

OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI - 110003

Date: 29-6-2020

No. YPMC/2019/451

The Ld. Registrar general
National Green Tribunal
Faridkot House, Copernicus Marg
New Delhi - 110001.

Dear Sir,

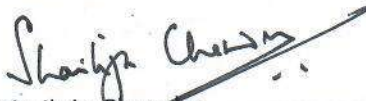
The Hon'ble National Green Tribunal vide its order dated 26th July 2018 in OA No. 6/2012 –Manoj Mishra Vs UOI & ors. had *inter alia* appointed a Monitoring Committee to monitor implementation of its Judgement dated 13-01-15 and orders thereafter. The Monitoring Committee submitted three interim reports and three supplementary report to the Hon'ble Tribunal during the last 23 months of its tenure.

In compliance of the Hon'ble Tribunal order dated 5.3.20 and 6.5.20 the Monitoring Committee has prepared its final Report, which is enclosed with a request to place the report before the Hon'ble bench of the Tribunal.

The YMC expresses its gratitude to the Hon'ble Tribunal for the opportunity given to its Members for rejuvenation of the River Yamuna

Enclosure: As above.

Yours Faithfully,


Shailaja Chandra,
Member,
Monitoring Committee for Yamuna


B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

Encl: as above

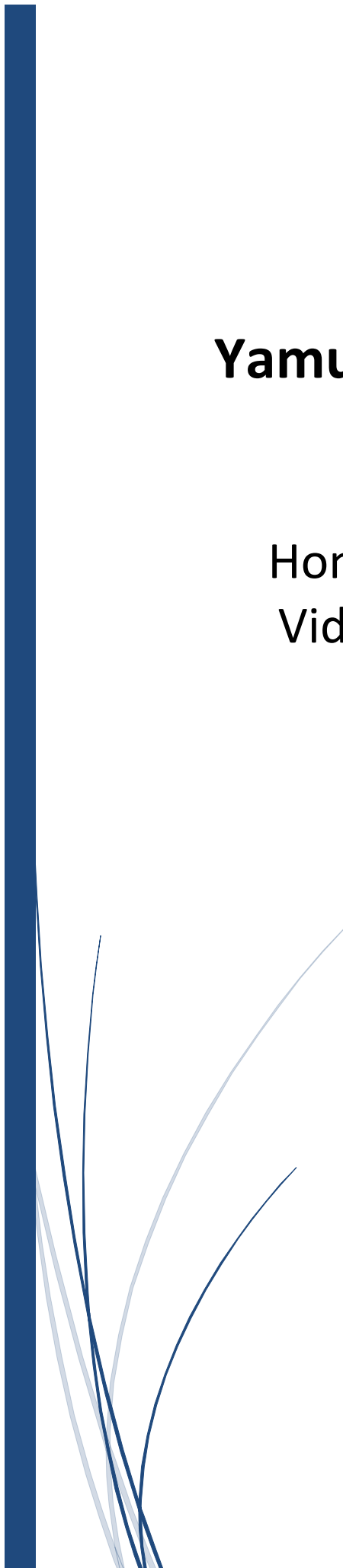
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Final Report of the Yamuna Monitoring Committee

Appointed by the
Hon'ble National Green Tribunal
Vide order Dated 26th July 2018

Shailaja Chandra
B.S. Sajwan

Dated 29th June, 2020.



**FINAL REPORT PREPARED BY THE
YAMUNA MONITORING COMMITTEE**

For the
REJUVENATION OF THE
RIVER YAMUNA
&
ABATEMENT OF POLLUTION

List of Abbreviations

BOD - Biochemical Oxygen Demand

CCTV - Closed-Circuit Television

CETPs - Common Effluent Treatment Plants

CPCB - Central Pollution Control Board

CSE - Centre for Science and Environment

CWC - Central Water Commission

DDA - Delhi Development Authority

DJB - Delhi Jal Board

DM - District Magistrates

DMC-Delhi Municipal Corporation(Includes North, South and East)

DO - Dissolved Oxygen

DPCC - Delhi Pollution Control Committee

DSIIDC - Delhi State Industrial and Infrastructure Development Corporation

DTTDC - Delhi Tourism and Transportation Development Corporation

DWS &SD - Delhi Water Supply and Sewage Disposal Undertaking

EPCA - Environment Pollution Control Authority

GPS - Global Positioning System

GSDL - Geospatial Delhi Limited

HPCB - Haryana State Pollution Control Board

I&FCD – Irrigation & Flood Control Department

IIT - Indian Institutes of Technology

INTACH - Indian National Trust for Art and Cultural Heritage

MC - Monitoring Committee

MGD - Million Gallons per Day MLD - Million Litres Per Day

MoEF &CC - Ministry of Environment, Forest and Climate Change

MoWR, RD&GR - Ministry of Water Resources, River Development & Ganga Rejuvenation

MoJS: Ministry of Jal Shakti

MSW - Municipal Solid Waste

NMCG-National Mission for Clean Ganga

NEERI - National Environmental Engineering Research Institute

NGO - Non Governmental Organization

NGT – National Green Tribunal

NIC - National Informatics Centre

PWD – Public Works Department

RWA - Resident Welfare Association

SMP - Sewerage Master Plan

SOP - Standard Operating Procedures

STP - Sewage Treatment Plants

UYRB - Upper Yamuna River Board

ZLD- Zero liquid discharge

IDMC- Integrated Drain Management Cell

WII-Wildlife Institute of India

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Acknowledgments

At the outset, the YMC thanks the Hon'ble Chairperson Justice Adarsh Goel and Hon'ble Members of the National Green Tribunal for reposing so much faith in the members of the Yamuna Monitoring Committee and for extending a unique opportunity to delve deep into a profoundly important part of Delhi's environment and the River Yamuna. The suggestions and findings given by the YMC in the previous interim reports have been upheld by the Tribunal and the members cherish the understanding and trust with which their advice was received and acted upon. But for this support forthcoming at every juncture, the Committee would not have been able to achieve anything of substance. Indeed, if some good results from the efforts made, it will be the outcome of the vision of the Chairperson who gave a platform to the Members to use their combined experience to advantage.

YMC also thanks the Hon'ble Chief Minister of Delhi Mr Arvind Kejriwal who himself took the initiative and called the members to his house for a detailed interaction. He took notes and gave instructions which helped the Committee in pursuing certain things particularly with DJB of which the CM was the Chairman. The Deputy Chief Minister Manish Sisodia was very receptive to the ideas put forward by YMC on the need for building a massive awareness programme I by bringing the Yamuna on centre stage in all school programmes to start with.

This being the Final report on the Yamuna from this Committee, the YMC now uses the opportunity to also acknowledge the support and guidance given to it by scores of officers, experts and citizens. It is difficult to include all the names but certain officers, experts and members of the public went out of their way and are being acknowledged here. If any names are left out it is not that the YMC does not appreciate their contribution but there is always the paucity of time and space. Some important names that must indeed find mention are however recounted.

Central Government:

The Ministry of Jal Shakti gave the Committee full support through its Secretary Mr U P Singh and the Director Technical in NMCG Mr Mathuria.

CPCB was very helpful to the YMC and in particular the support and co-operation received from the former Chairman SPS Parihar and the Member Secretaries - earlier Mr Sudhakar and then Mr Prashant Gargava merit mention.

Delhi Development Authority led by Mr Tarun Kapoor Vice Chairman and assisted by two Principal Commissioners Mr Shri pal and later Mr R K Tiwari supported the Committee through several meetings. Collation of data on the flood plains and visits. The contribution of Mr Manish Gupta who held charge as VC was a short interlude toward the end of the YMC's tenure, but he was very supportive. Several others in DDA provided assistance and the names of Poonam Dewan, Sanjeev Arya, Shyam Sunder Garg (although he has worked with the Committee very recently) merit mention.

GNCT Delhi

The direction and cooperation extended by the Chief Secretaries of GNCT Delhi Mr Anshu Prakash and later Mr Vijay Dev helped many matters which were hanging fire to move forward. Without them the YMC may not have been able to derive any team work from the officers as water pollution was not accorded high importance in the overall gamut of departmental priorities. Among the Secretaries and Heads of Department of the Delhi Government YMC recalls the contribution of Rajeev Yaghuvanshi, Rajeev Verma, Sanjeev Khirwar and Sandeep Kumar who handled the charges of Urban Development, Divisional Commissioner, the Departments of Environment and Forests and Education during the more active periods of YMC's tenure. In the area of Pollution Control the contribution of Arun Mishra as Member Secretary DPCC was noteworthy in preventing Idol immersion both he and K. Mahesh ADM showed a lot of initiative. Although they were in the background two scientists DK Singh and Nandita Moitra from DPCC need mention as they did enormous data collection for the Committee.

In all the three Municipal Corporations over a 20-month period the YMC dealt with 9 different Commissioners. Among them the officers who were proactive in carrying out strategies for reducing solid waste were Puneet Goel, Dilraj Kaur and Gyanesh Bharati.

From DJB, both the CEO's AK Singh and Nikhil Kumar gave the cooperation that was needed to make the YMC functional, provided the documentation as sought and facilitated several visits. Without their support, even logistic support may have been a problem. Both officers took care of the YMC's official requirements with grace and goodwill, for which the Committee is thankful. The Revenue and Engineering professionals in DJB were also very cooperative but unfortunately not all names can be cited. Those who went out of their way to assist the Committee included RS Negi, Vikram Singh, Vashisth, VK Gupta, D K Vaishya, Godbole, Mukul Bhandula and Ajay Arora in particular.

Others who were proactive in their responses were Mohanjeet Singh from Industries Department and DSIIDC besides the SE Sharat Kumar.

The Department of Irrigation and Flood Control was represented at all YMC meetings by two Chief Engineers OP Srivastav and Sanjay Saxena who contributed when the need arose.

Haryana:

The two Chief Secretaries who the YMC interacted with and who met the Committee at length and went through a complex agenda and gave directions were D S Dhesi and Ms Keshni Anand Arora. It was with their direction that work which was on the back burner got prominence and greater traction. A number of other officers also contributed but it is difficult to recount all the names. In particular the Member Secretary of the Haryana Pollution Control Board S Narayanan deserves special mention because unlike others he at least owned the problems of rampant pollution.

Uttar Pradesh: The present Chief Secretary Mr R K Tewari responded to the YMC's communications by finally, after more than a year by deputing his senior officers to present the State's plans for dealing with the pollution in the UP drains out falling into Delhi's drains. It is because of him that this Final Report has a substantial, (although not fully satisfactory,) account

of the progress made by the state in implementing NGT's directions. The other names which the Committee recalls are R Venkatesh, Manoj Kumar Singh Principal Secretaries for Irrigation and Urban Development, the Ghaziabad Municipal Commissioner Dinesh Chander and the District Magistrate of Ghaziabad Ritu Maheshwari. Both Ashish Tiwari MS UP PCB and Ashok Tiwari the Chief Environment Officer remained on call and furnished data although the YMC lamented that they did not have the wherewithal to get Government orders despite understanding the problems and solutions. But at least they tried.

Haryana Monitoring Committee

The Government of Haryana had set up a two-person Monitoring Committee as directed by the NGT. The two Members, namely, Dr PKMK Das and Er YK Garg worked very hard, visited all the locations and faithfully accepted their roles as independent evaluators. Their reports helped the YMC to highlight the most important issues before the two Chief Secretaries of Haryana. Appointing them brought perceptible change in the attitudes of those who previously denied the existence of several pollution related matters.

Experts Consulted.

YMC has already mentioned numerous experts that assisted the Committee. For the sake of brevity, they are not being acknowledged twice but a reference may be made to Table -I at the end of Overview.

However special mention must be made of the role of Mr RS Tyagi former Member Drainage in DJB who did yeoman's service in visiting many projects and drains and guided the YMC from the inner knowledge of how maintenance needs to be done. The role of Ankit Srivastav who is a young environmental engineer was of great help in making the committee familiar with alternate technologies.

Citizens who helped

It is not normal to thank the Resident Welfare Associations in such official reports but YMC is doing it because some members of the public were very tenacious and did everything possible to guide the YMC, accompanying them on visits and sitting for hours during official discussions much of it outside their area of direct relevance to them. Special mention is made of the RWAs and individuals listed below because unless common citizens take up issues and pursue them things cannot improve and the perseverance of these men and women has been exemplary.

RWAs

S.No.	Area	Name
1	GK-I	Sh. B.B.Patel, Sh. Dalip Jolly
2	Kalindi	Sh. Sanjay Naraynan
3	Defence Colony	Rajiv Suri
4	Subhash Nagar	Anil Khanna
5	Mangal Bazar M.B. Road	Sh. Ranjan Chatterjee
6	Ramnagar (Ext.)	Sh. Manish Kr Suryavanshi
7	Nizamuddin (West)	Sheikh Mohd. Umar
8	Sahibabad	Sh. Sushil Raghav
9	Encroachment on floodplain parallel to DND	Sh. Braham Singh, Advocate
10	Saket	Ms. Reema Ramchandran
11	Mayur Vihar	Sh. Umesh Aggarwal

India International Centre

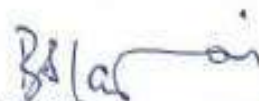
The former Director Air Marshal Naresh Verma and his successor Mr K N Srivastava gave the Committee all support which included seeing that the Centre's staff in charge of computer connectivity and housekeeping supported the Committee. Scores of officers who came to attend the YMC meetings were guided promptly and courteously.

YMC's staff

YMC also acknowledges the untiring work done by the skeletal staff that managed YMC's back-end work from arranging meetings, taking dictation, docketing papers and maintaining files. They have helped prepare all YMC reports in-house. This was extraordinary contribution made by retired people and contractual staff who despite facing personal tragedies and domestic upheavals, not having access to facilities like a departmental canteen worked tirelessly sometimes even on holidays. They even mastered computer skills which they had never heard of earlier. Special mention must be made of AK Datta who maintained all technical data, NK Rohilla who arranged scores of meetings and saw that the members faced no inconvenience and Naushad Ahmad who built a massive website from scratch in house. All these people grew in their own shoes and measured up to the YMC's exacting demands and deadlines without demur. They were ably assisted by Pankaj Kumar, Pawan Rawat and Rambir Singh whose seemingly insignificant contribution actually helped bring professionalism to the quality of documentation going on the website and issued from the office.



Shailaja Chandra,
Member,
Monitoring Committee for Yamuna



B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

An Overview of the Experience of the Yamuna Monitoring Committee

set up by

The National Green Tribunal.

A Synopsis of the Approach and Methodology followed and Key Challenges Ahead

Introduction

Through an order dated 26th July 2018 in the case Manoj Misra and Others, the National Green Tribunal (NGT) set up a Yamuna Monitoring Committee to pursue and report on the implementation of the Tribunal's judgments and orders on the abatement of pollution in the River Yamuna at Delhi, including containment of discharge from drains in Haryana and Uttar Pradesh; also to monitor the implementation of projects aimed at the rejuvenation of the river for ecological reasons as well as direct public benefit.

The stretch of the Yamuna as it traverses through Delhi accounts for 2% of the length of the river but accounts for over 75 per cent of the total pollution load in the river. NGT's directions involved more than 16 stakeholders. The two-person committee comprising the undersigned was directed to start work within one week of the order. The Chief Secretary Delhi was asked to make the Committee functional, immediately.

