 MLD	<50 mg/l
114	56-E	Drain Karawal Nagar road from Shiv Vihar chowk	1000	0.90	1.5	Upto 5 MLD	<50 mg/l
115	56-E	Drain Shiv Vihar Tiraha	175	0.90	2	Upto 5 MLD	<50 mg/l
116	57-E	Drain 33' road from Karawal Nagar	690	0.75	1.5	Upto 5 MLD	<50 mg/l
117	57-E	Drain Industrial area Nall from Karawal Nagar road	250	0.60	1.2	Upto 5 MLD	<50 mg/l
118	57-E	Drain Brijpuri road from gali no.1 to shiv Vihar Tiraha	450	0.90	2	Upto 5 MLD	<50 mg/l
119	57-E	Drain Karawal Nagar road from Shiv Vihar Tiraha to Mukhiya market	1350	0.90	1.5	Upto 5 MLD	<50 mg/l
120	57-E	Drain from Karawal Nagar road from Dayalpur 33' feet road	1100	0.60	1.5	Upto 5 MLD	<50 mg/l
121	59-E	Drain 25' road from Sanjay	750	0.90	1.25	Upto 5 MLD	<50 mg/l

		chowk road to Fauzi market				MLD	
122	59-E	Drain from 33' road from 25' road chowk to Gali No. 1 Nehru Vihar	800	0.70	1.2	Upto MLD 5	<50 mg/l
123	58-E	Drain 33' road from Brijpuri road to 25' Chowk	615	0.60	1.25	Upto MLD 5	<50 mg/l
124	58-E	Drain 33' road from Brijpuri road to 25' chowk	615	0.6	1.25	Upto MLD 5	<50 mg/l
125	37E	Nalla along East nathu Colony in C-37E	350	0.6	1.5	Upto MLD 5	<50 mg/l
126	36E	Hardevparl nalla from Hardevpuri to Ioni Rd. pump house.	1400	0.9	1.5	Upto MLD 5	<50 mg/l
127	39E	Khajoor wala nalla ( Covered drain) Naveen Shah. From gali No.2 West Rohtash Nagar to Naveen Shadara drain.	341	0.75	1.5	Upto MLD 5	<50 mg/l
128	39E	Punchsheel Garden nalla along sarovar marg to the jail opp. Muskan Restaurent on 65 No. road	30	1	1.43	Upto MLD 5	<50 mg/l
129	39E	Kabootar market drain from Mochi mkt. Drain (near kabristan) to masjid	100	0.8	1.15	Upto MLD 5	<50 mg/l
130	48E	Nalla from Mohanpuri school to gali no.16 Adrash mohalla vijay park	285	0.6	1.2	Upto MLD 5	<50 mg/l
131	48E	Nalla from C-12, Pump House to Priya Panchvati Yamuna Vihar C-11/8.	510	0.8	1.8	Upto MLD 5	<50 mg/l
132	48E	Nalla from Krishna Park A-Block North Ghonda to Gamri pump house	670	1	1.8	Upto MLD 5	<50 mg/l
133	48E	Nalla gali no. 16 Vijay park to Road No. 66.	330	0.76	2.44	Upto MLD 5	<50 mg/l
134	49E	Kardam Marg nalla from Harkishan Public School to Drain No. 1 Kardam Puri.	350	0.6	1.2	Upto MLD 5	<50 mg/l
135	51E	Drain from Gulati Tent House , New Zafrabad to 52 Cusec drain.	110	1	1.2	Upto MLD 5	<50 mg/l
136	51E	Drain opp. BSES office DDA colony New Zafrabad to 52 Cusec drain.	90	0.9	1.1	Upto MLD 5	<50 mg/l
137	51E	Drain from 52 cusec to pt. near H.No. B-64, Sudama Puri Ext.	90	1	1.2	Upto MLD 5	<50 mg/l
138	42E	J.J Cluster Nalla	550	0.85	1.25	Upto MLD 5	<50 mg/l
139	42E	Fruit Market Nalla	320	0.85	1.20	Upto MLD 5	<50 mg/l
140	43E	Moni Baba Nalla	544	0.75	1.50	Upto MLD 5	<50 mg/l
141	40E	Rajender Parsad Marg drain	175	0.75	1.50	Upto MLD 5	<50 mg/l
142	40E	Vijay Park Nalla	290	0.80	1.20	Upto MLD 5	<50 mg/l
143	62E	C Block Nalla	470	0.6	1.30	Upto MLD 5	<50 mg/l

						MLD	
144	61E	Pusta road Nalla	1200	0.50	1.25	Upto 5 MLD	<50 mg/l
145	61E	Karawal Nagar road Nalla	900	0.80	1.25	Upto 5 MLD	<50 mg/l
146	60E	Mariginal Bandh Ist pusta Nalla	1100	0.75	1.30	Upto 5 MLD	<50 mg/l
147	60E	Mariginal Bandh IInd pusta Nalla	500	0.65	1.20	Upto 5 MLD	<50 mg/l
		Total	77118				

### 3.2 CATEGORY B: Drain width 1-2m

S. No.	Ward No.	Name of Drain	Length of Drain (in Mtr)	Width of Drain (in Mtr)	Depth of drain (in Mtr)	Flow	Organic Loading (BOD)(mg/l)
1	21	Krishna Nagar drain	400	1.75	1.30	5-10 MLD	50-100
2	21	Radhey puri drain H Block, .	230	2.00	1.35	5-10 MLD	50-100
3	25	Kailash Nagar drain	760	1.20	2.00	5-10 MLD	50-100
4	25	Shastri Park drain	600	1.30	1.80	5-10 MLD	50-100
5	26	East Azad Nagar drain	520	1.50	0.75	5-10 MLD	50-100
6	26	Krishna Nagar drain	405	1.80	2.00	5-10 MLD	50-100
7	26		390	1.80	0.75	5-10 MLD	50-100
8	26	Shankar Nagar nalla	540	1.50	1.10	5-10 MLD	50-100
9	26		120	1.60	1.10	5-10 MLD	50-100
10	26		270	1.70	1.80	5-10 MLD	50-100
11	27	Scooter market Drain	500.00	1.50	0.65	5-10 MLD	50-100
12	27	Ajeet Nagar drain	700	1.25	2.00	5-10 MLD	50-100
13	27	Ramnagar drain	300	1.60	1.00	5-10 MLD	50-100
14	27	Raghubarpura Drain (RHS)	900	1.75	1.05	5-10 MLD	50-100

15	27	Raghubarpura drain (LHS)	600	1.65	1.05	5-10 MLD	50-100
16	27	Nalla along main road Seelampur	570	1.50	1.10	5-10 MLD	50-100
17	30E	Nalla along Railway line	1000	1.20	1.35	5-10 MLD	50-100
18		Swami Amardev Nalla	425	1.20	1.50	5-10 MLD	50-100
19	29E	Vishwkarma Nagar Nalla	900	1.50	2.10	5-10 MLD	50-100
20		Janta Flat Nalla	852	1.95	1.80	5-10 MLD	50-100
21		Majid Road Nalla	416	1.15	1.50	5-10 MLD	50-100
22	003E	DSIDC Market to Chilla drain along Pkt-III, Mayur Vihar Phase-I.	700.00	1.20	1.50	5-10 MLD	50-100
23	005E	Drain between C & D Block Gazipur Dairy Farm	225.00	1.30	1.75	5-10 MLD	50-100
24	10-E	Drain from Sadbhawna Chowk to Taxi Stand on Sadbhawana Road	420.00	1.30	1.50	5-10 MLD	50-100
25	11-E	Drain in Mayur Vihar Ph. II from E/560 to Pump House	400.00	1.20	1.30	5-10 MLD	50-100
26	11-E	Drain from G-Block to Gurudwara East Vinod Nagar adjoining NH-9	350.00	1.20	1.30	5-10 MLD	50-100
27	28 E	Nalla in Old Seemapuri G block to Pump house	1361	1.20	2.00	5-10 MLD	50-100
28	34 E	Nalla in Tahirpur village from Shiv mandir to Kali mandir	240	1.25	1.40	5-10 MLD	50-100
29	32 E	Nallah H.no-30 E-1 Nand Nagri to H.no-231 E-Block Nand Nagri	115	1.30	1.40	5-10 MLD	50-100
30	32 E	Nallah from H.no-481 E-2 Nand Nagri to H.no-280 E-2 Block Nand nagri	115	1.30	1.40	5-10 MLD	50-100
31	52 E	nallah in Bhagirathi Vihar from Brijpuri culvert to Drain No.1 in W.No.261 Shah.North Zone.	1410	1.04	1.50	5-10 MLD	50-100
32	54 E	Nalla along railway line from Saboli Phatak	620	1.2	1.30	5-10 MLD	50-100
33	<u>59-E</u>	Drain Karawal Nagar road from Chand bagh culvert to Sherpur Chowk	<u>800</u>	1.50	1.5	5-10 MLD	50-100

34	59-E	Drain Karawal Nagar road from Sherpur chowk up to 33 feet road	590	1.50	1.5	5-10 MLD	50-100
35	59-E	Drain from Gali No. 6 from 25' road to Escape drain in ward no. 267	300	1.20	1.5	5-10 MLD	50-100
36	59-E	Drain Gali No. 8 from 25' road to Escape drain	300	1.20	1.5	5-10 MLD	50-100
37	58-E	Drain Brijpuri road from escape drain	600	1.20	1.5	5-10 MLD	50-100
38	58-E	Drain Brijpuri road from escape drain to Gali no. 1 Mustafabad	814	1.20	1.6	5-10 MLD	50-100
39	38E	Covered drain from Loni road to Mother Dairy kabool Nagar	250	1.2	1.2	5-10 MLD	50-100
40	38E	Covered drain from 1/143 Sri Ram nagar to Shri Ram Nagar pump house internal nalla	524	1.2	1.8	5-10 MLD	50-100
41	38E	Moti Ram road nalla from loni road pump house to mandoli road dhalao	191	1.3	1.8	5-10 MLD	50-100
42	39E	Naveen Shahdara Nalla at G.T Road to pump house naveen Shahdara	900	1.2	0.6	5-10 MLD	50-100
43	39E	Chintamani pond drain from the point near power station to the jali behind Zonal Office	300	1.9	2.1	5-10 MLD	50-100
44	39E	Mochi Mkt. drain from Ravi Dass Mandir to Kabristan Culvert	225	1.58	1.6	5-10 MLD	50-100
45	51E	Drain from M.I office, New Zafrabad to 52 Cusec drain.	190	1.2	1.2	5-10 MLD	50-100
46	42E	CPJ & K Block Nalla	580	1.20	1.30	5-10 MLD	50-100
47	63E	Karawal Nagar road Nalla	540	1.2	1.30	5-10 MLD	50-100
48	63E	Karawal Nagar road Nalla	675	1.4	1.50	5-10 MLD	50-100
49	62E	Karawal Nagar road Nalla	1550	1.2	1.30	5-10 MLD	50-100
		Total	26683				

### 3.3 CATEGORY C: Drain width 2-3m

S. No.	Ward No.	Name of Drain	Length of Drain (in Mtr)	Width of Drain (in Mtr)	Depth of drain (in Mtr)	Flow	Organic Loading (BOD)(mg/l)
1	22	Jagat puri drain	1215	2.23	3.00	10-15MLD	50-100 mg/l
2	004E	Nalla from Vashundara Enclave to New Ashok Nagar Metro Station	1400.00	2.10	3.00	10-15MLD	50-100 mg/l
3	005E	Gazipur Out fall Nalla	400.00	2.90	1.60	10-15MLD	50-100 mg/l
4	13-E	MB road drain	1200.00	3.00	3.00	10-15MLD	50-100 mg/l
5	35 E	Nalla from SSBL drain Jalli Kheda Vill. To SDN Hopt. Road in W.No. 241	135	2.4	3.00	10-15MLD	50-100 mg/l
		Total	4350				

### 3.4 CATEGORY D: Drain width 3m and above

S. No.	Ward No.	Name of Drain	Length of Drain (in Mtr)	Width of Drain (in Mtr)	Depth of drain (in Mtr)	Flow	Organic Loading (BOD)(mg/l)
1	20E	Arya Nagar drain	625	3.60	1.80	15-20 MLD	>100 mg/l
2	002E	Sanjay drain in Trilok Puri	950.00	5.00	1.65	15-20 MLD	>100 mg/l
3	38E	52 cusec drain from Mandoli Rd. to Ioni Rd.	640	4.2	3.6	15-20 MLD	>100 mg/l
4	40E	Gokal Pur drain (325+108=433)	433	4.15	4.00	15-20 MLD	>100 mg/l
		Total	2648				

S. No.	Description	Length (in Meter)
1	Category – A drains	<b>77118</b>
2	Category – B drains	<b>26683</b>
3	Category – C drains	<b>4350</b>
4	Category – D drains	<b>2648</b>
	Total	<b>110799</b>
	Say	<b>111 Km</b>

#### 4 Classification of drains and Stream order:

As per the CPCB report, categorization of drains can be done on the basis of flow, organic load and width which is tabulated as under:

**Table a)**Based on flow rate:

S.no	Flow rate	Category
1.	<20MLD	Minor Drain
2	20 — 50 MLD	Medium Drain
3	>50 MLD	Major Drain

**Table b)** Based on organic load:

S.no	BOD(mg/l)	Category
1.	<50	Low pollution load
2	50-100	Moderate pollution load
3	>100	High pollution load

**Table c)** Based on channel width:

S.no	Width( in m)	Category
1.	<3m	Narrow drain
2	3-15m	Wide drain
3	>15m	Broad drain

Based on the drainage pattern, all drains traverse towards recipient water body located downstream of drains. Drains which directly discharge into recipient water bodies such as rivers, rivulets, ponds, lakes etc. are called as first order drain. Drains which join into first order drain are called as second order drains. Similarly, third and fourth order drains could be defined. The first and second order drains which confluence directly with river system are relatively larger with continuous flow. Generally, drain emerging from urban centers/ rural habitats are third or fourth order drains which confluence into larger second or first order drains finally meeting into river/ pond/lakes.

Third and fourth order drains are rather narrow, very shallow, located at higher gradient, usually shorter in length and often covered / or passed beneath roads. Similarly, due to unplanned growth, untreated sewage/ industrial discharge into such drains, which ultimately meets first and second order drain.

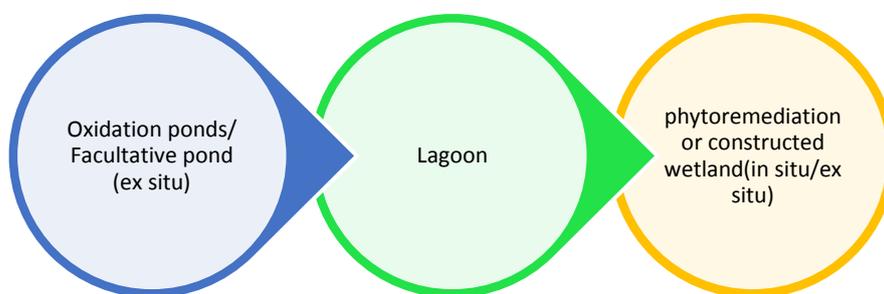
*This sort of order of drain is defined as classic stream order, also called Hack's stream order. Drains in East Delhi are usually third and fourth order.*

## 5 SCHEMES/MODELS FOR DIFFERENT SIZE OF DRAINS:

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5.1) **CATEGORY A i.e Drain width: 0-1m, Flow<5MLD and BOD<50 mg/l, Model 3 viz Minor sewage drain with moderate pollution load & narrow channel (as per CPCB report) is applicable.**

### 5.1.a) Treatment scheme:



**5.1.b) Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with channel width of less than 3m. This model is suitable for 3rd or higher order drains

**5.1.c) Design aspect:** Due to less flow width, In- situ treatment is generally not feasible in these categories of drains. Ex situ model may be best suitable for providing sufficient hydraulic retention time in oxidation pond + wetland system or Waste Stabilization Pond as per the space available. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 1)

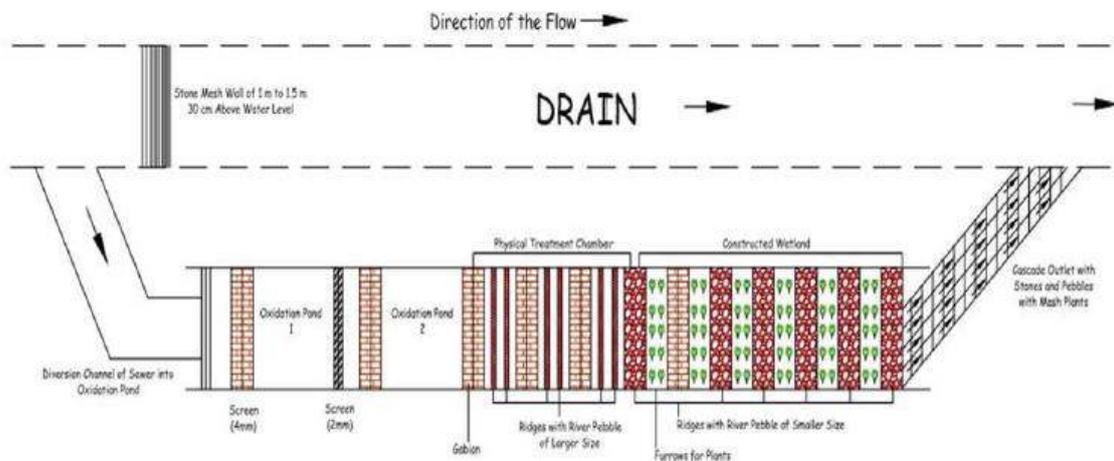
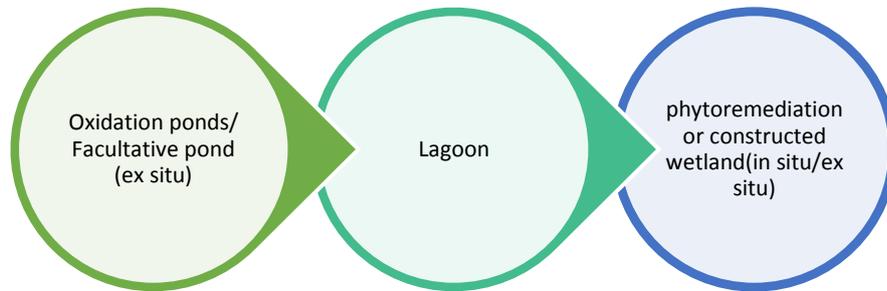


FIG 1: Schematic layout of ex-situ Biological Remediation

**5.2) CATEGORY B i.e Drain width: 1-2m, Flow=5-10MLD And BOD=50-100 mg/l, Model 3 viz Minor sewage drain with moderate pollution load & narrow channel(as per CPCB report) is applicable.**

**5.2.a) Treatment scheme:**



**5.2.b) Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with channel width of less than 3m. This type of model is suitable for 3rd or higher order drains

**5.2.c) Design aspect:** Due to less flow width, In- situ treatment is generally not feasible in these categories of drains. Ex situ model may be best suitable for providing sufficient hydraulic retention time in oxidation pond + wetland system or Waste Stabilization Pond as per the space available. Area and depth requirement for such system shall be worked out as per design criteria (Figure – 2)

FIG 2: Schematic layout of In situ Biological Remediation

**5.3) CATEGORY C i.e Drain width: 2-3m, Flow=10-15MLD And BOD=50-100 mg/l, Model 2 viz Minor sewage drain with moderate pollution load & wide channel (as per CPCB report) is applicable.**

**5.3. a) Treatment scheme:** Oxidation ponds/ Facultative pond (1-2 no.) + lagoon + wetland/phytoremediation or constructed wetland  
Treatment unit may be insitu/ ex situ as per available space.