As a first step the YMC was required to prepare its own Action Plan and submit it to the Tribunal by 15th September 2018, followed by submission of the first Interim Report by 31st December 2018. Directions had been given by NGT to the Chief Secretary GNCT, Vice Chairman DDA, the Commissioners of the Municipal Corporations, Chairman NDMC, NMCG, the States of Haryana and Uttar Pradesh, to cooperate and coordinate with the YMC. States of Haryana and UP were also directed to set up their own state specific monitoring committees which were to work in tandem with the Main Monitoring Committee.

The positive aspect of this development was that all authorities and officers got a forum where the progress as well as inter-agency difficulties could be addressed in a proficient manner instead of having to function only through filing affidavits which they had been doing over 3

years, many of which remained unimplemented for a multitude of reasons. A body like YMC could take an independent view of the problems cited and raise levels within the departmental hierarchy to remove obstacles. YMC selected major bottlenecks and had to overcome them through data collection, examination of technical issues by subject experts, identification of key deliverables and bringing the continuing adverse environmental impact to the notice of those at the helm. When nothing seemed to work it was reported to the NGT in the interim reports and because of the Tribunal's directions thereon the speed of implementation picked up in several cases. Each Chapter that ensues in this Report captures the status in August 2018, what has been achieved and directions requested from the NGT. The periodic documentation of the incremental progress has enabled YMC to create a practical road map for the future, divided into achievable goals and targets.

The canvas on which the monitoring had to be done involved several large organisations like the DDA, DJB, other Departments of GNCT Delhi, the Municipal Corporations besides the States of Haryana and Uttar Pradesh and experts from organisations like IITs, CPCB, NMCG, CEMDE, CSE and NGOs active in this area. The YMC had to also examine and give a finding or try and resolve specific public complaints which necessitated calling the affected citizens in groups to address their grievances in the presence of the key local officers and engineers. The Committee even received matters referred to it by the Hon'ble Supreme Court of India and the Hon'ble Delhi High Court for resolution of the problem of pollution faced by the public. On every matter the first step was to list the pending items organisation wise, calling for status reports from the concerned heads of organisations drawing attention to the specific directions given by NGT and finding a fair and feasible resolution.

After going through all the orders of NGT and understanding the recommendations made by the two expert committees whose reports had been made integral to the NGT judgments, YMC began discussions with a wide range of experts to enable prioritizing the subjects that the Action Plan had necessarily to include. The list of experts consulted, some several times, has been given in **Table I** at the end of this Chapter.

System for Holding Meetings

Very early in the process of seeking data, the current status and action taken on NGT's orders had to be sought officially and assessed. In looking for responses, it was apparent that e-mails were seldom read directly on receipt and until they were downloaded, registered and given in manual form to most officers, even the most important communications got no response. The YMC not only had to issue the mails invariably drawing attention to NGT's directions to get consideration but to follow up on telephone and Whatsapp to get an acknowledgment. The only way to overcome the tendency to treat almost everything as routine was to use the ample authority given by the NGT to call meetings with the key functionaries. Minutes were dictated or typed in the presence of those attending the meeting to ensure acceptance and compliance of agreed decisions. The broad categories of over 106 meetings held has been given in **Table 2** at the end of this Chapter.

NGT's directions to YMC to create a website and upload all developments thereon was immensely helpful to the Committee but more so for the media and the concerned citizens. Once the website was launched in a record span of just 4 months and later moved to a cloud server the minutes of meetings as well as photographs began to be uploaded including on social media, immediately. This greatly helped in maintaining a chronological record. The proceedings were often accessed by leading newspapers; reporters then began counterchecking with the heads of the organisations about the agreed next steps written in the minutes. This in turn alerted the senior officers as it was apparent that compliance was under public scrutiny. YMC did not hold any press briefings but the coverage YMC activities in the national print press was considerable. Perhaps uploading everything on the website was among the most influential in helping Yamuna related activities receive public attention.

NGT's Orders and Interventions: After 26th July 2018, NGT passed orders on 19.2.19, 11.9.19, 22.1.20, 5.3.20 and 6.5.20. The Tribunal's directions were explicit and time bound and the YMC was greatly helped by their specificity. The trust reposed by the Tribunal was the only reason that the YMC was listened to.

Before reporting to the NGT through 3 interim reports, three supplementary reports, and two special reports on In-situ Phyto/Bio remediation, and the need for an SPV for River Front management, YMC had invariably ensured that the more serious omissions had been brought to the notice of the concerned Principal Secretaries, Heads of Department and the MCD Commissioners in one-on-one meetings. If there was reluctance it was brought to NGT's notice through YMC's interim progress reports. On major matters, particularly where jurisdiction and inter-agency coordination issues were holding back progress, the matters were raised to the level of the Chief Secretaries of Delhi and Haryana whose intervention helped resolve several contentious issues where officers were shelving responsibility.

The State of UP was initially not forthcoming but this was overcome for some time only with NGT's intervention. Though the State of Haryana set up a state specific Monitoring Committee which has been functioning quite well, the State of UP had set up a Committee of serving officials who were too busy with their own priorities and disinclined to monitor the pollution related matters highlighted by NGT. Even a Committee which was eventually set up by the Government of UP was later wound up. It became almost impossible to get updates or even to know whether the communications sent by YMC were at all being seen by the officers. YMC used every possible communication channel including speaking to the Resident Commissioner of UP and mentioning the gravity to the Chief Secretary over phone regarding the continued non-implementation of NGT's orders. But the response from the Principal Secretaries in charge of Urban Development and Industries who alone could decide on administrative approvals and funding issues, was uncooperative.

Most responses from UP were given by representatives of UP PCB who sugar coated the absence of progress with assurances. Several months were lost in the process. When YMC undertook a visit to the impugned drains which were discharging effluent in the Shahdara drain and even showed the filth to the District Magistrate, it got a positive response but this never got converted into action.

Overall Experience: As far as YMC's experience is concerned, in the beginning the meetings remained inconclusive and the progress was slow. Each time inter-departmental and intra-

departmental issues were given precedence over the need to find solutions. The meetings were often attended by a different set of officers each time who came unprepared about decisions taken in earlier. The same degree of unpreparedness was evident from most officers who despite the purpose of every meeting having been sent a detailed Agenda prepared by the members in advance, came without reading NGT's orders or the Agenda. In time as the YMC kept up the pressure through continuous reviews and reports to NGT and the Tribunal upbraided several heads of organisations for failure on numerous counts and pinned them down, things began to improve.

Against several odds, the biggest contribution of YMC was to be able to focus on critical areas which hitherto had been lost in generalities. Because of the form set up under NGT's direction, both Officers and engineers could go into the details of each matter and over time the discussions evolved into new ways of doing things. Perhaps the biggest takeaway has been that major organisations began to understand where their roles fitted into the big picture. This had never been seen in the broader perspective of how so many things all matter and if ignored take their toll on the River.

Logistics and Staff Issues faced by YMC

This is being reported not as a complaint but as indicative of how systems function despite clear orders. The NGT had directed the Chief Secretary Delhi to make the YMC functional within one week. There was firstly a need for an easily identifiable office which could be accessed by officers from different organisations, officials from the states of UP and Haryana, including those at the township level besides the affected public whose cases had been referred by NGT or by other Courts. There was need for basic staff and office equipment. The CEO DJB had been entrusted with the task of providing space and logistic support to the Committee but on his first interaction with YMC, the then CEO expressed helplessness and requested that the members themselves suggest how to move ahead. He could suggest no space in an already functioning office and said DJB would hire space identified by YMC. This response was surprising but in view of the urgency expressed by NGT, YMC started looking for alternatives alongside its substantive responsibilities.

Other Monitoring Committees and institutions functioning in the area of Urban Development (even EPCA) had been operating out of India Habitat Centre for years. This option was considered but found unsuitable because of the expense involved and the need for separately hiring committee rooms for holding meetings. The Islamic Centre on Lodhi road was approached but the management said it did not allow extended stay. A request was then made to the Director of the India International Centre and fortunately he could suggest a small flat which had been hired out in the past for the long-term use of a single Ph.D. scholar. YMC decided to start functioning from this accommodation despite the fact that both members had to share the small space and facilities. An extra single room was arranged from where the staff could work which was converted into a meeting room when needed. It was through this improvisation that large meetings could be convened. YMC did not ordinarily allow the use of IIC facilities for offering water or tea and the attached kitchenette was used to reduce costs.

Government procedures made the purchase of equipment like computers, printers and scanners very slow and YMC began by using personal equipment. DJB provided a small fund to be operated by a DJB Executive Engineer who could make spot purchases of stationary and other supplies. All this is recounted because had things been left to GNCT /DJB it may have taken months for YMC to become functional whereas it was accomplished within a week of NGT's order.

YMC also faced a struggle in getting even rudimentary staff support. Full time officers could not be spared by the DJB or the Services Department despite YMC telling the Chief Secretary and giving numerous suggestions. All retired and willing officers identified by YMC were not approved on one ground or the other. A Personal Assistant joined after four weeks after the YMC started functioning. The YMC dictated most minutes and directions in the presence of officers and had them uploaded on the website which brought a sense of immediacy. Fortunately, both members were proficient in the use of computers which enabled the Committee to function using personal equipment. Despite having no regular staff support to maintain records, issue mails and docket of papers it was managed with help of a part time Engineer deputed by DJB occasionally.

A retired DJB Assistant Engineer finally joined nearly 5 months of NGT's order. Most work has been managed by the YMC on its own, calling the key officials to update data and having it counter-checked independently before including it in the reports sent to NGT.

Positive Highlights of YMC's Tenure

Despite many hurdles considerable progress has taken place in all the areas that this report covers. A professional report on Environmental flow and what needs to be done is now available. The quality of river water has begun to be measured and related to events like release of more water, extra discharge of effluent released into the drains, by location. DDA has put many of its 5-year-old commitments on track and the progress has been achieved only in the last 18 months or so. Matters related to STPs, drains, Septage management have begun to get primacy at a Government level which was unimaginable in August 2018. Efforts made to build public awareness and stop idol immersion have been successful. The management of CETPs, their on line monitoring as well as of STPs has been upgraded.

While all this gives cause for satisfaction a lot remains to be done. The issues selected by NGT for monitoring were key to bringing about improvement and the strict directions issued by the Tribunal have resulted in measurable compliance. There is a need for pressure to be maintained by oversight systems as things can slip back particularly as the COVID pandemic has posed unforeseen challenges to the adherence of timelines.

Site Visits undertaken by YMC

Several site visits were undertaken by YMC which proved to be extremely useful in identifying bottlenecks. Having paid these visits it was possible during discussions with individual heads of organisations to highlight what was happening as often the official reports that were being relied often did not convey a correct assessment of the dimension of the problem. The list of significant visits undertaken is given in **Table 3** at the end of this Chapter.

Governance Issues

Looking back over the last 23 months two things stand out: First, to overcome official indifference was the biggest challenge. It was not the result of any defiance or unwillingness to fulfill the NGT's directions or to thwart YMC's monitoring efforts but was mainly because water pollution, despite statutory provisions and copious exhortations is not a priority. Second, maintenance issues are given little importance at a political level as compared with new infrastructure projects and schemes. This has got embedded in mindset of officers and engineers because the benchmarks by which performance is judged rests mainly on the officer's capacity to get project approvals, garner funds and procure goods and services in time. Quality of life issues affecting citizens are often relegated to the background and day-to-day maintenance is at a low ebb often left to junior people to sort out, often the ends justifying the means as in the case of punctured sewers and poor capacity utilization.

Unless benchmarks which matter to the citizens' daily lives are set and begin to matter, any reduction in pollution will be pursued only as long as there is oversight. Organisations like DJB and MCDs which have statutory responsibilities accord very low priority to these functions. They avoid taking any action that might have an adverse public or political reaction and until such issues receive attention the atmosphere of laissez faire and conniving with contactors that find rough and ready solutions may continue. The DPCC does not have the stature and independence needed to function as an effective regulator for sewage.

After years of inertia and apportioning blame, finally air pollution issues have hit the public psyche in Delhi winters. In comparison water pollution remains relatively unseen and unimportant. Much more public involvement is needed for a cleaner Yamuna and to achieve this, unless citizens perceive that the river can provide opportunities for communion with nature and for open-air recreation there will never be a public demand for a cleaner Yamuna. Cleaning the river was included in the Government's list of election promises earlier this year and YMC was told that focus had begun to be given at a political level also. Because of the current health crisis it has again taken a back seat.

End Note: NGT had given the YMC overarching authority to undertake effective monitoring of scores of schemes and projects. The wording of its orders and the mandate have helped many

positive things to be achieved. These have been covered in the ensuing report and show how matters stood in August 2018, the progress made and the directions needed from NGT in the circumstances of each matter. The subject of water pollution continues to be given very low priority and the lay press has not covered the health hazards that ensue sufficiently. In times to come it is very necessary that research bodies are encouraged to study the effects of such rampant water pollution. It is also necessary to keep an eye on the claims being made by the Government agencies which have a public duty to prevent water pollution. Only external oversight will keep the pressure up.

The YMC thanks NGT for having placed trust and reliance in the capacity of the Members to address multifarious problems connected with the River Yamuna. Additionally, for having supported its recommendations which gave the efforts a much-needed boost. There have been several occasions when efforts have shown positive outcomes and given the YMC cause for satisfaction.

It is hoped that the recommendations made in the Final Report will be considered by NGT.

Table – I: List of Experts who assisted YMC

S.No.	Experts
1	Dr Rakesh Kumar, Director NEERI Nagpur
2	Prof CR Babu, Head, CEMDE, Delhi University
3	Prof Vinod Tare, IIT Kanpur
4	Prof. AK Gosain, IIT Delhi
5	Prof Brij Gopal, Former Member Expert Committee, NGT
6	Prof A.A. Kazmi, IIT Roorkee
7.	Prof SK Singh, HOD, Deptt of Environment Engg, DTU
8	Sh Shashi Sekhar, Former Secretary GOI, Ministry of water Resources
9	Dr Sudha Goel IIT Kharagpur
10	Dr Sanjiv Goyal, Chief Scientist NEERI
11	Sh RD Tyagi, Former Member(drainage), DJB
12	Sh. Ram Shekhar, DIMTS
13	Sh. Manu Bhatnagar, Director INTACH
14	Dr. Himank Sharma of Chicago University

15	Dr Priyank Hirani of Chicago University
16	Sh Manoj Mishra, Environmentalist
17	Sh Ankit Srivastava, Environmentalist
18	Sh. Farhad Contractor, Wetland Expert
19	Ms Neha Sinha, Environmental journalist

Table – II: Details of Important meetings held by YMC

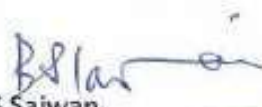
S.No.	Name of Department	No. of Meetings
1	DDA	9
2	DJB (STP's Drains, ISP, Septage)	20
3	DSIIDC	7
4	DPCC/CPCB	12
5	Div. Comm., DDA, DJB (Land issues)	3
6	RWA's	15
7	Haryana Government	4
8	U.P. Government	6
9	I&FCD	6
10	NHAI	2
12	NMCG	2
13	GSDL	1
14	Divisional Commissioner/ Education/Environment	8
15	Deputy CM	1
16	DTC	2
17	Commissioners / Staff of Municipal Corporation	8

Table-III: Details of Important Site Visits undertaken by YMC.