**5.3. b) Applicability:** This type of treatment scheme is suitable for drains carrying moderate pollution load sewage with wide channel suitable for in-situ/ex situ construction. This type of model is suitable for 2nd and 3rd order drains.

**5.3. c) Design aspect:** Depending on the space availability and the flow rates of the 2nd and 3rd order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised In-situ/ Ex-situ based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure –3 ).

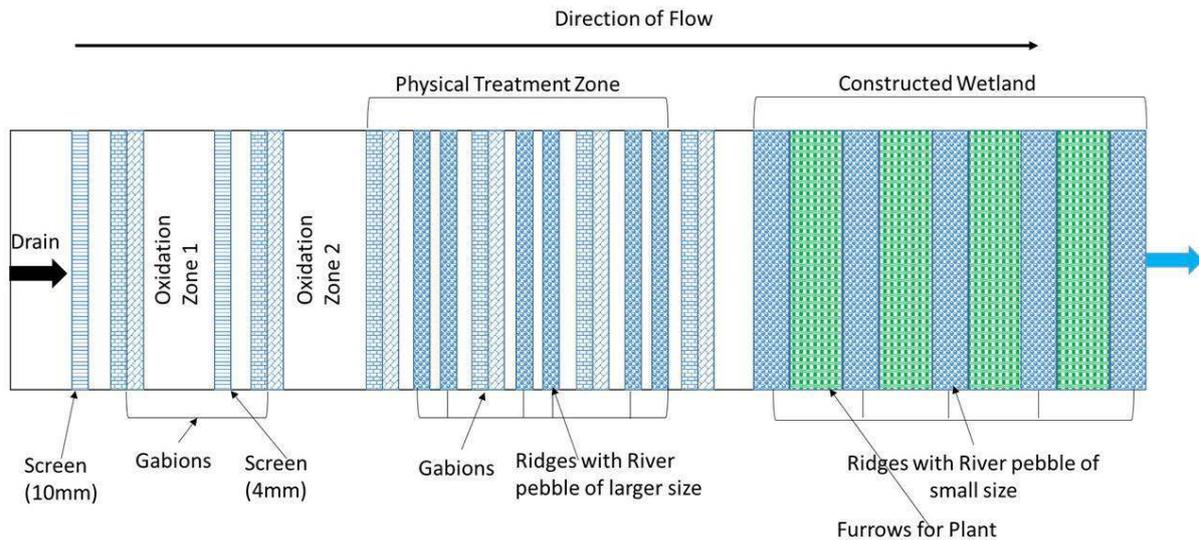
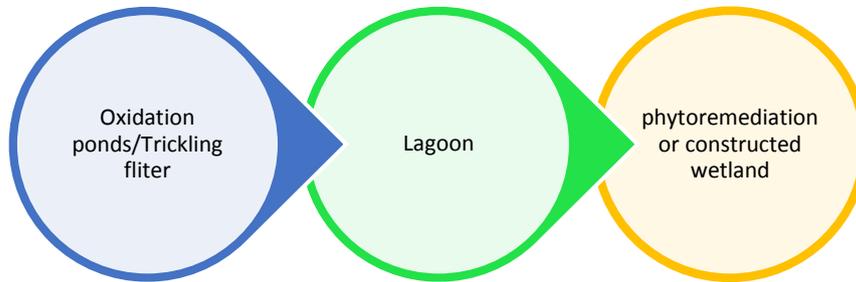


FIG 3: Schematic layout of *in-situ* Biological Remediation

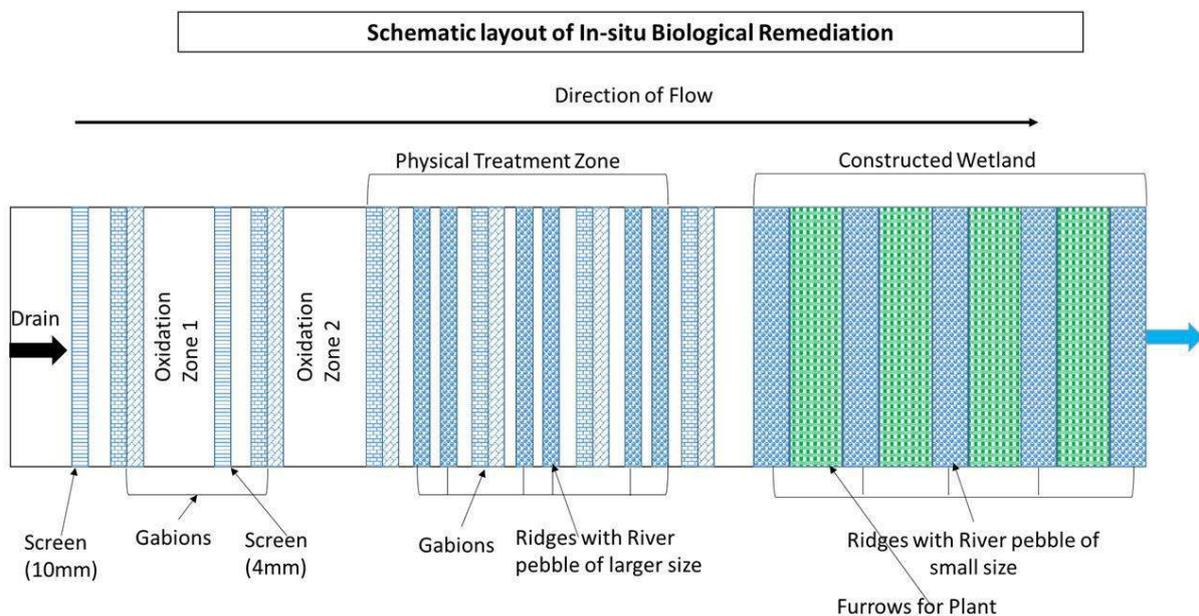
**5.4) CATEGORY D i.e Drain width: greater than 3m, Flow=15-20MLD And BOD greater than 100 mg/l, Model 5 viz Minor sewage drain with high pollution load & wide channel (as per CPCB report) is applicable**

**5.4. a) Treatment scheme:**



**5.4. b) Applicability:** This type of treatment scheme is suitable for drains carrying high pollution load (untreated sewage + industrial effluent) with channel width 3-15 m. This type of model is suitable for 1st and 2nd order drains.

**5.4. c) Design aspect:** Depending on the space availability and the flow rates of the 2nd and 3rd order drain, dimensions of oxidation pond and a wetland need to be customised based on the available flow width to provide the required hydraulic time of at least 20 hr in oxidation pond and wetland system. Treatment scheme configuration may be customised In-situ/ Ex-situ based on the flow width. Area and depth requirement for such system shall be worked out as per design criteria (Figure 4)



**FIG 4: Schematic layout of *in-situ* Biological Remediation**

## 6 Description of Treatment Technology

### 6.1 Facultative pond-

A facultative pond is a treatment unit with anaerobic and aerobic conditions. A typical pond is divided into an aerobic surface region consisting of bacteria and algae, an anaerobic bottom region, consisting of anaerobic bacteria, and a region in between anaerobic and aerobic conditions where bacteria can thrive in both conditions also called facultative zone. If used in series, effluent from a previously treated source enters the pond. Facultative ponds treat BOD, typically within a range of **100–400 kg BOD/ha/day**, by removing BOD by 95 %. Because facultative ponds employ algae as decomposers, the treatment time can range between 2 and 3 weeks, which is attributed to the photosynthetic processes that occur within the unit. A facultative pond on average has a depth of 1–2m.

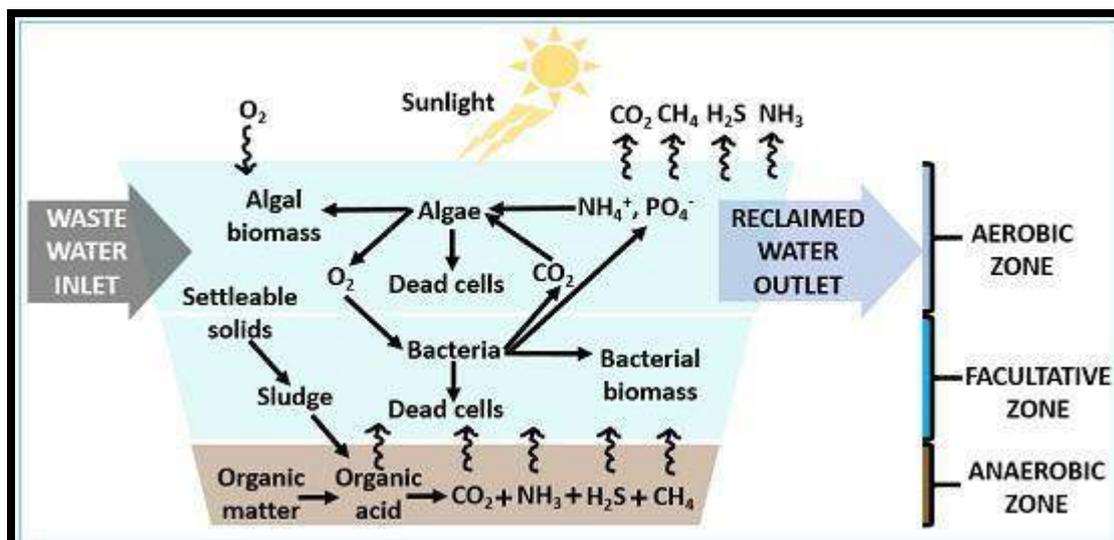


Fig5: Solid removal mechanism in a facultative stabilization pond

### 6.2 Oxidation pond

Oxidation pond can be defined as the **stabilization pond** that stabilizes the domestic, trade, industrial wastes etc. by the **microbial interaction**, primarily bacteria and algae. It is the large, shallow ponds having 2-6 feet height of water body. Oxidation pond requires the presence of sunlight and oxygen for the **secondary treatment** of domestic and trade wastes. The secondary treatment of the organic and inorganic waste coming from raw sewage and industrial effluents is necessary. The direct disposal of the wastewater to the aquatic system can affect the life of water-bodies and the quality of water as well.