S.No.	Date	Details of visit /Inspection
1	10.8.18	Visit to New Coronation Pillar STP to review the progress
2	07.12.18	Visit to Bio-diversity Park
3	27.12.18	Inspection of Sahibabad Drain & Ram Nagar Drains
4	19.6.19	Visit to Okhla STP, Phase –VI to see progress
5	4.7.19	Visit to Neela Hauz with Sh. C.R Babu
6	17.9.19	Visit to Millennium Depot
7	19.9.19	Visit to Coronation Plant to review progress
8	27.9.19	Inspection of G.K-I, Khushak & Barapulla Nallah
9	30.9.19	visit to CETP Societies Wazirpur to see staking of hazardous waste
10	1.11.19	Visit to Kalindi Colony to see bio Diversity Park being developed by DDA.
11	29.11.19	Visit to package-I site of ISP at Dwarka and adjacent areas.

12	27.2.20	Inspection of Khushak, GK-I & Nizamuddin Drain to see condition of Sewage flowing in the Nallah
13	17.3.20	Visit to Asita East & West projects of DDA
14	19.3.20	Visit to Bio-Diversity Park Projects of DDA and Barapulla Drain on Yamuna Western Bank
15	10.8.18	Visit to Dwarka Water Treatment Plant for Review of 14 STPs in Najafgarh basin
16	September 18	Visit to Geeta Colony on Yamuna bank for review of Idol Immersion site
17	June 19	Visit of Yamuna Vihar, Majnu Ka Tila and adjoining areas
18	25.1.2020	Visit to Najafgarh Jheel area with officials of CPCB, Prof Babu and Haryana Govt. officials


Shailaja Chandra,
 Member Yamuna Monitoring Committee
 of the National Green Tribunal
 27th June, 2020


B S Sajwan,
 Member Yamuna Monitoring Committee
 of the National Green Tribunal
 27th June, 2020

Chapter-1

Environmental Flow

As a living river the Yamuna should be able to fulfill its ecological functions. These include recharging the ground water aquifers, carrying nutrient rich alluvial sediment, supporting biodiversity and aquatic life and providing for social and cultural needs of the riparian populations. The Central Pollution Control Board has specified that the river must achieve atleast bathing standards. The river presently, however, not only receives large volumes of domestic sewage and industrial waste but also lacks the basic minimum of fresh water as almost all the water present in the river is diverted for various consumptive uses like drinking, agriculture and industries at the Hathanikund barrage.

NGT in its orders dated 13.01.2015 directed creation/deepening of water bodies upstream and downstream of Wazirabad and maintaining e-flow in the river. The directions are reproduced below:

NGT's order dated 13.1.15:

"94 (viii). Existing wetlands and water bodies, both upstream and downstream of Wazirabad reservoir should be deepened and enlarged. This should be done in addition to providing more water bodies.

We direct the chief secretaries of Himachal Pradesh, Uttarakhand, NCT of Delhi, Haryana and Uttar Pradesh, and Secretary Ministry of water Resources, Government of India and Secretary MOEF to hold a meeting within four weeks from today to prepare an immediate action Plan required to ensure proper environmental flows throughout the year in entire river and particularly the stretch flowing through Delhi."

The Principal Committee appointed by the Tribunal in its report submitted to NGT on 6.5.15 recommended a slew of measures like creating off-river reservoirs along the floodplains,

recycling of treated waste water, improving water use efficiency in agriculture and mandatory rainwater harvesting. While accepting these recommendations the Tribunal directed as under:

NGT's order dated 11.6.15

"In light of the above and after hearing the Learned Counsel appearing for the various parties, we direct the State of Haryana shall release of 10 cumecs water directly into main stream of river Yamuna from Hatnikhund barrage and maintain e-flow of the river till Wazirabad.

i. This release would be without prejudice to the sharing of water rights as per agreement between the State and order of the Hon'ble Supreme Court of India for the purposes of consumptive & irrigation purposes.

ii. This should be in addition to the seepage, besides seepage from the barrage body if any.

iii. At this stage we do not propose to issue any directions for enhancement or any variation in the utilization of water by the riparian states.

iv. The States are free to go by their own agreement and as they may decide otherwise, but in any case, 10 cumecs water flow in river Yamuna shall be maintained. It is to clarify the order of the Supreme Court; it has to be from Hathanikund to Wazirabad.

v. We direct the Principal Committee to grant hearing to all the concerned States and after considering their respective cases, if necessary, obtaining advices from the technical experts including Ministry of Water Resources and Central Water Commission answering the following: -

A. What should be the E-flow of river Yamuna in all these States more particularly from Hatnikhund to Wazirabad up to Agra.

B. For maintaining this E-flow what should be the release of water at Hathanikund with any variations in the shares of the States.

C. We do expect the Committee to take into consideration the development activity and other attendant factors but at the same time give utmost importance to the pollution to river Yamuna

in all these States while making the recommendations for E-flow of river Yamuna all through these States."

NGT's order dated 11.9.19:

"a) The impact on ground water regime due to pilot project may be monitored by CPCB, DPCC and CGWA. The study being carried out by the National Institute of Hydrology, Roorkee (NIH) on directions of NMCG may be completed as per schedule by March 2020. An interim report be furnished by

December 2019.

b) The current regime of Environmental flows may be augmented especially in lean seasons by way of coordination amongst member states stakeholders".

Status as in August 2018

The review undertaken by the YMC with the officials of MoWR, RD&GR (now MoJS) and UYRB in meeting held on 06.12.2018 revealed that 10 cumecs of water as ordered by the NGT is indeed being released downstream of Hathanikund barrage, however, almost all the fresh water released either evaporates or percolates into the river bed during the lean season before it reaches Wazirabad. Consequently, no fresh water is released into the river downstream of Wazirabad during the lean season and whatever flow is present in the river is the domestic sewage and industrial effluent joining the river through 22 storm water drains. Despite NGT's orders of 2015, no E- flow study had been undertaken for the Delhi stretch of the river. Also, no action had been taken to undertake deepening of water bodies and wetlands upstream of Wazirabad despite clear directions of NGT's order of 13.1.15.

Progress Achieved:

1. On the suggestion of YMC, in a meeting taken by Secretary, MoJS on 18.10.18, it was agreed to undertake an E-flow study for the river Yamuna. (**Annexure C-1/1**). Pursuant to the decision in the meeting, the NMCG assigned the study to National Institute of Hydrology Roorkee (NIH). The NIH submitted a Provisional report in December 2019 and,

thereafter, a Draft Report on E- flow for the Delhi stretch of river Yamuna to NMCG with a copy to the YMC on 01.05.20. A copy of the draft report is placed at **Annexure C-1/2**.

2. The report recommended the following releases required from Hathanikund barrage for maintaining suitable habitat at all downstream locations between Hathanikund and Okhla barrage

Month	Median of monthly inflows at Hathanikund barrage (cumec)	Average monthly releases from Hathanikund barrage (cumec)	Recommended minimum releases from Hathanikund barrage incorporating natural variability (cumec)	Flow regime obtained after implementing recommended minimum releases (cumec)	For inundating floodplains (cumec) - <i>once a month</i>
Jan	76	10	23	23	
Feb	78	10	23	23	
Mar	86	10	26	26	
Apr	95	10	29	29	
May	112	10	34	34	
Jun	148	18	44	44	
Jul	525	275	158	275	1400
Aug	780	298	220	298	1600
Sep	493	160	149	160	
Oct	145	30	44	44	
Nov	90	10	27	27	
Dec	81	10	24	24	

3. The recommended releases during the lean season months from December to May are aimed at maintaining required habitat conditions for the indicator fish species of Indian Carp (*Raiamas bola*) and Indian Trout (*Banganadero*). The study recommends the flow requirement for survival of these indicator species indigenous to the area. Based on the

depths of water required in the river at different locations releases from Hathanikund barrage during a specific month have been given. Releases estimated from Hathanikund barrage have been recommended for meeting the minimum depth requirement of 0.60 m for indicator species at 13 identified locations corresponding to the specific month. After perusal of the Draft Report YMC has vide e-mail dated 8.5.20 (**Annexure C-1/3**) conveyed its views to the NMCG with specific reference to the E-flow recommended in the Draft Report and the requirement of specific policy and water conservation measures to be suggested by the NIH study and to provide quantitative assessment of the resultant enhancement in the lean season flows if the suggested measures are adopted by the basin states, upstream of Wazirabad.

4. The draft report was discussed in a meeting taken by Secretary MoJS on 22.5.20. The meeting was attended by the members of Oversight Committee consisting, among others, of experts from IIT Kanpur, IIT Delhi, NEERI, and WII Dehradun. YMC members also attended the meeting. The state governments of Haryana, Delhi and UP were also represented. The State of Haryana raised certain issues on the E- flows recommended by the NIH being higher than those being released at present in terms of the water sharing agreement of 1994 and the directions of Supreme Court. YMC while reiterating the suggestions made vide mail dated 8.5.20 made the following observations:

- a. *Monitoring Committee supports the recommendations made in the draft report. The report may be set as platform/ benchmark on which policy decisions may be taken. It was suggested that in collaboration with Ministry of Agriculture steps shall be taken to increase the usage of water efficient irrigation practices*
- b. *In response to the Govt. of Haryana's various measures to encourage and practice water efficient measures in irrigation and usage of less water intensive crops, it was said monitoring and outcome of such measures remains in question.*
- c. *It was suggested that D/o WR, RD & GR after taking views/ suggestions of all the stakeholders and States should quantify the environmental flows in river Yamuna. Additionally, steps required to achieve these goals may also be formulated and pursued with different stakeholders.*

- d. In the absence of a policy on various water conservation measures being recommended as an integral part of study, the entire exercise may remain an academic exercise with little practical value.*

Minutes of the meeting held on 22.5.20 are placed at **Annexure C-1/4**.

5. YMC requested the MoJS to reconcile the views of the different stakeholders and take a final view on the quantum of E- flow required for the river.
6. As a follow up of the directions of NGT to deepen water bodies and wetlands and to create off river reservoirs, IFCD of GNCTD undertook a pilot project of creating off river shallow reservoirs at Palla over an area of 17.6 hectares on an experimental basis with the objective of retaining monsoon flood water and recharge the ground water aquifers. The pilot project is under observation by the CGWB, CWC and CPCB with reference to the ground water recharge, rise in water table and the environmental benefits arising out of such off-river reservoirs. IFCD has informed that a decision has been taken by the Govt to continue with the pilot project for two more years as per the recommendation of CWC and CGWB. Steps have already been initiated for allocation of funds and call of tenders for continuation of the Pilot project. "Work on the Pilot Project is expected to be taken up after lifting of lockdown due to Covid 19.

Directions sought from NGT:

The YMC requests the NGT to consider issuing the following directions:

1. That the recommended E- flow is a scientific study and all stakeholders should treat it as a critical parameter for revival of the river.
2. The, MOJS, UYRB and the riparian states of Uttarakhand, HP, UP, Haryana and Delhi who are beneficiary states under the Water Sharing agreement of 1994 to rework the water sharing arrangement to permit release of the recommended E- flow at Hathnikund barrage.
3. The NMCG, UYRB, MOJS and the riparian states should identify policy and water conservation measures, including measures for enhancing water use efficiency of

agricultural practices and promoting cultivation of less water intensive crops through price support mechanisms.

4. The NMCG and MOJS should prepare a road map, with timelines in consultation with state governments and other stake holders for the implementation of various policy and conservation measures.
5. CGWB and CPCB be directed to monitor the status of ground water in floodplains areas where shallow reservoirs have been created and if the outcomes are encouraging, direct GNCTD and States of Haryana and UP taking up such works in their areas along the floodplains

Chapter - 2

DDA and the Demarcation of the Flood Plain and Rejuvenation Activities

This being a final report of the YMC, this Chapter recapitulates how matters stood in August 2018 when YMC took over monitoring, the directions of NGT up to 5.3.20 and the current status of progress and achievements.

Status as in August 2018.

Although the YMC started its work from August 2018 it was not until the new Vice Chairman DDA took over in mid-October 2018 that the YMC was able to penetrate the organization's labyrinth of official systems despite NGT's clear orders. DDA is arguably the most important stakeholder in a slew of efforts being made to protect and rejuvenate the Yamuna at Delhi. Flood plains play an important role in maintaining the flow of the river, help recharge ground water and provide a habitat for aquatic biodiversity-the most significant sign of a river's health. Because the flood plains are integral to river hydrology, the Expert Committee which gave its report to NGT on 1.8.2014 on the steps needed for demarcation and protection of floodplains had recommended that demarcation and mapping of the 1 in 25 years flood plains both in Delhi and the UP portion of NCR should be done by DDA and the State of Uttar Pradesh. It had recommended total removal of all encroachments and solid waste and reclaiming possession of the floodplains; prohibition of growing agricultural crops and vegetables and permitting only floriculture and tree planting; and the creation of biodiversity parks in four phases. There were recommendations for the creation of constructed wetlands on the flood plains at the outfall points of all drains before they join the river. The Expert Committee's report was treated as a part of NGT's judgment.

The experts had also recommended declaration of river floodplains in the Delhi /UP stretch as an Eco-sensitive river conservation zone under provisions of the Environment (Protection) Act 1986 or the DDA Act, 1957 and the relevant Acts of the State of UP.

When the YMC took over DDA had informed the committee that the 1 in 25 year's floodplains within Delhi had been demarcated. DDA claimed that it had removed encroachments that had mushroomed over 400 acres of land. It reported that more than 17500 cum of malba (C&D waste) has been removed, vehicles had been seized but no data could be was ever furnished to YMC- not even the years when this was done.

YMC observed that there was no strategy for day to day surveillance of illegal activities which were taking place on the flood plains. In the Action Plan dated 22.10.18 the YMC noted that the receptivity to the Committee's questions was routine and did not inspire confidence. The roadmap for future reclamation which had been sought by the YMC was hazy and too broad to enable monitoring in terms of timelines and deliverables. Despite assertions by the DDA that Phase I of the Biodiversity Park has been completed and phase II, III were in the final stages of starting, no tangible plans could be shared by location. This cast doubts on the claims made. Even Phase I had been completed only partially. DDA was also unable to clarify the extent of agricultural activity which was continuing in portions despite there being no Court stay.

Environmental Compensation which was imposed by DDA under Polluter Pays Principle was stated to have been "opposed by the people"-and accepted as ground enough to drop surveillance. YMC could hold no meeting with the Vice Chairman DDA despite a suggestion by the members that they would visit his office at his convenience as the subjects referred by NGT were not receiving attention. Finally, it was only after the joining of the new Vice Chairman DDA in October 2018 that a meeting could be held 8 weeks after the YMC started functioning. Not even phone calls had been responded to by his predecessor which only demonstrates the difficulties faced despite NGT's orders being specific and time-bound. This was reported in YMC's Action Plan 2018.

It is against this disappointing background that YMC struggled for some months but it gives satisfaction to now state that substantial progress has been made judged by how things stood 20 months ago. The matters pertaining to DDA which Hon'ble NGT had entrusted to YMC for being monitored related primarily to (i) DDA's efforts to provide protection to the Yamuna flood plains, (ii) to undertake the reclamation, repossession and preservation of areas on the

flood plain and (iii) to oversee measures being taken to remove illegal habitation or activities which are not conducive to riverine habitat and ecology and (iv) to have the rejuvenation projects put on fast track.

The Chairman of the Principal Committee/ Secretary MoWR, RD&GR (now MoJS) was contacted by the YMC. He was told that many matters including the projects promised by DDA before NGT were not taking off and it was necessary to make up for lost time. It was suggested that since NGT had asked the Principal Committee and the YMC to work in tandem, the VC may be asked to attend a meeting where members of the Expert Committee and YMC would jointly use the opportunity to get a fast track approach adopted by DDA.

The Secretary called a meeting at the request of YMC where of the Principal Committee members addressed various issues which had not been taken forward for years. At the outset he agreed with the recommendations of Monitoring Committee of simultaneously initiating the works of the rejuvenation in all phases and submission of timelines to Monitoring Committee. This was the first time that DDA agreed with the decision and the projects were identified after a Seminar with experts was organized in November 2018.

At the meeting YMC drew the attention of the Principal Committee to the recommendation of the Expert Committee which forms part of the NGT judgment dated 13-01-2015 that the flood plain zone in the Delhi stretch be notified as Eco-Sensitive zone under the Environment (Protection) Act 1986 and for this, the matter be pursued with the Ministry of Environment Forests and Climate Change. In response Secretary, MoWR, RD&GR pointed out that the notification of 7th October 2016 conferring the status of Authority to NMCG gave wide powers to NMCG to prohibit and regulate activities in the river and on the flood plains. Member MC (BSS) had requested that a formal view should be taken by the Principal Committee in its next meeting after consulting the Ministry of EF&CC. These points have not been decided formally and finally by the Ministry of JS. In the context of the need for preserving, restoring, regulating and rejuvenating the Flood plain and in view of DDA's reluctance to deal with all the issues at a

focal point through a SPV, NGT may consider asking NMCG to exercise authority to notify the Yamuna flood plain as an Eco-sensitive Zone in the larger public interest.

Alternately to approach the Ministry of Ministry of Environment Forests and Climate Change to do so. The need to find a permanent solution is discussed under the heading SPV later in this Report.

Progress Achieved

YMC subdivided monitoring efforts into different categories and in its Final Report these are covered as follows:

1. Demarcation of the Flood Plain, progress of important Court cases and vacation of stays; also, the outcome of demolition action undertaken to get encroached areas on the flood plain whether on account of unauthorized construction or agriculture vacated.
2. Enforcement action taken to prevent dumping of solid waste through the installation of CCTVs, use of satellite technology, drones etc. and the resultant action for nabbing and effecting recoveries from trespassing vehicles.
3. Monitoring the progress of ten rejuvenation and bio diversity projects aimed at creating constructed wet lands and other eco-friendly measures to restore and revitalize the flood plains and the river.
4. Suggestion of YMC to create a focal point whether named an SPV, or any other nomenclature, to give single minded attention to the protection and proper management of a relatively small but culturally important segment of the river flood plain starting from the Old Railway Bridge to Majnu ka Tila and the need to manage this segment which is next to the river and presently having unregulated entry as an integrated area for public benefit.

Progress on NGT's orders on these four categories has been covered hereinafter:

Status in August 2018

1. (i) Demarcation of the Yamuna Flood the Plain

At the YMC took over DDA had been repeatedly giving assurances to NGT that the entire one in 25 years flood plain had been demarcated. On visits YMC found that there were no identifiable physical boundaries anywhere. In the absence of physical demarcation, DDA was relying on blue prints and maps in the office and occasional signages but without there being a continuous and dependable way of identifying the physical landmarks. DDA had already, in compliance of NGT's direction, adopted the 2011 High Flood Line at 206 meters as a base-line for demarcating the one in 25-year floodplain. This had been made on the recommendations of IIT Delhi and got prepared through the Geospatial Delhi Limited Company (GSDL) set up by Government of Delhi, but prepared under the aegis of the Irrigation & Flood Control Department of GNCT. Although the initiative can be used for different applications, by itself it is not a tool which can protect the flood plain from encroachment-much less to fix accountability for different stretches. The state of helplessness in confronting the need for physical demarcation was palpable.

During spot visits undertaken YMC saw large-scale encroachments taking place which were visible but were not being stopped by DDA, Police or MCD. In early meetings there was an admission that the problem was extensive but no one felt it was critical to stop the intrusion. The Horticulture and Engineering wings of DDA did not speak in one voice even as the encroachments continued to grow, a fact confirmed by the local police, passersby and petitioners before NGT who had approached YMC. Officers never came prepared for the YMC's reviews for which detailed agenda notes were issued in advance. At most places there were no pillars or bollards erected on the floodplain to understand which portion of land was within the flood plain and which lay outside.

The occasional signage boards which had been erected were mostly dilapidated and rusted at most places. They were not acting as a deterrent to prevent encroachment or pollution and the fact that violation would lead to no punitive action was widely known. It was therefore essential that the demarcation of the one in 25 years flood plain from Wazirabad to Jaitpur was got done in a way that was resilient and easily discernible with signposts which could not be obliterated or vandalized.

YMC had given several directions to DDA as a part of the monitoring efforts and reported the prevailing conditions to NGT. DDA started taking action and by 28.8.19 the installation of bollards had begun. Once NGT supported the YMC in its order dated 11.9.19, the work was expedited. Today the flood plains stretching from Wazirabad to Hazrat Nizamuddin and Sundial to Dhobi Ghat now stands demarcated by providing $349 + 242 = 591$ bollards respectively at both stretches. Photographs are at **Annexure C-2/1**.

The YMC has seen the bollards which are made of cement concrete and are encased on a foundation going underground which cannot be removed. The tender document had included the provision of flags alongside the bollards and once the flags go up these will be clearly visible and would reduce chances of encroachment. The DDA reported that the entire flood plain now stands demarcated by providing bollards at a distance of 70- 100 meters between each bollard. The physical signage boards are under fabrication and will be up to a vertical height of 9 meters with the flags at a height of 6 meters. The tender for installation for signage boards has been awarded on 6.2.2020.

NGT may consider directing that the area Chief Engineer undertakes foot marches along the bollards in his jurisdiction and even small encroachments are removed there and then. The Vice Chairman may be asked to get a signed compliance from each area in-charge every month and to report unwanted activity or encroachments.

(ii) Repossession of land given to other Departments.

DDA has reported that 12.11 hectares of land has been repossessed from DMRC and 7.5 hectares is in the process of being handed over to DDA although the custody continues presently with DMRC. This process needs to be completed by July 31st 2020. DDA has not given any update on other pockets of land allotted to PWD, Power Department, DMRC, NCERT and Forest Department. The completion of handing over by DMRC and other Departments needs follow up.

(iii) 1972 case of disputed land on UP side.

This Court case has been continuing from 1972 and refers to a tract of approximately 323 Hectares and had been referred by YMC in its earlier reports. In a case of State of U.P. v/s DDA and others, execution no. 45449/2016. DDA has reported that the case came up on 22.4.19 before the court of Sh. Harleen Singh, Session Court Judge (SCJ)/ RC (East) at Karkarduma Court due to non-compliance of order dated 19.12.2018 till 26.3.2019 on the part of decree holder (Private party). On 16.5.2019 the decree holder filed an application under section 151 CPC for recalling the order dated 22.4.19 and the Court issued notice and directed the Decree Holder to file the process fee. The matter was last to be listed on 22.3.2020 but because of the lockdown the case was adjourned to 5.6.2020. The next hearing is in July.

DDA has been told to have an effective presence in the Court. In the past contradictory responses have been coming and the Horticulture Department does not seem to be having any connection with the Court case which is handled by the Lands Department or Legal side but none the less it is the Horticulture Department which has been attending YMC meetings. The YMC had even suggested to the former VC DDA and the E-in-C of UP to try for an out of court settlement as precious publicly owned land has been left without retrieval from private possession for nearly 50 years. Even in the latest report dated June 2020 there is no mention of the matter except to state that the final judgment is expected on the next date.

YMC has brought a subject involving vast tracts of land to the front burner but even in mid-June 2020 there is haziness as one arm of DDA does not seem to speak to the other. NGT may kindly consider directing that a status report be filed by the Vice Chairman DDA after he has gone into the case because there is no clarity on the matter even within DDA or as related to UP.

(iv) Payment of Rs 35 crores by UP Irrigation to the DDA to take up rejuvenation work on the UP side of the river.

This matter had been reported by YMC to the NGT because it was getting delayed. The YMC in its report dated 5.2.2020 had stated:

“Flood Plain Rejuvenation: 167 Hectare flood plain of river Yamuna falling within UP is proposed to be rejuvenated by creating wetlands and biodiversity parks through DDA and funds for this purpose has been agreed to be provided by the state of UP. in the meeting held on 30.12.19, the Engineer in Chief UP Irrigation Department informed the YMC that the Finance department has since concurred in the payment of Rs. 35 crores to DDA for flood plain rejuvenation as a deposit work on the lines of 10 projects that are being implemented by DDA on flood plains under its control.”

“The DDA has on its part already completed the tendering process and once funds are received from the state of UP, the implementation of flood plain rejuvenation activities as per the project prepared by DDA can commence on the ground. YMC will monitor this.”

The E-in-C UP State I&F informed YMC that after receipt of the detailed estimate from DDA and after undertaking independent scrutiny, the Technical Committee of UP Irrigation had since cleared the estimate for Rs 35 crores which would now be forwarded to the State Secretariat for approval of Finance Department and thereafter the State Cabinet. All this was stated to take about three months. The MC reminded the E-in-C that in terms of NGT's order dated 11.9.19 the work must commence before 31.12.19, and therefore the state Government must expedite the approval and release funds to the DDA at the earliest, preferably within one month.

In the meantime, DDA was asked by YMC to proceed with their Internal technical approvals and even release the NIT in anticipation of receipt of funds from UP.

As of June 2020, the funds have not been placed at the disposal of the DDA by UP Irrigation. The VC and the Chief Engineer DDA have sent regular reminders to the UP Government on 13.9.19, 17.9.19 and 21.2.2020. The YMC had called UP Govt. representatives and the E-in-C had committed in November 2019 that it was just a matter of days to get permission of the Chief Minister but the money has not been released even now which was reported in the YMC's report dated 5.2.20. This is an important matter directly and wholly connected with rejuvenation of the Yamuna. Already more than one and half years have gone just in official correspondence.

Hon'ble NGT is requested to direct that the work should start and to consider passing strictures against the officials who handled the case in UP Irrigation for giving assurances to the YMC which have been forgotten after the meeting. The work should start as it is connected with rejuvenation and UP authorities are delaying transfer of funds. NGT may consider passing an appropriate order as this is not a new matter and is being delayed unnecessarily.

(v) Retrieval of land under cultivation and dairying

During the period 2018 up to September 2019, 352.36 hectare land has been cleared of encroachment. This is sizeable and the land now stands retrieved. A considerable portion of this land is related to the ten projects being undertaken by DDA. While this has been achieved, a much larger tract remains to be reclaimed.

DDA's present Plan for removal of encroachments:

DDA has stated that the encroached area is proposed to be got vacated when the implementation of the projects starts so that the area is immediately occupied and work is started immediately on the eviction of encroachments, as has been done previously. YMC feels this is only a means of parrying what was directed to be done by NGT. With the delays in project execution which DDA itself has referred to repeatedly and the non-availability of labour the timelines for the commencement of all projects and their completion appear to be quite elastic. To allow private agriculturists to continue to use publicly owned land does not appear to be defensible. It will be seen that in four villages there are 954 hectares of land under agricultural encroachment. DDA has given no plan or timelines or explained difficulties in reclaiming this land which is not linked to litigation. All that the officers have been telling YMC is that it lies with the Lands Division to take action and not with Horticulture. The whole exercise of demarcating the floodplains with boundary pillars would be rendered futile if DDA does not reclaim the land. NGT may consider giving the new Vice Chairman 3 months to review the status of all these pockets of land which are not under litigation and prepare a detailed action plan to retrieve the land and to either hand it to the forest department or take up plantation. A report in this regard may be asked to be filed as presently despite rigorous monitoring this matter is being treated routinely.

The statement below would show the total land under agriculture and its early repossession requires oversight of DDA's plans and implementation.

S.No.	Description	Area in Hectares
1	- Land falling in Yamuna Plain both side of Yamuna River in four villages Le., Bela, Inderpat, Chiragah Janubi & Chiragah Shurnali.	1108.8 Ha.
2	-Land transferred to Forest Deptt.	279.23 Ha.
3	-Land reclaimed	352.36 Ha.
4	'A' Land pockets under encroachment and agricultural use.	954.24 Ha.
5	'B' Land pockets under litigation (Four Court cases)	5.26 Ha.
6	Total land under encroachment (A+B)	959.50 a.

2. Enforcement action taken to prevent dumping of solid waste

(i) Security of flood Plain and Installation of CCTVs

YMC had asked for 100 security guards in addition to the existing 100 to be deployed. The DDA states that now that they have closed the entry point's engagement of an additional 40 more security guards has been approved and the tender for engaging them has issued. A Quick Response Team has been entrusted with the work of guarding the flood plains till the new private security guards are in position. The effort to engage ex-serviceman from Army Placement Organisation which had been committed did not fructify.

(ii) As far as issue of challans is concerned in the last report the YMC had reported 170 challans had been issued and a recovery of Rs. 4lakhs had been made. The data has been shared with the State Transport Commissioners as the violators refused to pay Environmental compensation levied on the vehicle owners and 23 vehicles have been challaned. The present position is that 190 challans for Rs. 50,000 each have been issued against violators and reported to the Transport Commissioners of the concerned states along with the vehicle registration numbers. Now cumulatively Rs. 5 lacs have been realized. Since the number of vehicles

proceeded against remains the same it is apparent that no fresh vehicles have been seized for dumping solid waste. DDA is now taking the stand that there is no dumping because the messages on loudspeakers are given before the trucks try to enter the area. This claim will need to be checked periodically because in the case of the area under Nizamuddin Bridge, it was an NGO which brought to the notice of the YMC that large scale dumping was going on and it was only after YMC had intervened several times did 2600 cum of C&D waste at the Hazrat Nizamuddin bridge opposite Sarai Kale Khan get lifted and sent to IL&FS site at Shastri Park. Another 2000 Cum. C & D waste was lifted from stretch from Wazirabad to Shastri Park.

DDA is now taking the stand that there is no dumping because the messages on loudspeakers are given before the trucks try to enter the area.

When asked how the colossal dumping at Nizamuddin bridge was not noticed by DDA despite the presence of Security guards and CCTV cameras the response was that this area does not have CCTVs. Therefore there is a need for third party oversight because with reduced plying of trucks dumping solid waste, it is possible that the CCTV surveillance may fall into disuse. As it is only 36 CCTVs have been installed and the remainder of 66 CCTVs is still to be completed.

It is recommended that an NGO working in the area of river ecology and rejuvenation should be engaged to give feedback. YMC suggests entrusting the work of generating photos along with the location to an NGO as such bodies are very active on Twitter and until now YMC has been receiving and responding by referring to detailed complaints on Twitter.