Oxidation pond is a biological system which takes about 10-40days of **detention time**. This method can load organic matter up to **300-150Kg/hectare/day** and having a length of 50-

100m, a width of 30-50m and a depth of 0.9-1.5m. An oxidation pond can hold water up to 0.3m and settled sludge up to 0.02m. The decomposition of bio-organics produces a foul smell, that's why the stabilization pond is kept away from the residential areas.

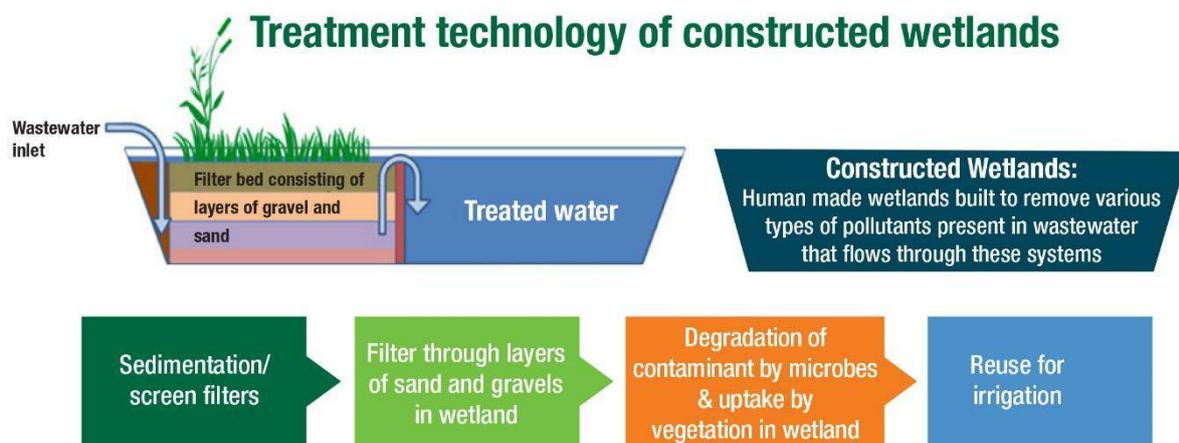
### 6.3 Phytoremediation

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. Phytoremediation involves the removal of organic compounds and nutrients from wastewater through bio-sorption/uptake by pollution-tolerant aquatic plants (such as algae, water hyacinth, duckweeds, etc.) growing in the wastewater. Quite often such plants grow along the littoral zones on either side of the drain.

### 6.4 Constructed Wetland

Constructed wetlands are treatment systems that use natural processes involving (macrophytes) vegetation, soils, and their associated microbial assemblages to improve water quality (USEPA). As the name suggests a constructed wetland is an artificial wetland developed to treat wastewaters from domestic and industrial discharges. The biological diversity and ecological productivity of these natural wetlands is remarkable.

Compared to conventional wastewater treatment systems, the constructed wetlands are low cost, relatively easy to operate and can be constructed with locally available materials. The technology of constructed wetlands is cost-effective in terms of generation of biofuel from the regular harvesting of plants of the wetlands and also because of the least consumption of energy in its operation. Constructed wetlands used for the removal of BOD, nitrogen, phosphorus and pathogens from primary treated wastewater. Efficiency of removing BOD and nitrogen are 67–90% and 58–63% respectively.



## 6.5 Trickling filter

Trickling filters (TFs) are used to remove organic matter from wastewater. The TF is an aerobic treatment system that utilizes microorganisms attached to a medium to remove organic matter from wastewater. This type of system is common to a number of technologies such as rotating biological contactors and packed bed reactors (biotowers). These systems are known as attached-growth processes.

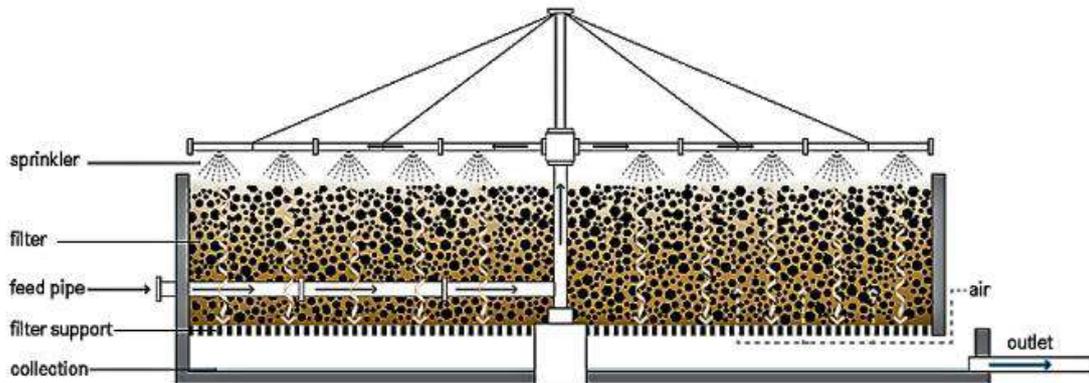


FIG 6: TRICKLING FILTER

Types of filter:

Trickling filters are classified as high rate or low rate, based on the organic and hydraulic loading applied to the unit.

S.No.	Design Feature	Low Rate Filter	High Rate Filter
1.	Hydraulic loading, $m^3/m^2.d$	1 - 4	10 - 40
2.	Organic loading, kg BOD / $m^3.d$	0.08 - 0.32	0.32 - 1.0
3.	Depth, m.	1.8 - 3.0	0.9 - 2.5
4.	Recirculation ratio	0	0.5 - 3.0 (domestic wastewater) upto 8 for strong industrial wastewater.

- Recirculation is generally not adopted in low rate filters.
- A well operated low rate trickling filter in combination with secondary settling tank may remove 75 to 90% BOD and produce highly nitrified effluent. It is suitable for treatment of low to medium strength domestic wastewaters.
- The high rate trickling filter, single stage or two stage are recommended for medium to relatively high strength domestic and industrial wastewater. The BOD removal efficiency is around 75 to 90% but the effluent is only partially nitrified.
- Single stage unit consists of a primary settling tank, filter, secondary settling tank and facilities for recirculation of the effluent. Two stage filters consist of two filters in series with a primary settling tank, an intermediate settling tank which may be omitted in certain cases and a final settling tank.

## 7 Costing of Treatment Technology:

In reference to CPCB report of “Alternative treatment technologies for wastewater treatment in drains”, the cost calculated for all 4 categories of EDMC drains viz category A,B,C and D is tabulated below which is only approximate. Actual cost will reflect after a techno economic feasibility study.

<b>CATEGORY A</b>		
<b>Design characteristics: Flow &lt; 5 MLD, BOD &lt; 50mg/l and width upto 1m</b>		
<b>Model 3: Minor sewage drain with moderate pollution load &amp; narrow channel</b>		
<b>Treatment Technology: Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)</b>		
<b>Description</b>	<b>Tentative cost in Lakh (INR)</b>	<b>Reference or other details</b>
<b>Cost of Gabions</b>	2.4	lumpsum cost will be around
<b>Cost of Ridges</b>	2.4	lumpsum cost will be around
<b>Oxidation Pond including Lagoon (5 MLD)</b>	145(capital cost) 10/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES; Exhibit A-3: Facultative Aerated Lagoon(FAT)
<b>Wet Land (5 MLD)</b>	225(capital cost) 5/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES Exhibit A-1: Waste Stabilisation Pond Systems(WSPS)
		This model also include lumpsum cost of screens which should be used
<b>Total cost of the Treatment Technology(In Lacs) for first year</b>	389.8	
<b>Per MLD cost (In Lacs) for first year</b>	77.96	
<b>Total cost of the Treatment Technologyfor 15 yrs design period(In Lacs)</b>	600	
<b>Per MLD cost for 15 yrs design period(In Lacs)</b>	120	

**CATEGORY B****Design characteristics: Flow 5-10 MLD, BOD =50-100mg/l and width 1-2m****Model 3: Minor sewage drain with moderate pollution load & narrow channel****Treatment Technology: Oxidation pond/ Facultative pond + Lagoon  
Wetland/phytoremediation or Constructed Wet Land (CWS)**

<b>Description</b>	<b>Tentative cost in Lakh (INR)</b>	<b>Reference or other details</b>
<b>Cost of Gabions</b>	2.4	lumpsum cost will be around
<b>Cost of Ridges</b>	2.4	lumpsum cost will be around
<b>Oxidation Pond including Lagoon (10 MLD)</b>	290(capital cost) 20/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES; Exhibit A-3: Facultative Aerated Lagoon(FAT)
<b>Wet Land (10 MLD)</b>	450(capital cost) 10/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES Exhibit A-1: Waste Stabilisation Pond Systems(WSPS)
		This model also include lumpsum cost of screens which should be used
<b>Total cost of the Treatment Technology(In Lacs) for first year</b>	774.8	
<b>Per MLD cost (In Lacs) for first year</b>	77.48	
<b>Total cost of the Treatment Technologyfor 15 yrs design period(In Lacs)</b>	1194.8	
<b>Per MLD cost for 15 yrs design period(In Lacs)</b>	119.48	