It is unlikely that this will be carried out by DDA as the handling of DDA's Twitter account is generally unresponsive. It is best that the Vice Chairman institutes a system of directly receiving flood plain related waste dumping and encroachment Twitter messages on the in his office. It is recommended that NGT directs the DDA to certify that there are now no portions of the flood plains outside CCTV or security coverage and to consider giving watch and ward responsibility to a reputed NGO if they work on nominal payment or pro-bono.

(i) Demolition Action for the Removal of illegal encroachment:

A drive to remove the illegal cultivation by encroachers had been taken up and till 7.01.2020, and 352.36 Ha. of land has been evicted & repossessed from the illegal cultivation. There are 954 hectares under encroachment and agricultural use. YMC has been following up

on this relentlessly but in 20 months no plan for eviction has been given To link it with new projects is not an acceptable alternative and it creates suspicion that the plan is to go slow.

Physical Progress of Works under Restoration and Rejuvenation of Yamuna River Flood Plains

S.No.	Name of Project/Work	Physical progress as on 05.02.2020	Physical progress as on 15.06.2020	Physical progress made since previous report (05.02.2020).
1	Installations of bollards for demarcation of flood plains	100 Bollards installed	591 Bollards installed	491 Bollards installed
2	Installation of signages and flags	0%	15%	15%
3	Installation of CCTV System	50%	60%	10%
10 Projects of Restoration and rejuvenation of Flood Plains :				
1	Old Railway Bridge to ITO Barrage (Eastern Bank) - Asita East	40%	50%	10% more work executed.
2	NH24 to DND Flyway (Western Bank)	10%	40%	30%. more work executed.
3	DND to proposed Kalindi By-pass (Western Bank) – Khijrabad	10%	15%	5% more work executed.
4	Old Railway Bridge to ITO Barrage (Western Bank)- Asita West	The drawings prepared, estimate framed & under scrutiny for accord of Administrative Approval and Expenditure Sanction (A/A & E/S).	Estimate resubmitted after incorporating modifications in the estimate for accord of Administrative approval and expenditure sanction.	Modified estimate prepared.
5	Geeta Colony Bridge to ITO Barrage (Western Bank) Eco-Tourism Bundh	Soil and water samples collected for testing	Report received and matter is under deliberations.	Report received
6	NH-24 to DND Flyway (Eastern Bank) Part Area- I	Design development work is under progress.	Design development done. Preparation	Design work completed

			of estimate is under progress.	
7	NH-24 to DND Flyway (Eastern Bank) Part Area- II- Hindon Cut Wetlands I&II	0%	0%	No progress.
8	Wazirabad Barrage to ISBT Bridge (Eastern Bank) around GarhiMandu Village &Usmanpur Village	Design development of the entire area is under process.	Design development of the entire area has been completed and landscape design have been issued and preliminary estimate has been prepared and is under scrutiny.	Design report prepared and preliminary estimate framed.
9	Wazirabad to Old Railway Bridge (Western Bank)	Drawings for Qudsia Ghat have been issued and estimate is under preperation.	Estimate prepared and submitted for accord of administrative approval and expenditure sanction (AA&ES)	Estimate prepared.
10	ITO to NH-24 (Eastern Bank)- Area south of Commonwealth Games Village Area	Preliminary estimate for works are under scrutiny	Preliminary estimates for works of the area resubmitted after incorporating the modifications and suggestions suggested by headoffice now it is under scrutiny.	modified estimate prepared.

NGT may consider directing that a plan for eviction of those possessing the land and where there are no court stays be prepared. DDA needs to be reprimanded for evading doing this

for so long .Without a plan the agriculturists will only get more strength to ward off reclamation efforts whenever these are mounted.

3. Progress of ten projects aimed at creating constructed wet lands and other eco-friendly measures undertaken by DDA to restore and rejuvenate the flood plains.

- I. Wazirabad to Old Railway Bridge (Western Bank) QUDESIA GHAT- expected completion date was June'20 which have now been extended to 30.6.2021 due to Covid and non-availability of labour.
- II. Wazirabad Barrage to ISBT Bridge (Eastern Bank) around Garhi Mandu Village & Usmanpur Village- expected completion date was September'20 which have now been extended to 31.7.2021 due to Covid and non-availability of labour.
- III. Old Railway Bridge to ITO Barrage(Western Bank) Asita West- expected completion date was January'21 which have now been extended to 30.6.2021 due to Covid and non-availability of labour.
- IV. Geeta Colony Bridge to ITO Barrage(Western Bank) expected completion date was January'22 which have now been extended to 31.7.2022 due to Covid and non-availability of labour.
- V. Old Railway Bridge to ITO Barrage (Eastern Bank) - expected completion date was March'20 which have now been extended to 15.9.2020 due to Covid and non-availability of labour.
- VI. ITO to NH-24 (Eastern Bank)- Area south of Commonwealth Games Village expected completion date was January'21 which have now been extended to 31.7.2021 due to Covid and non-availability of labour.
- VII. NH-24 to DND Flyway (Eastern Bank) Part Area- II- expected completion date was July'20 which have now been extended to 30.9.2020 due to Covid and non-availability of labour. (subject to resolving a land ownership dispute at Chacchilla village).
- VIII. NH-24 to DND Flyway (Eastern Bank) Part Area- I- expected completion date was January'21 which have now been extended to 15.6.2021 due to Covid and non-availability of labour.

- IX. DND to proposed Kalindi By-pass (Western Bank) – Khijrabad expected completion date was December'19 which have now been extended to 31.12.2020 due to Covid and non-availability of labour.
- X. NH24 to DND Flyway (Western Bank)- expected completion date was May'20 which have now been extended to 30.9.2020 due to Covid and non-availability of labour.

Details of above projects is placed at **Annexure C-2/2**

In all 10 projects YMC had been monitoring in depth and had visited the areas as late as March 2020. The progress was satisfactory and in fact it was quite inspiring to see how much had been achieved. But the Lockdown and non-availability of labour has made the future timelines look elastic. NGT is requested to entrust the monitoring of future work to some responsible entity as the unforeseen events has no doubt given a legitimate cause for delay but unless there is oversight the momentum built up may slow down indefinitely.

4. Setting up an SPV

NGT in the order has directed as follows:-

“The DDA may constitute a Special Purpose Vehicle (SPV) preferably within two weeks from today for rejuvenation of river Yamuna. The functions of such entity will include ecological restoration of the flood plain zones, setting up of bio-diversity parks, artificial wetlands, and phytoremediation of drains at the river mouth locations, maintaining the vigil and undertaking flow measurement, creating ecological services, removing encroachments and undertaking other activities, including river front development. It may also take steps to attract and educate the citizens and nature enthusiasts for nature related activities, including building environmental temper amongst citizenry, without in any manner causing any damage to the flood plains”.

Initially the DDA took the view that setting up an Authority within an Authority was not possible but it agreed to the creation of an SPV. In its reply dated 17.2.2020 it had been stated that DDA would be setting up SPV. In the latest reply through email dated 10.6.2020 it has stated that there is no provision in the DDA Act to constitute a society or SPV or to delegate its powers to any entity or a person. It has reneged on a written commitment taking shelter of a legal

opinion. An application has been filed by DDA before NGT. *In its latest reply, DDA states that it is still the land owning agency and the management of the area would be entrusted to an officer /wing.*

In the order of the NGT dated 5.3.20 the direction was to set up an SPV, which had been agreed by DDA. The recommendation of YMC in so far as the SPV model was concerned was to cover a relatively compact area with heterogeneous activities and heavy footfalls. NGT in the order dated 5.3.20 had broadened the concept to the proposed SPV taking over the protection, rejuvenation and management of the entire Yamuna Flood Plain starting from entry into Delhi at Wazirabad right up to the exit of the river from the city.

NGT's order had envisaged and directed that a larger entity should be created which would additionally subsume all monitoring activities. After the order of NGT which envisages a much larger vision, DDA has responded that nothing would be possible except to depute an officer or a wing of DDA office to whom responsibility for managing the area shall be entrusted. YMC feels this solution will not meet the objective set out in the NGT's order dated 5.3.20 and an officer or a Wing of DDA would not be able to exercise the sweeping authority the situation demands.

YMC's suggestion to set up an SPV or some other entity was to enable the body to pay constant attention to specific areas in a stretch of around 3 kilometers alongside the river where there are heavy footfalls and where encroachments have altered the river front's ecology. The idea was that this smaller SPV, at the operational level, would be responsible for upkeep, regulation of entry to the public and management of amenities within the entire complex stretching over a maximum length of 2.5 to 3 Kms from Old Railway Bridge to Majnu Ka Tila. This is very small stretch compared to the entire river which is 48 kilometers in length. The suggestion for this limited stretch was made by YMC for the following reasons:

- A. That it is an area which has got immense cultural and religious significance.
- B. That the Ghats are numerous and are both under Private and Government ownership.

- C. Footfalls on specific dates and timings are in excess of the carrying capacity of the area which is on the tip of the river and uncontrolled human activity leads to pollution of different kinds.
- D. DDA has already developed different pockets within this entire area comprising of a DDA park and a forested area has been fenced in. But there is no common approach or continuity between different areas and in the absence of proper integrated management a culturally significant area next to the river has lost its character altogether.

An SPV for this comparatively small stretch would have had continuous stake in its proper management and the development aspects could have been dovetailed with the enforcement aspects- both needing to be handled together. The small stretch is unique and has to be managed as a place of cultural interest but regulated on the lines of how monuments are regulated by ASI. It is in that context that YMC had referred to the management of Red Fort which has been outsourced by ASI only for management purposes but under the strict oversight of the DG ASI. It involves no leasing of land or control thereof.

For this comparatively small stretch DDA had accepted the SPV suggestion but has now backed down taking shelter behind a recent legal interpretation.

NGT expects that the new entity will undertake ecological restoration of the flood plain zones, set up of bio-diversity parks, artificial wetlands, and undertake phytoremediation of drains at the river mouth locations. It will maintain vigil and undertaking flow measurement, creating ecological services, remove encroachments and undertake other activities, including river front development. It may also take steps to attract and educate the citizens and nature enthusiasts for nature related activities, including building environmental temper amongst citizenry, without in any manner causing any damage to the flood plains.

If the SPV is negated and the entire flood plain, including the management of land, afforestation, regulation at the ghats, oversight of the religious and cultural bodies, court cases, demolition action, security and surveillance of the flood plain and completion of the biodiversity projects is entrusted to an officer or a Wing of DDA the outcome can be calamitous. Land is extremely valuable and no officer or wing can monitor the activities on the entire flood plain. The experience of laxity and apathy which was encountered by YMC gives an indication of what

happens when issues of land protection, rejuvenation, reclamation and legal ownership are left to departmental control. Two expert committees have elaborated on the issues in detail and YMC has brought many pending matters on the front burner and had them converted into implementation mode. A new oversight body will require authority, clout and imagination to fulfill the vision of NGT. In its letter dated 14.2.20 YMC had given the entire history of various committees set up by Government of India over some 15 years. Even such high powered bodies have not been able to give the direction that they had authority to get implemented and to relegate this back to a wing of DDA would be a travesty. Seeing the track record of delays and prevarication that has beset the way DDA has handled its responsibilities right from 2015 YMC advises that the subject be revisited.

Whatever be the ultimate contours of the future monitoring of activities on the flood plain there is a need to have a constant vigil on land issues, rejuvenation and bio-diversity projects and the effectiveness of enforcement measures. It requires constant follow up with numerous offices not only within DDA but outside. If left to be handled by DDA it will put the clock back after considerable progress has been made on several fronts. The tempo gained must not get an opportunity to slow down.

Directions Sought from NGT

1. Demarcation : NGT may consider directing that the area Chief Engineer undertakes foot marches along the bollards in his jurisdiction and even small encroachments are removed there and then. The Vice Chairman may be asked to get a signed compliance from each area in-charge every month.
2. Land allotted by DDA to other Departments. The completion of handing over by DMRC and other Departments needs follow up. A firm direction to complete the process in 3 months is needed.
3. 48 year old Court Matter involving vast tracts of land. NGT may kindly consider directing that a status report be filed by the Vice Chairman DDA after he has gone into the case.
4. UP delay in making payment to DDA: Hon'ble NGT is requested to direct that the work should start and to consider passing strictures against the officials who handled the case in UP Irrigation for giving assurances to the YMC which have been forgotten after the

meeting. The work should start as it is connected with rejuvenation and UP authorities are delaying transfer of funds. NGT may consider passing an appropriate order as this is not a new matter and is being delayed unnecessarily.

5. 954 hectares are still under cultivation :NGT may consider directing that a plan for eviction of those possessing the land and where there are no court stays be prepared. DDA needs to be reprimanded for evading doing this for so long .Without a plan the agriculturists will only get more strength to ward off reclamation efforts whenever these are mounted.
6. Surveillance to Prevent Dumping :It is recommended that NGT directs the DDA to certify that there are now no portions of the flood plains outside CCTV or security coverage and to consider giving watch and ward responsibility to a reputed NGO if they work on nominal payment or pro-bono.
7. Progress of 10 projects for Rejuvenation NGT is requested to entrust the monitoring of future work to some responsible entity as the unforeseen events has no doubt given a legitimate cause for delay but unless there is oversight the momentum built up may slow down indefinitely.
8. SPV :

Part A:It is urged that the management of a relatively small area from Old Railway Bridge to Majnu Ka Tila which YMC had referred to in all its reports may be entrusted for integrated management in public interest. It is very necessary that the present truncated management both public and private leading to haphazard activities are brought under a unified, cohesive structure for coordination. This needs to have representation from DDA, MCD (North,) Police, either the Delhi Government's Department of Art and Culture or an arm of the Union Ministry of Culture and some reputable NGOs to plan to make this an integrated area to promote cultural/ religious and historical interest but managed as a whole without ownership of land changing.

Part B: NGT has given its vision of an SPV which would be all encompassing for the entire flood plain. The YMC's only comment is to flag the need for the tempo built up not to be slowed down in the process.

Chapter - 3

Quality of River water

River Yamuna flows through 54 KM of Delhi territory from Palla to Badarpur. However, the stretch between Wazirabad and Okhla, extending over 22 KM, which is less than 2% of the total length of 1370 KM of the river from Yamunotri to Allahabad, accounts for about 76% of the pollution in the river. During the dry season, spreading over nearly nine months of the year, the river has no fresh water downstream of Wazirabad and the only flow available is sewage, both treated and untreated, flowing through 22 drains that join the river Yamuna all through its journey from end to end within Delhi. NGT has in its various orders since 13.1.15 directed setting up of Sewage Treatment Plants (STPs), Common Effluent Treatment Plants (CETPs) and several other measures like trapping of drains so that untreated wastewater does not find its way into storm water drains which eventually join the river. Directions have also been given to the CPCB and DPCC to monitor the river quality on a regular basis to ascertain if the water quality in the river is meeting standards laid down by the CPCB.

NGT's order dated 26.7.18

"xii. The mandate of the Monitoring Committee is to ensure requisite level of standard of water at the entry point and the exit point of river Yamuna as well as the drains which meet river Yamuna so that there are no pollutants beyond the determined standards."