**CATEGORY C****Design characteristics: Flow 10-15 MLD, BOD =50-100mg/l and width 2-3m****Model 2: Minor sewage drain with moderate pollution load & wide channel****Treatment Technology: Oxidation pond/ Facultative pond + Lagoon  
Wetland/phytoremediation or Constructed Wet Land (CWS)**

Description	Tentative cost in Lakh (INR)	Reference or other details
<b>Cost of Gabions</b>	2.4	lumpsum cost will be around
<b>Cost of Ridges</b>	2.4	lumpsum cost will be around
<b>Oxidation Pond including Lagoon (15 MLD)</b>	435(capital cost) 30/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES; Exhibit A-3: Facultative Aerated Lagoon(FAT)
<b>Wet Land (15 MLD)</b>	675(capital cost) 15/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES Exhibit A-1: Waste Stabilisation Pond Systems(WSPS)
		This model also include lumpsum cost of screens which should be used
<b>Total cost of the Treatment Technology(In Lacs) for first year</b>	1159.8	
<b>Per MLD cost (In Lacs) for first year</b>	77.32	
<b>Total cost of the Treatment Technologyfor 15 yrs design period(In Lacs)</b>	1789.8	
<b>Per MLD cost for 15 yrs design period(In Lacs)</b>	119.32	

**CATEGORY D****Design characteristics: Flow 15-20 MLD, BOD >100mg/l and width >3m****Model 5: Minor sewage drain with high pollution load & wide channel****Treatment Technology: Oxidation pond/ Facultative pond + Lagoon  
Wetland/phytoremediation or Constructed Wet Land (CWS)**

Description	Tentative cost in Lakh (INR)	Reference or other details
<b>Cost of Gabions</b>	2.4	lumpsum cost will be around
<b>Cost of Ridges</b>	2.4	lumpsum cost will be around
<b>Oxidation Pond including Lagoon (20 MLD)</b>	580(capital cost) 40/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES; Exhibit A-3: Facultative Aerated Lagoon(FAT)
<b>Wet Land (20 MLD)</b>	900(capital cost) 20/year(O&M cost)	as per COMPENDIUM OF SEWAGE TREATMENT TECHNOLOGIES Exhibit A-1: Waste Stabilisation Pond Systems(WSPS)
		This model also include lumpsum cost of screens which should be used
<b>Total cost of the Treatment Technology(In Lacs) for first year</b>	1544.8	
<b>Per MLD cost (In Lacs) for first year</b>	77.24	
<b>Total cost of the Treatment Technologyfor 15 yrs design period(In Lacs)</b>	2384.8	
<b>Per MLD cost for 15 yrs design period(In Lacs)</b>	158.98	

## 8 Schedule Timeline

S.N.	Activity	M1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	M18
1	Request for proposal for consultancy																		
2	Detailed design and Engineering																		
3	Tender Preparation																		
4	Expression of Interest float and screen organization																		
5	Request for Proposal for construction from selected organization																		
6	Construction of In-Situ and Ex-Situ Treatment																		
7	Commissioning																		

## 9 CONCLUSION:

Summary of the report is tabulated below:

Width(in m)	Upto 1m	1-2m	2-3m	Greater than 3m
Category	A	B	C	D
Flow(MLD)	<5	5-10	10-15	15-20
Organic load(mg/l)	<50	50-100	50-100	>100
Number of drains	147	49	5	4
Technology model (as per CPCB matrix)	Model no.3	Model no.3	Model no.2	Model no.5
Treatment method(as per CPCB matrix)	Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	Oxidation pond/ Facultative pond + Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)	Oxidation pond/trickling filter+ Lagoon Wetland/phytoremediation or Constructed Wet Land (CWS)
Total cost of the Treatment Technology(In Lacs) for first year	389.8	774.8	1159.8	1544.8
Per MLD cost (In Lacs) for first year	77.96	77.48	77.32	77.24
Total cost of the Treatment Technology for 15 yrs design period(In Lacs)	600	1194.8	1789.8	2384.8
Per MLD cost for 15 yrs design period(In Lacs)	120	119.48	119.32	158.98
<b>Total Financial implication for alternative technology for management of waste water in drain for period of 1st year 3869.20 Lacs and for the entire duration i.e. 15 years 5969.40 Lacs</b>				

## **10 Limitations:**

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### **Site and fund limitations:**

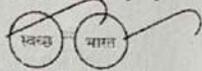
- In EDMC, maximum number of drains are narrow width and exists in densely populated area and there is scarcity of open spaces. Thus, provision of ex-situ treatment will be difficult. Such condition may affect efficient working of these technologies
- As per latest Delhi Government orders ,no government projects are allowed to commence for few months that are capital intensive and where workers are available on site and no workers are to be brought in from outside.
- EDMC is facing acute financial constraints, so funds for this project needs to be arranged either through Govt. Grants or Environmental compensation funds of Delhi.

### **Technical limitations**

- There will be considerable volumes of sludge that need to be disposed off after treatment process especially during cold climates due to reduced microbial activity. Larger sludge volumes will lead to higher associated disposal costs.
- During monsoon period ,there might be over-loading and can make ponds septic
- Mosquitoes and other insects can breed if vegetation is not controlled.
- Constructed wetlands are unable to treat highly toxic modern wastewater

**END OF REPORT**

उत्तरी दिल्ली नगर निगम



No. D/206/EE(M-I)C-SPZ/2020-21

Dated: 2/7/2020

The Director,  
Indian Institute of Technology,  
Hauz Khas, New Delhi,



Office of C.E. (Dr.) Proj-III  
Diary No. 902  
Dated 6.7.20

Kind attention: Sh. Vivek Kumar, Professor CRDT, IIT Delhi (Mob. 9412619735)  
(Through mail [vivek.kumar@rdat.iitd.ac.in](mailto:vivek.kumar@rdat.iitd.ac.in), [vivekk@iitd.ac.in](mailto:vivekk@iitd.ac.in))

Subject: Preparation of Action Plan on "Alternate Technology for Management of Wastewater Drains" for major drains under the jurisdiction of NDMC.

Sir,

In reference to this office letter No.EE(M)-I/CSPZ/2020-21/D-02 dated 02-06-2020 followed by letter No.EE(M)-I/CSPZ/2020-21/D-162 dated 25-6-2020 and your mail dated 30-6-2020 agreeing to take up the consultancy assignment for above mentioned work for a cost of Rs.15,00,000/- plus taxes (if applicable), this is to convey that the same has been approved by the Competent Authority, North DMC.

You are requested to attend this office to complete the formal agreement and forward the details of the Delhi Bank Account, so that consultancy amount (as asked by you and approved by competent authority) can be paid by North DMC.

As you are aware, the subject assignment has been taken up as per the directions of the Hon'ble NGT. the same is time bound in nature. In view of the same, it is hereby requested to take up the subject consultancy assignment immediately and complete the same at the earliest not later than 30 days as agreed by you in the project proposal.

Executive Engineer (M)-I/City-SPZ

Copy to:

- 1) P.S to Commissioner, North DMC : For kind information of Commissioner, North DMC.
- 2) P.S to CEO, Delhi Jal Board, Varunalaya Phase-II, Jhandewalan, New Delhi : For kind information of CEO
- 3) P.S to Addl. Commissioner (Engg.) : For kind information of Addl. Cm. (Engg.)
- 4) E-in-C, North DMC : For kind information
- 5) D-in-C, North DMC / CE-I : -----do-----
- 6) C.E-II, North DMC : -----do-----
- 7) All CE's North DivC : With request to direct the concerned EE maintenance to provide the desired information about the drains under their jurisdiction as & when required by the agency in the said matter.

8) S.E-CSPZ, North DMC

Executive Engineer (M)-I/City-SPZ

C.E. (Dr.) Proj-III  
Delhi Jal Board  
Diary No. 805  
Date 08/7/20

DELHI STATE INDUSTRIAL & INFRASTRUCTURE DEV. CORN. LTD  
Plot No. 74A, 3<sup>rd</sup> Floor, Ring Road, Lajpat Nagar-III, New Delhi-110024

Office of the Chief Engineer-II

No. DSIIDC/CE-II/2020-21/120

Date: 30.06.2020

The CEO, Delhi Jal Board,  
Member Secretary, Integrated Drain Management Cell (IDMC)  
Varunalaya, Jhandewalan,  
New Delhi

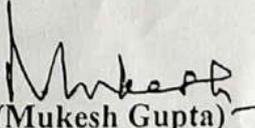
**Sub: Revised Action Plan along with timelines for remediation and management of all drains under jurisdiction of DSIIDC.**

Ref:

1. Hon'ble NGT orders dated 05.03.2020 in the matter of "Manoj Mishra Vs Uol" (Original Application No. 06/2012)
2. Minutes of IDMC meeting held on 17.06.2020

Sir,

This is in Continuation to this office letter No. DSIIDC/CE-II/2020-21/113 dated 28.05.2020. Please find enclosed herewith the Revised Action Plan along with the timelines for remediation and management of all drains under jurisdiction of DSIIDC, in compliance of Hon'ble NGT orders dated 05.03.2020 and directions of IDMC issued during the 4<sup>th</sup> meeting held on 17.06.2020, for kind information & necessary action please.