NGT's order dated 11.9.19:

"Monthly reports on the water quality be furnished by DPCC to the Monitoring Committee which must also contain data on Faecal coliform and till the time DPCC establishes its own laboratory network, the samples may be got analysed either from CPCB laboratory or other accredited laboratory with respect to aforesaid parameter. Such reports must be placed on the website of DPCC and CPCB."

NGT's order dated 5.3.20:

A joint Committee comprising CPCB, NMCG, NEERI, IIT Roorkee and IIT Delhi may assess damage to environment, in monetary terms after the date of order of this Tribunal 13.01.2015, on account

of degradation of river Yamuna, by continued inaction of the authorities in Delhi, Haryana (from Hathanikund till entry in State of UP), U.P. (upto Mathura), within three months from today. CPCB will be the nodal agency for coordination and compliance. The Committee will be at liberty to take such assistance from any individual(s)/institutions as may be necessary.

Status as in August 2018

As per the report of CPCB (2017) the river receives about 3911 MLD of sewage, which includes industrial effluent. Out of this Delhi alone contributes about 3270 MLD (reckoning 80% of water supplied as sewage), and has a BOD at Okhla ranging from 31mg/L to 64mg/L with virtually no DO and Total Coliform level varying from 1.3 million to 16 million MPN/100ml. The limits prescribed by CPCB for the Delhi stretch are 3 mg/L and 5000 MPN/100ml for DO and Total coliform respectively.

Progress achieved by the YMC:

Improvement in the quality of the river water is linked to the twin factors of maintaining a minimum flow of fresh water and reduction in the discharge of polluted water, both domestic and industrial, joining the river. Although covered in detail under Chapter I, at the initiative of YMC, an E- flow study which assessed the fresh water flows required for sustaining aquatic life in the river and also for dilution, was commissioned by MoJS and the draft report has since been received. Regarding containment of pollution ISP project which seeks to trap and treat sewage 242 MGD (1100 MLD) flowing in drains has been completed about 98% but the commissioning of the STPs has been delayed, some of which are expected to be commissioned only by December 2022. There is also delay on the part of State of Haryana and UP to set up STPs in the respective states resulting in flow of substantial volume of sewage in Najafgarh and Shahdara drains. The details of STPs are discussed in the relevant chapters for greater clarity on the steps underway by each state.

a) High levels of Ammonical Nitrogen in River Yamuna:

The DJB has raised the issue of intermittent pollution, including high levels of Ammonical Nitrogen in the river at Wazirabad causing disruption in drinking water supply to Delhi. On receipt

of the report from CE, DJB on 03.12.18 and a report published in Hindustan Times of 03.12.18, the YMC alerted the Chief Secretaries of Haryana and Delhi and followed up with a letter dated 03.12.18 asking them to hold a meeting and identify the sources of such high levels of Ammonia, take corrective action and also evolve an institutional mechanism including preparing a Standard Operating Procedure to deal with such emergencies caused by high levels of toxicity in drinking water which can have a major health impact on the residents of the capital city.

To identify source of high Ammonical Nitrogen, YMC also ordered a Committee of CPCB and NEERI scientists to inspect and submit a report on the sources of such pollution. Based on the report of the Committee, directions were issued to CPCB and HSPCB to take action against the distillery M/s RSL Distillery identified by the Committee. CPCB has also been directed to ensure that all the STPs and ETPs of Grossly Polluting Industries in Haryana are connected online to the CPCB server and effective monitoring done to locate the point sources of pollution in the river, well in advance.

During the meetings of YMC with CPCB and DPCC it also transpired that though CPCB had set up two Online Monitoring Stations at Wazirabad and Okhla but none of them were being run properly. DPCC volunteered to take over these for proper maintenance. In addition DPCC installed a new station at Palla for the purpose of advance alert on the quality of water at Palla particularly when the Ammonical Nitrogen level rises abnormally high to affect drinking water quality at Wazirabad. Therefore, after discussion with CPCB and DPCC, the YMC also ordered DPCC to take over the real time On line Monitoring Stations for measuring water quality parameters like pH, TSS, BOD, DO and Ammonical Nitrogen, with a view to giving early alert to the DJB about the presence of pollutants in the river water so that pre-emptive action can be taken to guard against the pollution of raw water being treated at the Water treatment Plan supplying drinking water to Delhi. All the stations are functional.

DPCC has nine water quality monitoring stations in Delhi for monitoring water quality in river Yamuna at Palla, Surghat(downstream of Wazirabad), Khajoori Palto on Pul (downstream of Nazafgarh drain), Qudesia Ghat, ITO bridge, Nizamuddin bridge, Agra Canal (Okhla), after meeting Shahdara drain(Downstream of Okhla) and at Agra Canal(Jaitpur). The parameters monitored are

pH, TSS, BOD, DO, COD, Ammonical Nitrogen, Phosphates (as P) which are recorded and a monthly report is generated and displayed on the website of DPCC. Separately, CPCB has also set up 5 water quality monitoring stations at Palla, Nizamuddin, Agra Canal at KalindiKunj, Okhla (downstream) and Agra Canal at Badarpur. The testing is done once a month and the report is displayed on the website of CPCB. The CPCB additionally generates reports on Faecal Coliform and Total Coliform. Month wise reports for different years are available on the websites of both the DPCC and CPCB. On the directions of NGT, DPCC has also set up laboratory facility for testing Total and Fecal Coliform in February 2020. All the data displayed on the website of DPCC is linked to the Website of CPCB.

b) Pollution levels in drains

The YMC has also received comparative drain data both of flow and BOD load discharged into the river Yamuna. The comparative figures of 2017, 2018 and 2019 are placed at **Annexure C-3/1**. It will be noticed that although the discharge into river Yamuna from various drains has reduced from 3450 MLD in 2017 to 3026 MLD in 2019, the reduction in BOD load per day is only marginal though there was substantial decline of 20.53% TPD during 2018 in comparison to 2017. The BOD load per day reduction in 2019 in comparison to 2018 is 48.66 TPD.

c) Action by YMC on Media reports

A number of reports in electronic media and social media circulated during the lockdown showed substantial improvement in the river quality. In order to assess the veracity of the claims and to identify the causes of improvement in water quality, the YMC vide Whatsapp messages dated 4.4.20 and 5.4.20 asked the CPCB and DPCC to collect samples and give a detailed report after analyzing the factors responsible for improvement in river quality, if any noticed. The Report of CPCB and DPCC received are available on the website of the YMC. Both the reports indicated definite improvement in DO and considerable reduction in BOD and COD, though the degree of improvement was different at different points of measurement. The causes for improvement identified were the increased discharge of fresh water in the river downstream of Wazirabad. CPCB report indicated that compared to pre-lock down period the discharge of fresh water was almost five-fold more after lockdown and decrease in industrial pollution, particularly closure of

all the industries operating in household areas and those in the industrial clusters. (**CPCB report placed at Annexure-C-3/2**)

d) Damage Assessment by Joint Team constituted by NGT:

Pursuant to the directions of NGT in order dated 5.3.20 constituting a Joint Committee comprising CPCB, NMCG, NEERI, IIT Delhi and IIT Roorkee to assess damage to the environment in monetary terms on account of degradation of river Yamuna by continued inaction of the authorities in Delhi, Haryana (from Hathnikund till entry in state of U.P), UP (upto Mathura) within three months from 05.03.2020, the CPCB has informed that after receipt of nominations in April 2020, first meeting of the Committee was held on 06.05. 2020 through VC under the Chairmanship of Shri. D.P Mathuria, ED (Technical), NMCG. The CPCB informed that damage assessment due to non- compliance of directions of the Tribunal is being done in consultation with all the stakeholders after assessing the level of non- compliance and the continuing pollution of river Yamuna. The status of implementation of various directions of the Tribunal pertaining to containment of sewage and industrial effluent flowing into the river, e flow and protection and rejuvenation of floodplains is discussed in the fourteen Chapters of this report. Though the Committee was asked to submit damage assessment report within 3 months, the work of the Committee, as informed by CPCB, is hampered due to the lockdown imposed due to Covid19 pandemic.

It is thus undisputed that for river rejuvenation availability of fresh water in substantial quantity and closure of the industries operating from households which release toxic effluents into the drains without any treatment is essential. With no flow in the river downstream of Wazirabad, more than 3000 MLD of sewage (both treated and untreated) released into the river with a BOD level in excess of 30 mg/L and virtually zero DO for most part of the year, there is no scope for any dilution which can improve the quality significantly. In the short and medium term, therefore, there appears to be no possibility of achieving a BOD level of 3 mg/L for a C Class river as categorized by the CPCB. While the commissioning of ISP, and installation and up gradation of STPs, trapping of sewage flowing in the drains and effective septage management will definitely bring improvement in the river water quality but for the river to ever reach bathing standards as

prescribed by CPCB availability of fresh water is critical. And the measures for pollution control cannot be limited to Delhi but also the state of Haryana and UP, which contribute significant amount of waste water, both sewage and industrial effluent, in to the river. Hence the E- flow and taking measures for water conservation in the upper riparian states Haryana and UP are vital for rejuvenation of the river. The incremental change in the quality parameters of river water should be monitored by the CPCB and DPCC consequent to commissioning of the Interceptor Sewer projects, setting up or upgrading the STPs and other connected activities like septage management, trapping of drains, creation of biodiversity parks and wetlands on the flood plains.

Directions requested from NGT:

1. CPCB in collaboration with DPCC should bring out a monthly report on the quality of river Yamuna and display it on the Website of CPCB for public information. The Report should be compiled after assimilating and incorporating the test reports of DPCC which maintains nine stations so that there is no variance between the reports of the two organizations. At present the independent reports generated by the two regulatory bodies are difficult to reconcile and can create confusion in the mind of the public and media.
2. The River Front and River Conservation Authority as a SPV which the NGT has directed to be created should be given the mandate to closely and periodically monitor the river Quality and submit periodic report to the Tribunal and also bring out an annual report in the public domain.
3. CPCB be directed to submit damage assessment report without any further loss of time. Considering the disruption caused due to the lockdown, a two-month extension to the Committee to submit their report is recommended.
4. It is abundantly clear that rejuvenation of the River Yamuna is within reach if the flow of the river is sustained and the polluting industries closed down. The experience during the Lockdown period when unrelated to the closure, extra water was released, shows what a huge difference heightened flow can make. Although industries were closed sewage was being discharged in the drains and river and septage management by itself was not substantial enough to make such a big difference. The conclusion that is self-evident is

the fact that increased flow and closure of industries-both in conforming areas and in the non- conforming areas had contributed despite the presence of sewage as was prevalent as usual. For the health of the river more water is needed. There is every need to revisit the water sharing agreement and incentivize less water intensive crops to conserve it. Use of less water intensive crops and other conservation measures was a task given to the National Institute of Hydrology as a part of E flow study which the Institute must suggest.

Chapter – 4

Sewage Treatment Plants (STPs)

Treatment of sewage by setting up sewage treatment plants, their up-gradation from time to time and their smooth functioning to ensure that they achieve the prescribed environmental standards for release of treated water into the river and water bodies have been the key directions issued by the NGT in its judgment dated 13.1.15 and reiterated in its various orders from time to time thereafter. These were summed up in the Tribunals order dated 25.7.18 and 26.7.18. After reviewing the Second Interim Report of the YMC, the Hon'ble Tribunal passed the following directions:

Directions of the Hon'ble National Green Tribunal (NGT) dated 11.9.19

- a) DJB has to give definite milestones and timelines to bridge the gap in terms of poor capacity initialization within one month.*
- b) The DJB to prepare an Action Plan with timelines for better capacity utilization of STPs by tapping the drain as a short term measure to reduce pollution in River Yamuna within one month.*
- c) DJB to prepare an action plan with specific timelines and implement the same in terms of bridging the capacity gap and upgradation of existing STPs that are functioning on old parameters.*
- d) DJB to take concrete steps in terms of actions not taken so far and fix the accountability of erring officials.*
- e) DJB to complete the task of setting up of STPs by 31.12.2020.*
- f) The DJB needs to spell out action to be taken with specific timelines within one month.*
- g) Bioremediation and/or phytoremediation or any other remediation measures may start as an interim measure positively from 01.01.2020, failing which the Govt. of NCT of Delhi may be liable to pay compensation of Rs. 5 Lakhs per month per drain to be deposited with the CPCB. This*

however, is not to be taken as an excuse to delay the installation of STPs, sewerage network and its connectivity. For delay of the work, the Chief Secretary, Govt. of NCT Delhi must identify the officers responsible and assign specific accountability. Wherever there are violations, adverse entries in the ACRs must be made in respect of such identified officers for delay in setting up of STPs, sewerage network and its connectivity by the concerned head of the department.

h) The Govt. of NCT, Delhi will be liable to pay Environment

Compensation if defaults take place as under:

- i. The operational deficiencies of the existing STPs must be rectified within three months failing which Environmental compensation of Rs. 5 Lacs per month for STP shall be deposited with CPCB.*
- ii. With regard to works under construction, after 01.07.2020, direction for payment of environmental compensation of Rs. 10 lakhs per month to CPCB for discharging untreated sewage in any drain connected to river Yamuna and Rs. 10 lakhs per month to CPCB per incomplete STP, sewerage network and its connectivity will apply.*
- iii. With regard to the situation where works with regard to STP, sewerage network and its connectivity have not yet started, the Govt. of NCT, Delhi has to pay an Environmental Compensation at the rate of Rs. 10 lakhs per month per STP, Sewerage network and its connectivity after 31.12.2020 for the delay in setting up of the same. It will be open to Govt. of NCT of Delhi to recover the said amount from erring officers/contractors.*

NGT's direction dated 5.3.20 on in situ-Bio/Phyto-remediation:

CPCB may revise its report on Alternate Technologies for Management of Waste Water in Drains' in the light of comments of the YMC dated 5.3.20MC dated 17.02.2020 and forward the same to the Ministry of Urban Development, Jal Shakti, Govt. of India, NMCG, Governments of Delhi, Haryana and U.P. within one week from today for further necessary action on their part for making a policy which may be finalized within one month from today.

Status as in August 2018:

As recorded in NGT's order dated 26.07.18 there were 41 STPs at 22 locations, out of which 6 STPs were closed and 5 out of these 6 were proposed to be rehabilitated/ upgraded. Twenty (20) STPs were receiving waste water (sewage) below their installed capacity. Five plants as per the DJB test reports were not meeting design parameters, although as per DPCC's test report dated 23-08-2018, as many as nine (9) STPs were not meeting the design parameters. NGT in its order dated 13-01-2015 and 08-05-2015 had directed that plans should be prepared for the up gradation of STPs, optimal utilization of capacity of those STPs that are receiving waste water/sewage below capacity and removing deficiencies in the STPs that were not meeting design parameters for treated waste water. As regards, setting up of new STPs NGT's order dated 13-01-2015 records that 32 new STPs will be installed on a decentralized basis. None of these had been installed and work has not even begun.