  
(Mukesh Gupta)  
CHIEF ENGINEER-II

Copy to:

1. Pr. Secy. UD, GNCTD; for kind information please.
2. MD, DSIIDC; for kind information please.
3. ED, DSIIDC; for kind information please.
4. Office Copy

CHIEF ENGINEER-II

**ACTION PLAN ON THE ALTERNATE TECHNOLOGIES FOR MANAGEMENT OF WASTE WATER IN DRAINS**

**1.BACKGROUND**

Hon'ble NGT on dated 05.03.2020 in the matter of "Manoj Mishra vs UOI and ORS.(OA No 06/20212)" had issued following direction:

*"The IDMC may prepare and execute an action plan on the subject of 'Alternate Technologies for Management of Waste Water Drains' after appropriate techno-economic evaluation in the light of the reports of CPCB."*

**2.MAINTENANCE OF STORM WATER DRAINS IN INDUSTRIAL AREAS**

Management of Storm water drainage system within NCT of DELHI is being looked after by a number of Civic Bodies and Departments. DSIIDC is not maintaining any natural drain. However, DSIIDC is looking after maintenance of storm water drains in 24 industrial areas. Storm water drains in other industrial areas are being maintained by respective DMCs and other agencies.

After the enactment of DIDOM Act, 2010 the responsibility of maintenance of storm water drains of following 24 industrial areas has been assigned to DSIIDC:

- I. DSIIDC Sheds Nangloi
- II. FFC at Jhilmil Industrial Area
- III. Flatted Factories for Leather Goods, Wazirpur industrial area
- IV. FFC at Rani Jhansi Road
- V. FFC, Okhla Industrial Area
- VI. Functional Industrial Estate for Electronics, A-Block, Okhla Industrial Area
- VII. Functional Industrial Estate for Electronics, S-Block, Okhla Industrial Area
- VIII. Patparganj Industrial Area
- IX. Badli Industrial Area
- X. Okhla Industrial Estate PH-III
- XI. Bawana Industrial Area
- XII. Narela Industrial Area
- XIII. Rajasthan Udyog Nagar Industrial Area
- XIV. GT Karnal Road Industrial Area

- XV. Lawrence Road Industrial Area
- XVI. Wazirpur Industrial Area
- XVII. Udyog Nagar Industrial Area Ph-I
- XVIII. Naraina Industrial Area(Ph-I & Ph-II)
- XIX. DLF Industrial Area, Moti Nagar
- XX. Najafgarh Road Industrial Area
- XXI. Jhilmil Industrial Area
- XXII. Kirti Nagar Industrial Area
- XXIII. Mangolpuri Industrial Area(Phase-I & Phase-II )
- XXIV. Mayapuri Industrial Area(Phase-I & Phase -II)

The sewerage system/conveyance system in all the industrial areas are being maintained by DJB except the industrial areas namely Patparganj ,Bawana and Narela.

### 3.TREATMENT OF WASTE WATER/EFFLUENT GENERATED BY INDUSTRIES IN INDUSTRIAL AREAS

DSIIDC has constructed 13 CETP namely Wazirpur, GTK Rd, Lawrence Rd, SMA, Badli, Mangolpori, Nangloi, Mayapuri, Naraina, Okhla Industrial Area, Jhilmil, Narela and Bawana which cater to 17 industrial areas.

13 CETPs receives the waste water/effluent through this Sewerage system/conveyance system. About 50-60 mld of effluent is being received by these CETPs against the installed capacity of 212.3 mld which indicates the fact that they have extra capacity to treat the waste water flowing into drains. However, these CETPs to be upgraded depending upon the quality and quantity of waste water.

### 4. SOURCES OF WASTE WATER IN STORM WATER DRAINS IN INDUSTRIAL AREAS

Though industries and other establishments in the industrial area should discharge waste water/effluent in sewerage system/conveyance system, some industries and establishments are discharging it in the storm water drains which ultimately reaches Yamuna river without any treatment.

In the Industrial areas, waste water in storm water drains is discharged mainly from following sources;

- a) Industries
- b) JJ Clusters
- c) Food outlets operating on the streets/roads and open land

## 5. EFFORTS OF DSIIDC FOR PREVENTION OF DISCHARGE OF WASTE WATER INTO STORM WATER DRAINS

DSIIDC and DPCC have surveyed jointly the industries of the various industrial areas in order to verify the connectivity of individual industries to the conveyance system of CETPs and also to identify industries discharging waste water in storm water drains. Notices were issued to all defaulting industries besides levy of Environmental Compensation.

Further, Executive Engineers/Estate Managers are constantly monitoring and conducting field visits on regular basis so as to prevent the discharge of waste water into storm water drains by industries and the notices are being served to all defaulting industries and Environmental compensation is also being levied.

Due to efforts made by DSIIDC, almost all the industries have been connected to the sewerage system/conveyance system barring few industries. Action on such industries is taken as and when Estate managers/Executive Engineers identifies them.

## 6. ALTERNATIVE TREATMENT TECHNOLOGIES FOR WASTEWATER TREATMENT IN DRAINS SUGGESTED BY CPCB

CPCB suggested the following treatment methods for treatment of waste water in drains:

- a) In-Situ treatment methods such as constructed wetland system, phytoremediation, Eco Bio Block system, microbial bio remediation are most favorable methods for alternative biological treatment technology of drains.
- b) Ex-Situ treatment methods includes constructed wetland, waste stabilization pond, aerated lagoon and oxidation pond.

The drains having less width, In-Situ treatment methods are generally not feasible. Ex-Situ model may be best suitable for providing sufficient hydraulic retention time for such cases where width of the drain is less.

## 7. TREATMENT OF WASTE WATER IN DRAINS IN INDUSTRIAL AREAS

None of the industrial area under the jurisdiction of DSIIDC has the width of drains more than 3 meters. Hence, possibility of implementation of in-situ treatment suggested by CPCB is very remote. Only Ex -Situ treatment of waste water of storm water drains is possible.

Further, DSIIDC has signed an MoU with National Environmental Engineering Research Institute (NEERI), Nagpur in July, 2019 for dealing with Environmental related matters including waste water treatment of industrial areas and under this MoU, DSIIDC has assigned them the work of up gradation of 13 CETPs in Nov, 2019 and to formulate an action plan for the treatment of waste water generated in 17 industrial areas being served by these CETPs.

Besides other options for treatment of waste water of industrial areas, NEERI has also been requested to look into the feasibility of diversion of waste water of storm water drains of industrial areas to existing underutilized CETPs for treatment and accordingly, CETPs may have to be upgraded for all the waste water generated by Industrial area thus leaving no scope for discharge of untreated waste water from industrial areas. NEERI has been requested to consider and see the feasibility of incorporation of Ex-Situ Treatment methods while going for up-gradation of CETPs.

Besides this, NEERI is devising an action plan for treatment of waste water generated in 11 industrial areas where CETP is not available.

As per the timelines mentioned in the work order given to NEERI, time of completion is 27 months but NEERI is requested to complete the work at the earliest. However, due to Covid19, work was held up since mid of March, 2020 and now it has been started again.

## **8. ACTION PLAN AND TIMELINES FOR TRAPPING THE DRAINS AND UPGRADATION OF CETPs**

For Upgradation of CETPs and trapping up drains discharge and for their treatment in CETPs, NEERI is conducting the whole study in following 4 parts.

- i. Module 1: Status of 17 Industrial Areas connected to CETPs
  - Type of Industries
  - Wastewater connectivity status
  - Other Drains
  - Flow Volume
  - Waste Water characteristics (Diurnal/Daily Variation)
  
- ii. Module 2: Existing CETPs
  - Overall Performance Evaluation
  - Unit – Wise Treatment Adequacy
  - Upgradation requirement after treatability studies
    - a) CETP-wise Detailed Evaluation, Treatability Study, Upgradation assessment, Basic Process Design.
    - b) Detailed Engineering Design/Drawing, Estimates for agreed upgradation.
  
- iii. Module 3: Integrated Planning for treated Water Utilization ( based on Secondary Data + Limited Primary study)
  - Horticulture in different regions
  - Reservoir/Water body Creation
  - Discharge to River Yamuna

iv. Module 4: Integrated Planning for sludge utilization (based on Secondary Data + Limited Primary study)

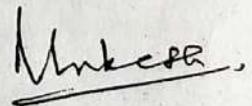
- Characterization (Fresh & Stored)
- Leaching Potential/ Toxicity
- Utilization- Brick/ Tile/Block Manufacturing Unit in Delhi
- Disposal at SLF (TSDf) in Delhi

Action plan and timelines for 17 industrial areas are as under:

- a) NEERI will submit an interim report on the status of 17 Industrial areas connecting to CETPs along with overall performance evaluation of existing CETPs which will also contain the details of waste water flowing into Storm Water drain by 30<sup>th</sup> September, 2020.
- b) After the receipt of interim report by NEERI, discussions will be made with different stake holders i.e MCD, DJB, DPCC, PWD, DDA etc for trapping the waste water of drains falling under their jurisdiction and will be requested to connect the storm water drain to CETP within 4 to 6 months. Simultaneously, DSIIDC shall connect the storm water drain of the industrial areas which comes under its purview within 4 to 6 months to the CETPs.
- c) Subsequently, NEERI shall submit the report for upgradation of CETPs within 8 to 10 months after ensuring total flow connectivity of respective industrial areas. Simultaneously, detailed engineering designs/drawings as per agreed upgradation requirement shall also be submitted by NEERI.
- d) After getting the detailed engineering design/drawings, necessary action shall be taken for upgradation of CETPs for the treatment of waste water.

Further, the report on 11 industrial areas shall be submitted by NEERI by December 2020 for the management of waste water in the industrial area. Accordingly, necessary action shall be taken as per the recommendation of NEERI.