Progress achieved:

Delhi Jal Board produces 935 MGD of fresh water (including 80 MGD of bore well water). Taking 80% of water as sewage generated, the total sewage generated is 748 MGD. The present capacity based on the data from functional STPs and their capacity utilization is as listed below:

1. Total Sewage generated in Delhi : 748 MGD
2. Sewage Treatment Capacity. : 597 MGD
3. Treatment being done. : 540 MGD

The Action plan of DJB for setting up STPs, their up-gradation and increasing capacity utilization have been discussed over several meetings with the CEO, the Member Drainage and the concerned DJB officials. Smaller one-on-one reviews were held frequently on 01.10.2018, 04.10.2018, 07.02.2019, 18.02.2019, 25.03.2019, 09.04.2019, 23.04.2019, 10.05.2019, 12.06.2019, 20.06.2019, 22.07.2019, 30.07.2019, 19.09.2019, 04.11.2019, 09.01.2020 & 01.06.2020 to take stock of the progress achieved and compliance of NGT's directions. The Minutes of the meeting held with the DJB officials have been incorporated in the three Interim Reports submitted to the Tribunal.

a. Capacity utilization and the future roadmap:

As per the Action Plan submitted by DJB, the Sewage treatment capacity and capacity utilization during the next three years is projected as tabulated below:

Timelines	June '20	Dec '20	Dec '21	Dec 22	June '23	
Treatment Capacity (MGD)	597	637*	637	657#	707##	*The capacity reduced from 617 to 597 mgd due to shut down of 20 mgd unit at Rithala taken up for rehabilitation. **After commissioning of Coronation Pillar STP(70 MGD)- 40 MGD extra capacity will be added. #After rehabilitation of Rithala STP(40 MGD), 20 MGD capacity will be added. And remaining will be upgradation. After Rehab. of Kondli STP, 20 MGD capacity will be added. ##After commissioning of Okhla STP, 30 MGD capacity will be added
Utilization (MGD)	540	592*	607**	627#	707##	*After commissioning of ISP Package 5,6 & Pkg. 3 (partial) **After part commissioning of Package 3 & 4 of ISP #After full commissioning of ISP Package 3 & 4 and interconnecting Rithala STP to Rohini STP ## After commissioning of Rithala STP, the flow of Pkg. 3 of ISP will be fully trapped.
% utilization	90.45	93.0	95.3	95.5	100	<i>Capacity Utilization of some of the STPs like Ghitorni, Kapashera, Vasant Kunj, Mehrauli, Najafgarh, Narela is less according to DJB because development of the area has not taken place as anticipated in DDA's Master Plan. As per the CPHEEO manual design period of STP is 30 yrs.</i>

The DJB plans to increase capacity utilization to 100% against a capacity utilization of 82%. What technological and efficiency measures would be put in place have not been spelt out by DJB. The Board will need to create and spell out measureable benchmarks and milestones to evaluate performance.

b. Functioning of existing STPs

According to DPCC's report for the month of December 2019, 14 STPs out of 35 functional STPs were non-compliant on one or the other parameter. NGT had directed that DJB should remove the deficiencies in the STPs within a period of one month. From the Action Taken Report of DJB, it is seen that out of the 35 functional STPs with DJB, 5 STPs are designed for TSS/BOD: 10/10, four for 10/15, five for 20/30 and the rest for 30/50 parameters as per the Table below:

Design Parameters of STPs: TSS/BOD: 30/50 mg/L		Design Parameters of STPs: TSS/BOD:20/30(mg/L)		Design Parameters of STPs: TSS/BOD:10/15 (mg/L)		Design Parameters of STPs: TSS/BOD:10/10 or less(mg/L)	
No. of STPs	Total Capacity (MGD)	No. of STPs	Total Capacity (MGD)	No. of STPs	Total Capacity (MGD)	No. of STPs	Total Capacity (MGD)
21	387	5	117	4	59.4	5	55

As per DJB's test reports, 30 out of 35 STPs are meeting their design parameters. However, as per the DPCC test report for May 2020, 7 STPs out of 31 tested by DPCC are meeting 10/10 standards and 17 STPs are meeting 30/50 standards. Only one STP out of 31 tested by DPCC is fully compliant on the revised parameters for TSS/BOD/Coliform parameters fixed by the DPCC in 2016.

DJB's stand is that a STP designed to treat sewage at TSS/BOD 30/50 or 20/30 mg/l parameters cannot be expected to achieve 10/10 standards. DPCC being a regulatory authority, however, insists that the revised standards were fixed in 2016 and there has been little progress towards achieving these standards by DJB. In addition to 5 STPs with a total capacity of 55 MGD

presently functioning with design parameters of TSS/BOD: 10/10, 279 MGD four new STPs at Coronation Pillar, Rithala, Kondli and Okhla designed to TSS/BOD: 10/10 parameters will be commissioned by March 2021, December 2022 and June 2023. Also DJB has informed that consultants are being appointed for up-gradation of STPs at Rohini, Narela, Rithala Ph-II and new 60 MGD STP Keshopur. These assurances, however, appear to be quite vague at present and there is no clarity if and when these up-gradations will happen though the DJB has projected a budget requirement of Rs 3000 crores for these up-gradations. Non-adherence to environmental standards due to funds constraint is unacceptable and the state should mobilize resources, even by invoking the Polluter Pays Principle as directed by NGT in its order dated 13.1.15 and reiterated in order dated 26.7.18.

Statement of performance of STPs as assessed by DPCC in May 2020 is at **Annexure – C-4/1**

c. STPs installed after the 2015 Judgment and those under Construction:

In all 4 STPs at Nilothi, Pappan kalan, Delhi Gate and Yamuna Vihar with a total of 80 MGD have been installed by DJB since 2015 after the judgment in OA 06/2012. Report regarding status of STPs after 13.01.2015

New STPs constructed since 2015:

Locations	Capacity of STP (MGD)	Date of commissioning	Treated effluent parameters (mg/l)
Nilothi Phase-II	20	April, 2015	BOD-10,TSS-10
Pappankalan Phase-II	20	May, 2015	BOD-10,TSS-10
Yamuna Vihar- Ph.-III	25	Sept., 2015	BOD-20,TSS-30
Delhi Gate Phase-II	15	March, 2016	BOD-10,TSS-10

Another STP at Yamuna Vihar STP (10 MGD) has been rehabilitated at TSS/BOD: 20/30 in February 2020. In addition, with the commissioning of Coronation, Rithala, Kondli and Okhla, 70 MGD additional capacity will be added to the existing treatment capacity available with the DJB and STPs. And STPs with an aggregate capacity of 200 MGD operating on old parameters of

TSS/BOD: 30/50 will be upgraded to 10/10 levels with tertiary treatment facility for bacterial treatment.

The Timelines for completion of the projects are as tabulated below:

STPs under construction

Location	Capacity of STP (MGD)	Target Date of Commissioning	Treated effluent parameters (mg/l)	Remarks
Coronation Pillar	70	50% completion by 31.12.2020 and 100% completion by 31.03.2021	BOD-10,TSS-10	Capacity addition will be only 40 MGD as existing STPs of 30 MGD capacity will be de-commissioned.
Rithala	40	50% completion by 15.03.2021 and 100% by 30.12.2022	BOD-10,TSS-10	There will be no capacity addition only existing STP of 40 MGD capacity shall be rehabilitated and upgraded to parameters of 10/10.
Kondli	45	Phase-I & III by 31.12.2021 and Phase-II by 31.12.2022	BOD-10,TSS-10	Two existing STPs for Phase-I&III of 10 MGD capacity each will be rehabilitated and put into operation. Further, existing STP of 25 MGD shall be upgraded to 10/10 parameters after completion of Phase-I&III.
Okhla	124	30.06.2023	BOD-10,TSS-10	Capacity addition will be only 30 MGD as one existing STP of 30 MGD capacity will be put into operation. Also, in place of four existing STPs of total 94 MGD capacity a new plant of 124 MGD shall be constructed with upgraded parameters of 10/10.
Najafgarh Drainage Zone (9+5) STPs	39	24 months after allotment of land and funds.	BOD-10,TSS-10	14 decentralised Sewage Treatment Plants having capacity 0.66 MGD to 7.92 MGD are to be constructed in the Najafgarh Drainage Zone. Initially, Sewage from the drains in the command area will be taken to these

				STPs so that no untreated waste goes to the drains etc.

Even after commissioning of the STPs under construction/up-gradation, however, almost half of the treatment capacity available with the DJB will continue to be at standards inferior to TSS/BOD: 10/10 mg/L.

In addition, 39 MGD is expected to be added to the existing capacity through 14 decentralized STPs in Najafgarh basin after allotment of land and resolution of other contractual issues. DJB also has a Plan to set up 42 STPs on a decentralized basis to cater to 158 MGD of sewage generated from unauthorised colonies and rural areas of Delhi subject to availability of land. This is discussed separately under the heading ‘Decentralized STPs’.

d. Six Monthly Milestones of Projects under Implementation:

On NGT’s directions the YMC had asked the DJB to submit six monthly milestones of the projects under construction for the purpose of monitoring, not merely in terms of percentages but actual milestones reflected in terms of the physical achievements on the ground. The DJB has submitted the six monthly milestones for Kondli, Okhla and Rithala STPs. First due to ban on construction during October /November 2019 and later due to lockdown from 25.3.20 following the Covid19 pandemic, DJB has informed that there will be slippage of six months in the milestones furnished with the Third Interim Report. The revised milestones and timelines will have to be monitored and a quarterly report submitted to the Tribunal. YMC requests strong direction to the state government on this from NGT.

e. Short Term measures for Increasing Capacity utilization:

Low capacity utilization of some of the STPs was an important action point flagged for taking short term measures. DJB in their status report has now stated that low capacity utilization in some STPs like the Rohini, Narela, Kapashera, Nilothi, Najafgarh and Yamuna Vihar is mainly due to absence of sewerage network in the catchment of the STPs. This statement of DJB appears to be too sweeping and not factually correct. YMC has ascertained through an independent expert that Rohini and Narela being sub-cities of DDA are actually having sewerage network, and so is Yamuna Vihar. Some drains in Yamuna Vihar are also being trapped through Interceptor

sewer. DJB needs to examine and ascertain as to why there isn't adequate flow reaching the STPs through the network. Likewise, Kapashera sewerage network requires to be checked and reasons for low sewage ascertained. In Nilothi, Najafgarh and Kapashera, sewage is flowing into drains which can and must be trapped.

This issue was also identified for action at the time of preparation of Action plan by the YMC. Accordingly YMC had asked DJB to prepare a short term plan for better capacity utilization by trapping some drains flowing in the vicinity of the existing STPs. The short term Plan submitted for better conveyance and capacity utilization of the STPs is as given below:

Name of STP	Capacity of STP (in MGD)	Present Utilization (in MGD)	Target date for completion as per the Third Interim Report	Date by which full capacity will be utilized
Rohini	15	05	30.6.20	31.03.2021. It is proposed to divert excess sewage from Rithala to Rohini by laying a rising main of 800 mm dia which will be completed by March, 2021 for which LOI has been issued on 31.03.2020. However the work order will be issued after clearance on from the Finance department which has put all works on hold due to financial constraints following COVID-19 pandemic The completion of work will ensure 100% utilization of Rohini STP.
Narela	10	04	30.6.20	31.3.21. It is proposed to construct a permanent weir in DD-6 drain which will divert the complete flow to Narela STP for which work is awarded at the total cost of Rs. 89.64 Lacs on 09.04.2020. The work is already awarded and is expected to be completed by March, 2021.
Kapashera	05	02	Completed	Treatment at Kapashera STP is increased from 2.7 to 3 MGD by trapping nearby Kapashera drain temporary. However, permanent arrangement is being made by making provision of weir in drain which will further increase the utilization.

Nilothi Ph I	40	16	15.3.20	All the drains in the command area have already been trapped via ISP, however, the discharge in the command area will increase after completion of laying of internal sewer in the command areas, like Ranholla, GOC and Shiv Enclave GOC along with Bakkerwalla RSC by 2023.
Najafgarh	05	02	15.1.20	31.12.20. Treatment at Kapashera STP has increased from 2.7 to 3 MGD by trapping nearby Kapashera drain temporarily. However, permanent arrangement is being made by making a provision of weir in drain which will further increase the utilization.
Yamuna Vihar	45	28	31.3.20	Treatment at Najafgarh STP has increased to 4.5 to 4.7 MGD by trapping Dharampura drain utilising full capacity of the STP thereby ensuring 100% utilization of Najafgarh STP

These are short term measures for capacity enhancement and are according to the Action Plan submitted by DJB in January 2020. All these works had been promised to have been completed by June 2020. However, completion will now spill over to nearer 31.3.21. Such extended timelines for undertaking trapping of drains, as a short term measure defeats the very purpose of such interim measures for better capacity utilization of STPs and stoppage sewage in storm water drains. These were relatively small works and needed to be given priority. This also shows a complete lack of adherence to the commitment made by the officers and lack of accountability. This work is likely to be neglected unless NGT directs completion on fast track.

f. Decentralized STPs

As per Sewerage Master Plan- SMP 2031, 32 STPs were to be constructed, of which 14 STPs were to be constructed in Najafgarh Drainage Zone and 18 in Narela, Okhla, Outer South Delhi, Kanjhawala, Bawana, Shahdara zone. The plan was subsequently revised and instead of 18, it was proposed to construct STPs at 42 locations. For setting up 56 DSTPs (42+14) and 02 STPs at the mouth of drain, land is required at 73 locations which includes 15 locations for Sewage Pumping Stations (SPS). Out of total 73 locations, land at 10 location is already available with DJB

and for the balance 63 location, land would have to be made available by different agencies as follows:

1. Private land(acquisition) by Land and Building Department GNCTD:13 locations
2. Gaon Sabha lands: 11 locations
3. DDA: 39 locations

DJB has furnished Status of 56 DSTPs as under:-

S. No	Name of STP	Timeline	Remark	Estimated Cost (in Crores)
1.	14 (7+7) STPs in Najafgarh Drainage Zone	18 to 30 months after approval of funding of balance STP by NMCG and allotment of land	Out of 14 locations, land is available only at 08 locations and land at balance 06 locations is yet to be allotted.	Cost of 56 nos. decentralized STPs with treatment capacity of about 92 MGD is about Rs. 828 Crores.
2.	42 Decentralized STPs at various locations.	24 to 36 month after allotment of land	Land for construction of 42 DSTPs and connecting SPSs have been identified at various locations and it is still in the process of allotment by Revenue department of GNCT/ DDA Delhi. Necessary action will be taken by DJB after allotment of land.	Further the land cost for these new DSTPs will be about Rs. 300 Crores. Thus total cost for construction of new DSTPs work out to about Rs. 1128 crores.

Out of 14 STPs, NMCG has already sanctioned 7 STPs and released funds during 2017. Land for two out of the 7 sanctioned project is in possession of DJB. However, the construction could not commence on the ground due to one or the other reason. First, there were doubts raised about the quantum of sewage flowing through the drains in the basin and accordingly WAPCOS were asked to undertake flow measurement. Later there was problem associated with

the Concessionaire due to capacity alterations of the five sanctioned STPs. Even the land for the remaining five sanctioned STPs has not yet been allotted to the DJB. YMC monitored this with Revenue Department officials in October 2018 and later during 2019. YMC also held meetings with DDA and Director Panchayats attached to the Divisional Commissioner to expedite the land allotment on 13.12.19. The Committee even organized a joint sitting of the Director Panchayats and the DJB officers as both were giving contradictory reports about progress. Even now the status of land allotment remains at the same level as it was during 2018. Out of the remaining 7 STPs proposed, although land is available for 4 STPs, administrative and financial approvals are yet to be obtained. There is no clarity about the future of these projects. The interest that an owner Department normally shows has been found lacking. The YMC feels that unless land to utilities is put on a fast track automatic route under some legal provision the allotting Department will continue to delay as has happened over the last 2 years.