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MUKESH GUPTA  
Chief Engineer-II  
DSIIDC



दिल्लीछावनीपरिषद  
Delhi Cantonment Board  
सदरबाजार, दिल्लीछावनी 10 -  
Sadar Bazar, Delhi Cantt - 10.  
Tel. No. : 25693837, 25695450  
Email : [ceodelhicantt@gmail.com](mailto:ceodelhicantt@gmail.com)  
Website : [www.cbdelhi.in](http://www.cbdelhi.in)



No.DCB/8/Engg/Drainage/2020-21

Dated 23 May, 2020

To

CEO, DJB  
Member Secretary,  
Integrated Drainage Management Cell (IDMC)  
Varunalaya, Jandewalan  
New Delhi

**SUB: ACTION PLAN ON ALTERNATE TECHNOLOGIES FOR  
MANAGEMENT OF WASTE WATER IN DRAINS IN DELHI  
CANTT**

Please find enclosed herewith Action plan for remediation and management of the drains using Alternate Technology i.e. Bio remediation in Delhi Cantt in terms of the discussion held in the IDMC meeting held on 15.05.2020.

**Encl: As above.**

**(Rakesh Rana)**  
Assistant Engineer  
For Chief Executive Officer  
Delhi Cantonment Board

## ACTION PLAN ON EFFECTIVE BIO- REMEDIATION TECHNOLOGY AND SUSTAINABLE MAINTENANCE OF DRAINS IN DELHI CANTONMENT

### I. Drain Network:

Delhi Cantonment Board is maintaining 4 main drains and 19 link drains, combined length 39.28 running Km. All link drains are connected with the said main drains which in turn get connected to MCD drains at 4 different locations viz Braham Puri, Indira Park, Palam Colony and khajan Basti after crossing Delhi - Rewari Railway track. All these four drains fall in the category of Minor drains based on the flow as flow in these drains is less than 1 MLD.

Sl. No.	Name of Drain	Location	Total Length in (mtr.)	Avg. Width (mtr.)	Category of Drain based on Flow	Category of Drain based on Width
1	Sadar Bazar main drain	From Subzi Mandi to Railway line CVD area	1550	4.79	Minor	Wide
2	Sadar Bazar link drain No.II	Tigris Road to 629 TPT Company	1440	3.67		Wide
2(a)	Link drain to Sadar Bazar	Along Gen. Desouza Marg	745	0.45		Narrow
2(b)	Link drain to Sadar Bazar	Along Cavallery Road	745	0.45		Narrow
3	Maude line link drain	Signal Canteen unit of Maude line to Sadar Bazar	1600	1.45		Narrow
4	Base Hospital Link drain	PN Mess to Chanan Singh Park	922	3.64		Wide
5	New Partap Chowk link drain	Partap Chowk to Station Road along Arjun Vihar	444	2.88		Narrow
6	Base Hospital Link drain II	Sadar Bazaar road drain from 629 TPT Company to Subzi Mandi Sadar Bazar	1350	1.03		Narrow
7	Sadar Bazar Link drain	From Maude Road upto Sadar Bazar junction along Tigris Road	850	3.03		Wide
8	Mehram Nagar drain	From East Mehram Nagar Village to Railway line along Dwarka Road	4710	2.93	Narrow	

9.	Loreto School link drain	Signal Enclave along Rao Tula Marg to Loreto School	3160	1.57	Minor	Narrow
✓ 10.	Mehram Nagar Link drain	Along Parade ground boundary wall to Maude Road	425	2.40		Narrow
11.	Loreto School link drain No.2	Infront MSM and Loreto School upto Parade road Jharera drain junction	556	0.92		Narrow
12.	Subroto Park Link drain	From Partap Chowk triangle to Jharera drain near Mall road	867	3.85		Wide
13.	Khyber line link drain	Khyber line to Jharera drain	380	4.54		Wide
14.	Subroto Park Command link drain	Manekshaw Centre to Jharera drain	1400	2.38		Narrow
✓ 15.	Palam drain	Fom Golf Course to Pankha road, Railway line along Station and Chanan Singh Park	5625	7.58		Wide
16.	Railway Station link drain	FOL Depot to Pankha road along Railway line	1461	3.33		Wide
✓ 17.	COD drain	From Ring road to Railway line Naraina, Village	1204	1.19		Narrow
18.	Gopi Nath Bazar link drain	From Sadar Bazar Police Station to Kirby Place, Palam Drain	915	0.88		Narrow
19.	Kirby Place link drain	Chanan Singh Park, Kirby Place	835	3.36		Wide
20.	Brar Square link drain	Uri Enclave to Palam drain	2115	4.15		Wide
21.	Kandhar link drain	Kandhar line to Palam drain	338	1.68		Narrow
✓ 22.	Jharera drain	Parade road to Maude road Palam drain	2870	3.57	Wide	
23.	Mall road link drain	From Church Road servant Qtr to Recruitment office, GopiNath Bazar	765	1.92	Narrow	

## II. Management of Waste in Drain:

- (i)
- a) The Sewerage system of DCB are either connected with the STPs maintained by MES or in the trunk Sewer lines of MES which are eventually connected with the DJB trunk sewer lines.
  - b) Army and Airforce are having their own sewerage system including STPs under their control and command.
  - c) The storm water drains in Delhi Cantonment have not been connected with the sewerage system.
  - d) The surface rainwater from the roads and Cantonment Buildings are scientifically channelized and harvested in the pits.

(ii) On the directions of IDMC the Nodal Officer along with other Engineering Staff of Delhi Cantonment Board inspected all the drains in Delhi Cantonment to locate portions of the drains which required remediation for the contamination and other issues. Accordingly the following drains were observed to be having contamination such as Black color water, Foul smell, Accumulated sludge, Floating materials and at few places discharge of Sewage water etc

- a) **Drain near Naraina Sump**
- b) **Mehram Nagar drain**
- c) **Palam drain**
- d) **Sadar Bazar main drain**
- e) **Jharera Drain**
- f) **COD drain**

(iii) After evaluating the site conditions, alternate technology available and the time line available the Engineering Department of Delhi Cantonment Board has proposed to take up Bioremediation at above mentioned six locations/ drains at para II (ii) till permanent resolution of contamination of these drains is made. The tentative time line for start of Bioremediation in these drains shall be about 20 days and will be a regular feature thereafter.

(iv) **Status of 6 drains mentioned at para II (ii) above.**

**a) Drain near Naraina Sump**

The Delhi Cantonment Board sewerage line from Vill CB Naraina was earlier connected with DJB. It got non functional due to damage caused during metro line

work in its close vicinity. Delhi Cantonment Board had approached DJB for restoration of damaged sewer lines and for ensuring proper disposal of sewerage generated from CB area of Vill Naraina under the management of Delhi Cantonment Board. This issue of restoration of Naraina sewerage system have been taken up on regular basis in the past but was not resolved. The CEO, Delhi Cantonment Board again discussed this issue of restoration of sewer connection with the CEO, DJB in the IDMC meeting held on 15-05-2020 and the CEO, DJB had assured that the issue would be resolved for best possible solution on priority. After the meeting, this office received DJB letter number DJB/CE(WEST)/AC-39/2020/127 dt 21-5-2020 wherein it has been informed that DJB has agreed to execute the restoration work as deposit work and that the estimates for the same are being prepared and the amount shall be intimated by 10-06-2020. As soon as the estimates for the deposit work are received from DJB the payment shall be released to the DJB as per procedure and issue of this drain shall be resolved permanently. During the intervening period Bioremediation in this drain shall be done using scientific method.

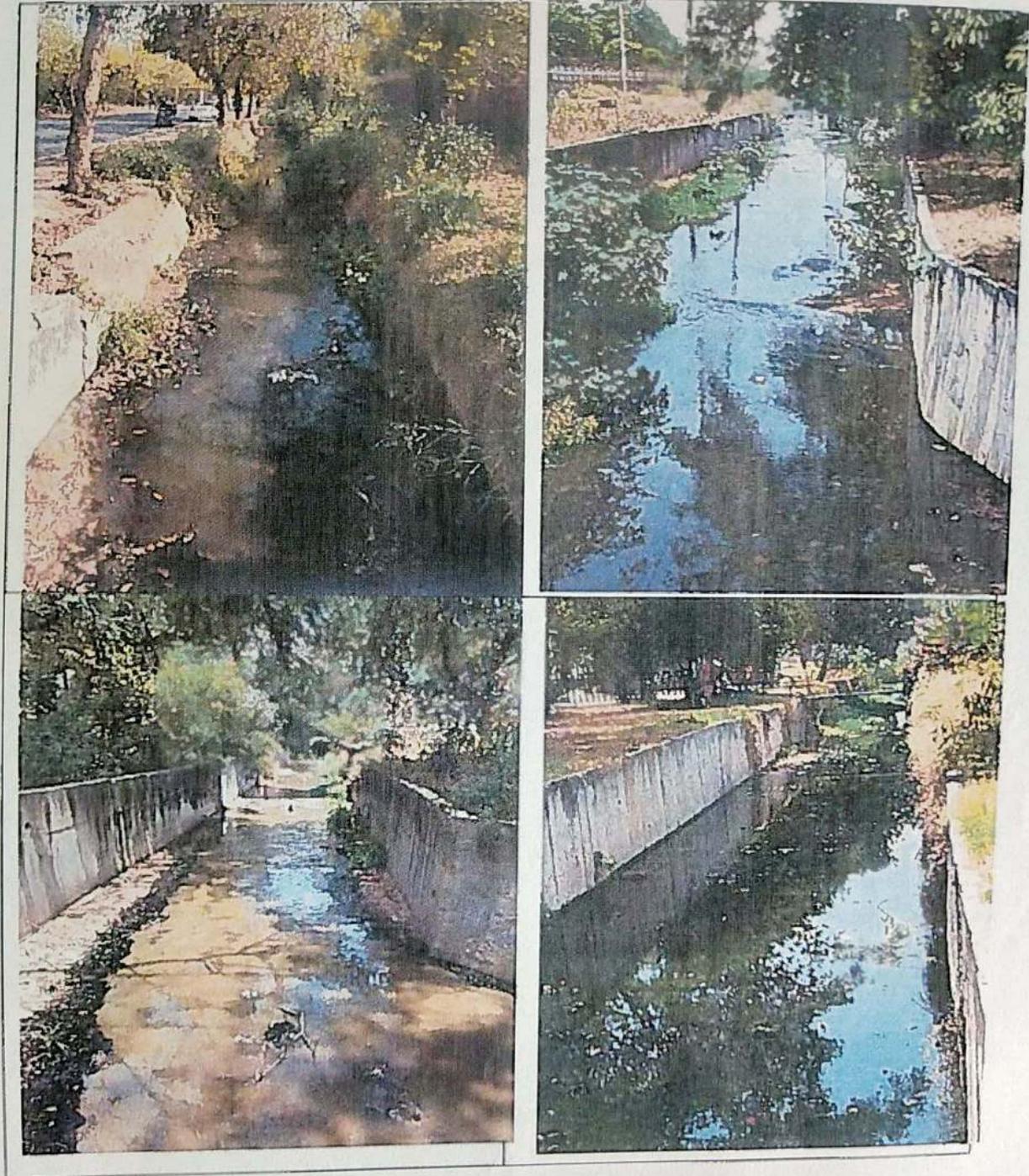
**b) Mehram Nagar drain :**

Delhi Cantonment Board has laid sewerage system in Vill East and West Mehram Nagar but the system is non functional due to its non connection with the existing Central Sewerage System available at Thammiya Marg. This connection is being delayed as the connection line requires crossing of Dwarka road junction near Rock View, Delhi Cantt and that the road in question is under the management of PWD Authorities and the case was being pursued by Delhi Cantonment Board with PWD for the NOC. After prolonged persuasion now PWD Authorities vide their demand letter dated 22-05-2020 has forwarded detail of the restoration charges which shall be deposited by this office shortly. After that the sewerage system shall be made operation in about 3 months time and the flow of sewerage of Vill East and West Mehram Nagar shall thereafter be scientifically discharged. During the intervening period Bioremediation in this drain shall be done using scientific method.

**c) Drains at Sr. number (c), (d), (e) and (f) :**

During Survey of the drains in Delhi Cantt by the Nodal Officer along with other Engineering Staff of this Office, these drains were also found to be having contamination on physically viewing like Black color water, Foul smell, Floating impurities etc. Till the time the real cause of contamination is found it is proposed to treat these drains also using Bioremediation method.

➤ Few Locations where Bioremediation will be done :

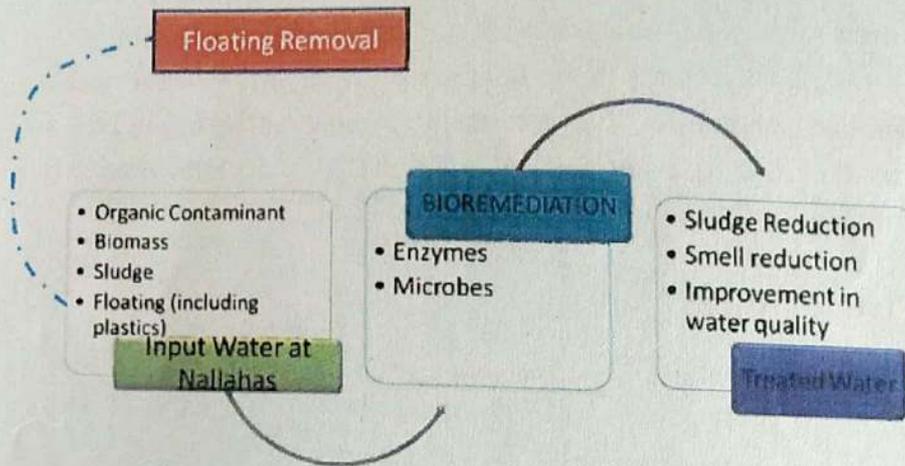


**III.** During the IDMC second meeting held on 15-05-2020 through Video Conferencing it was decided that all the drain owing agencies shall draw a plan for Bioremediation of the effluents in their drains. Accordingly Delhi Cantt Board after survey of drains and after going through the literature and consultation with the experts in the field has drawn a dosing/Treatment plan as submitted hereunder for treatment of the effluent in the aforementioned 6 drains as mentioned at para II (ii) by Bioremediation method till permanent solution for the treatment is found.

➤ **Treatment Plan (1 Month)**

S.No	Location	Dosing Material	Dosing Patern	Total Quantity
1.	Drain near Naraina Sump	1. Super 24	12 Kg/week (dosing twice a week)	Super 24: 48 Kg
2.	Mehram Nagar Drain	1. Oxyrich 2. Super24 (for sewage digestion) 3. Pond Sludge/Lake clean	4 Kg/week Oxyrich (dosing twice a week) 2 Kg/week super 24 (dosing twice a week) 4L/week Pond sludge/lake clean (dosing twice a week)	Oxyrich: 16 Kg Super 24: 8 Kg Pond Sludge/Lake clean: 16 Kg
3.	Jharera Drain	1. Oxyrich 2. Super24 (for sewage digestion) 3. Pond Sludge/Lake clean	4 Kg/week Oxyrich (dosing twice a week) 2 Kg/week super 24 (dosing twice a week) 4L/week Pond sludge/lake clean (dosing twice a week)	Oxyrich: 16 Kg Super 24: 8 Kg Pond Sludge/Lake clean: 16 Kg
4.	COD drain	1. Oxyrich 2. Super24 (for sewage digestion) 3. Pond Sludge/Lake clean	4 Kg/week Oxyrich (dosing twice a week) 2 Kg/week super 24 (dosing twice a week) 4L/week Pond sludge/lake clean (dosing twice a week)	Oxyrich: 16 Kg Super 24: 8 Kg Pond Sludge/Lake clean: 16 Kg
5.	Palam Drain	1. Oxyrich 2. Pond Sludge/Lake clean	5 Kg/week Oxyrich (dosing twice a week) 5 L/week Pond sludge/lake clean (dosing twice a week)	Oxyrich: 20 Kg Pond Sludge/Lake clean: 20 Kg
6.	Sadar Bazar main drain	--do--	8 Kg/week Oxyrich (dosing twice a week) 8 L/week Pond sludge/lake clean (dosing twice a week)	Oxyrich: 32 Kg Pond Sludge/Lake clean: 32 Kg

- > **The Bioremediation process has been designed to achieve desirables as given below:**

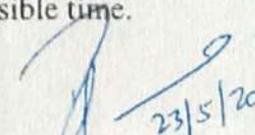


- > **The Output Parameters after Bioremediation in the Drains**

S.No	Parameters	Input Range	Output Range after Bioremediation in the drain shall be within the range prescribed by CPCB
1	BOD (mg/l)	100-350	30
2	COD (mg/l)	300-450	250
3	pH	5-10	6.5-9.0
4	TSS (mg/l)	20-400	100

- > **Benefits of Bioremediation:**

The biggest benefit from using bioremediation processes is its contribution to the environment. Bioremediation uses nature to fix nature. Properly applied by knowledgeable people using specialized equipment designed for bioremediation, this is the safest and least invasive soil and groundwater cleanup available. Bioremediation is also effective for cleaning insecticides and herbicides intrusion into aquifers in the shortest possible time.

  
 23/5/20  
 Rakesh Rana  
 Nodal Officer  
 Delhi Cantonment Board  
 Delhi Cantt

DELHI URBAN SHELTER IMPROVEMENT BOARD  
GOVT OF NCT OF DELHI  
OFFICE OF THE CHIEF ENGINEER (COORDINATION)  
PUNARWAS BHAWAN, ITO, NEW DELHI

No. F/10967/SE (COORD)/E e/NGT/2019/D-36

Dated: 09-06-2020

To,

Member Secretary (IDMC),  
Delhi Jal Board, GNCTD,  
Office of The Chief Executive Officer,  
Varunalya Phase-II, Karol Bagh,  
New Delhi-110005.



Subject :- Action Plan for the remediation and management of all the drains through alternative technologies as suggested by CPCB.

Sir,

This is in reference to the meeting through video conferencing of 'Integrated Drain Management Cell' for remediation and drain management of all drains of Delhi held under the chairmanship of Chief Secretary, Govt of NCT of Delhi on 29.05.2020.

During the detailed review and discussion, Member Secretary desired to explore the possibility of preparation of action Plan for in-situ drain treatment, if technically possible. As already reiterated that the JJ Clusters are unplanned encroachment on Govt. lands and drains are zigzag to carry out the liquid discharge through shallow drains on both sides of C.C. Pavement in narrow lanes of JJ Bastis and are finally connected to nearby regular network of PWD or MCDs drains. Therefore, it is not possible to go for alternate technology due to land constraints.

It is pertinent to mention here that till now cleaning, scavenging and de-silting of drains and solid waste manage in JJ Bastis is done by respective DMCs. Further as per DUSIB Act, 2010 DUSIB is primarily carrying out the rehabilitation of JJ Bastis and implementing the scheme regarding providing minimum basic amenities in JJ Bastis under the plan scheme of Delhi Govt. till such times these JJ Bastis are Rehabilitated/Relocated.

C.E. (Coord) DUSIB  
19/6

Office of the Member (Ex.)  
Diary No. 4206  
Date 19-06-20  
D. J. B. Varunalya Ph-II

S.K Mahajan  
Chief Engineer, DUSIB