DJB has plans to set up 42 decentralized STPs additionally in rural areas and unauthorized colonies with a total capacity of 158 MGD. However, DJB is not in possession of land for any of these 42 STPs so far. YMC held meetings with the representative of Divisional Commissioner and the DDA officials as 32 of these sites now fall within the urbanized villages. The status of land allotment at 8 places in Najafgarh and 42 places other places is not clear. Also, it is estimated that setting up STPs at 56 locations(42+14) will require a budget of Rs 5800 crores against a budgetary availability of only Rs. 1000 crores with the DJB. In short, there is a complete lack of clarity on whether and when the DJB will be able to handle sewage from these areas.

In the absence of STPs for treatment of 158 MGD of sewage, the colonies, mostly unauthorized lying in the catchment of these proposed STPs will continue to release their waste water into Yamuna. YMC is informed that some of these colonies and their sewage is already being trapped under ISP, however, substantial quantum of flow will continue to pollute Yamuna. If this delay in commissioning of STPs is allowed to continue there is little hope for any revival of river Yamuna. Therefore in the interim, Govt of NCT Delhi should follow a two pronged approach, firstly to intensify Septage/Sewage Collection under the Septage Management Regulations for full coverage of all the colonies in the catchment and secondly to prepare and execute plans for in-situ drain treatment through Bio/Phyto remediation. The IDMC under the CS should be

mandated, among other activities, to focus on these colonies for intensive septage collection and pin the authorities down. From a perusal of the IDMC meetings and in a review by the YMC it was conveyed to YMC that the Cell under the Chief Secretary is only to focus on phyto remediation. In fact there was a denial that the Cell is expected to monitor the drain owning agencies which had to ensure that the entry of sewage was located and for IDMC to see that short-term engineering solutions or bio remediation alternatives were introduced. A strong direction from NGT to the Chief Secretary GNCTD is needed for

- Providing oversight to the land allotment issues within a specified period, say, three months is needed.
- Instituting a mechanism which makes it incumbent on the drain owning agency to locate and stop flow of sewage from the point of entry into the drain. IDMC should be making the drain owning agency and the concerned DMC responsible for stopping sewage flow in their drain.

g. Commencement of work on all STPs by 31.12.19 and Completion of all the STPs by 31.12.20.

NGT had earlier in its order of 11.9.19 directed that all the STPs should be commissioned by 31.12.20 and in the event of failure to meet the timeline, EC at the rate of 5 lakhs per month shall be levied on the authorities concerned. The timelines given by the DJB for commissioning of STPs at Rithala, Coronation, Kondli and Okhla and 14 decentralized STPs go much beyond the timeline of 31.12.20 as directed by the NGT. Even the Action plan for alternative mechanism of In-situ Bio/Phyto remediation of drains is still at the conceptual stage in the Govt of NCT of Delhi and, therefore, the timelines as laid down by the NGT cannot be met even for operationalising the In-situ remediation. DJB has clearly mentioned that the timelines cannot be squeezed as they are bound by contractual agreements. Also, the ambitious plan of setting up 56 decentralized STPs for treatment of 158 MGD of sewage generated in unauthorised colonies is mired in land allotment issues. Even the 7 out of these which were sanctioned and funds released in 2017 by NMCG have not commenced construction due to land allotment, flow re-assessment and other

technical and procedural issues. There is also no clarity on if and when these projects are likely to commence.

NGT may kindly pass appropriate directions in the matter in the light of the grounds for non-completion by 31.12.20 furnished by the DJB.

h. Phyto-remediation/Bioremediation of waste water in drains:

The matter was taken up by the Hon'ble NGT on 3.1.2020 and certain directions have been issued. Pursuant to those directions, YMC submitted a report dated 20.1.20 to the NGT on Phyto-remediation technologies and the organizations possessing expertise on the subject. In the said report it was also pointed out that there are multiple agencies in Delhi who have control over the drains and complex jurisdictional issues need to be resolved particularly for handling sewage from a large number of unauthorized colonies whose sewage goes into storm water drains.

After perusing the report of YMC, Hon'ble NGT has issued several directions to the CPCB, GNCTD, DDA and other stakeholders in the order dated 24.1.20.

i. Compliance as reported by CPCB:

In pursuance to Hon'ble NGT Order dated 05.03.2020, CPCB revised its report entitles 'Alternate treatment technologies for waste water treatment of drains and the revised report has been shared with Ministry of Housing and Urban Affairs (MoH&UA), Ministry of JalShakti (MoJS), National Mission for Clean Ganga (NMCG).

MoHUA and MoJS should formulate a national policy on alternative technologies for in-situ waste water treatment for adoption by different state governments and civic authorities. **NGT has already given a direction but it will require follow up. Without a policy which dovetails into the Septage management Policy 2017 this may not be adopted by the States.**

ii. Compliance as reported by DJB:

In compliance of the order of NGT, Govt of NCT Delhi has constituted an Integrated Drain management Cell (IDMC) under the Chairmanship of Chief Secretary for management and pollution remediation of all drains regardless of their ownership. Representatives of all drain owning agencies/departments are its members and CEO DJB, the member Secretary.

The mandate of IDMC is to prepare 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 CPCB. In-situ Bio/Phyto-remediation of waste water in drains is one of the mandates of the IDMC. Order constituting IDMC is placed at **Annexure – C-4/2**. The Cell has so far held three meetings. As pointed out earlier, the mandate of IDMC goes beyond in-situ remediation and includes whole gamut of activities like preventing sewage going into drains, taking enforcement action and also take engineering solutions for maintaining cleanliness of storm water drains.

iii. Compliance as reported by SDMC:

SDMC had identified TERI, NEERI, CEMDE and IIT, Delhi for preparation of Action Plan. Chief Engineer (South Zone), SDMC has been appointed as Nodal officer of SDMC. After examining proposals from the shortlisted agencies, IIT Delhi has been selected and asked vide SDMC’s letter dated 20.5.20 for preparation of Action Plan with timeline of three weeks.

The flowing drains are proposed to be covered under the Action Plan:

- i. Pepsi Cola Nallah, Mohan Co-operative.
- ii. Z-block Nallah, Okhla Industrial
- iii. Taimur Nagar Nallah
- iv. Barapulla Nallah
- v. Drain No.-14
- vi. Drain No.-12
- vii. Drain No.-12A

A draft Action Plan giving the details of the major drains of the SDMC area, drainage basin of each drain, technological options available and preparation of plans for remediation are proposed to be shared with DJB after due in-house deliberation. Further discussion about the

cost implications of different technologies proposed to be deployed is yet to be made with IIT Team.

The final report is likely to be received from IIT Delhi in next 15 days.

There is no clarity on when the work will commence and by what time will the project be commissioned.

iv. **Compliance as reported by EDMC:**

EDMC has prepared an action Plan for In situ bio/Phytoremediation of the drains under its jurisdiction. In all there are drains covering a length of 140.63 Km under EDMC. As informed by EDMC, remediation is proposed to be led by the Principal Scientific Adviser to the Govt of India. EDMC seeks to undertake phytoremediation in partnership with IIT/D, DESMI Denmark based entity and Vetiver Pvt Ltd.

The following drains are proposed to be taken up for in situ remediation:

- i. Kazzoriwali drain (5.5.KM length)
- ii. Babarpur drain(4.5.KM)
- iii. Gokulpur drain(4.5.KM)
- iv. Geeta Colony Drain(2 KM)
- v. Kasturba Drain(2 KM)
- vi. SSBL Drain(3 KM)

At this stage, there is no clarity on timelines for commencement and completion of the work.

YMC has not received any Action Plan for In-situ phyto/bio-remediation from other drain owning agencies, viz, IFCD, PWD, DSII DC, North DMC, NDMC and DCB.

Directions sought from NGT:

1. Much of the work on new STPS are at a nascent stage and monitoring at this stage is being done in respect of land allotment issues. A strong direction from NGT to the Chief Secretary GNCTD is needed to provide oversight to land allotments within a period of three months.

2. An increase in capacity utilization of STPs would need much more capacity building within the organisation. The DJB has not shared any details of the technological and efficiency parameters by which it will achieve this. The DJB was asked to create measurable benchmarks to evaluate progress but this has not been done.
3. It is the understanding of the YMC that the IDMC was not only to focus on phyto- bio- remediation. That was suggested as a means to tackle the sewage which is flowing in the storm water drains. But there is a need to have a focal point to which the drain owning agency reports if sewage is not plugged/ diverted or the polluter pays principle applied on households that have not arranged for collection services or provided septic tanks. In the chapter on septage Management the data on colonies and populations have been tabulated. A Government order number dated 31.3.2020 **Annexure – C-4/3** places responsibility for enforcement on the urban local bodies. But unless someone monitors this it will remain a paper order. **The IDMC should be directed to examine the progress made by the local bodies through its own administrative mechanism.**
4. Pending land allotment for STPs, Govt of NCT Delhi be directed to concentrate on extensive coverage of the households/colonies relying on Septic tanks as in- situ sanitation measure in the catchment areas of the proposed STPs on the one hand and in-situ remediation of sewage in drains on the other.
5. Up-gradation of STPs to meet revised standards laid down by DPCC and also directed by the NGT, be taken up in a time bound manner. Non- compliance to environmental standards on the grounds of non-availability of funds is unacceptable. If required funds should be directed to be mobilised by levying sewage charges on all the citizens irrespective of the water consumption and whether they live in sewered areas or un-sewered areas. This was also ordered by NGT in its order of 13.1.15 and reiterated in order dated 26.7.18. YMC does not find any justification in subsidising those living in colonies like GK, Vasant Vihar, Vasant Kunj etc where almost 50% of the households do not pay any water and sewerage charges under 20 KL free water scheme.

Chapter – 5

Interceptor Sewer Project (ISP)

Background:

Delhi is a large urban megapol is where large sections of the population live in unplanned colonies and slums devoid of functional sewerage infrastructure. At present there are 1797 unauthorised colonies which have a population of about 70 lacs. Additionally, there are 675 jhuggi clusters with a population of about 30 lacs. In the absence of a functional sewerage network vast swathes of sewage is released unauthorizedly into natural storm water drains. Eventually all such drains flow into the river Yamuna and inundate the habitations which dwell in the vicinity. Not only is it a health hazard for inhabitants living along the drains but the discharge kills the capacity of the river to regenerate itself as has been brought out in the study of NIH Roorkee.

The DJB in the year 2006 in a Civil Writ petition no. WP(C):725/1994 title “Quiet Flows Maily Yamuna” before Hon’ble Supreme Court of India proposed laying interceptor sewers along the three major drains (i.e. Najafgarh, Supplementary and Shahdara) to intercept sewage flowing from smaller subsidiary drains., This was planned as an interim measure pending laying of a sewerage network, which would convey it to the nearest Sewage Treatment Plants (STPs).The goal was to ensure that only treated sewage gets discharged into these drains. Thereafter, the proposal was examined by a High-Power Technical Committee comprising members from IIT/D, CWC, CPCB, CGWB and CPHEEO & DJB and recommended to the Hon’ble Supreme Court in the year 2007. After detailed Survey and preparation of DPR, grant of Environment clearance, administrative approval and tendering the works with a total outlay of Rs 1962 crores were finally awarded to four different agencies in July 2011. Six (6) packages were proposed taking into account the STP command areas, the geography and the planning zones of DDA. These six packages included the STP command areas of Dwarka / Najafgarh, Niloti / Keshopur, Coronation Pillar, Rithala / Rohini, Yamuna Vihar and Kondli. Approximately 56km of Interceptor Sewers were proposed to be installed along the banks of the three drains.

The project was to be commissioned in 2014 but has been dogged by delays, missed timelines and cost overruns. Under the Project sewage in 108 drains passing through different unauthorised colonies and having outfall into Najafgarh and Shahdara drains were to be trapped and conveyed through Trunk sewers to the nearest STPs. In all 242 MGD of sewage was to be trapped and conveyed to STPs for treatment before being released in to the drains eventually leading to river Yamuna.

NGT's order dated 5.8.16

We reiterate that the judgment of the its way to river Yamuna Tribunal dated 13.1.15 has attained finality. It also specifically provides the points where STPs are to be set up, the locations of interceptor sewage and how sewage and effluent are to be treated. In terms of the judgment. These two drains contribute nearly 64% of pollution in river Yamuna. Thus, STPs to be constructed on drains leading to Najafgarh and Delhi Gate drains and interceptor sewer lines to connect and finally convey sewage to STP for treatment and discharge into the drains for meeting the river in much cleaner form and without pollutants.

NGT's order dated 11.9.19;

- a) DJB to put the systems in place for project monitoring so that timelines are adhered to.*
- b) DJB is directed to adhere to the timelines with regard to ISP and treat all the 242 MGD sewage by 31.12.2019.*
- c) For failure to comply with the above directions compensation will be payable at the rate of Rs. 5 Lakhs per month till compliance from 01.01.2020. Entries be also made in the service records of the erring officers to fix their responsibility.*

Status as in August 2018:

Though the project was planned for commissioning by June 2014, even at the time when YMC started monitoring the project in 2018, the project was nowhere near completion. Against 242 MGD, only 99 MGD of sewage was actually being trapped and treated. The DJB assured that

by December 2018 about 180 MGD of sewage will be trapped and treated and the entire project commissioned by December 2019. This date was subsequently revised to 31.3.20.

Progress Achieved:

Intensive monitoring and oversight have resulted in progress on infrastructural development which will lead to the trapping 226.30 MGD out of 242 for which the erection/engineering work has been completed. However, the actual quantity of sewage being trapped and treated is only 148.25 MGD as the STPs for treating the balance sewage are yet to be commissioned. The reasons advanced by DJB are poor financial health of one of the Concessionaire and frequent disruption in work due to ban imposed by EPCA on construction during the winter months and the lockdown due to Covid19. The Officers of DJB in their meeting with YMC on 01.06.20 have stated that Govt of NCT Delhi has directed all the Departments not to incur any expenditure except on salaries till June 2020 in view of financial stress caused to the state exchequer due to prolonged lockdown. DJB has now given the following timelines for commissioning of 242 MGD ISP, both of treatment and treatment in the status report submitted on 8.6.20:

i. Trapping of 242 MGD of sewage in 108 drains:	31.08.2020
ii. Trapping & Treatment of 165 MGD:	31.08.2020
iii. Trapping & Treatment of 200 MGD:	31.12.2020
iv. Trapping & Treatment of 242 MGD:	31.12.2022

(After commissioning of STPs at Rithala, Coronation and Kondli)

The project implementation and monitoring present a sorry picture as the milestones and timelines have been changed repeatedly resulting in delays and cost overruns. The project was to be commissioned by 30.6.2014 but is expected to be commissioned only by 31.08.20 and even then, it will only make a provision for trapping 242 MGD but will actually trap and treat only 165 MGD. A flagship program of the Board which has been held out as panacea for the problems of pollution in river Yamuna has already been delayed by six years which shows complete absence

of an effective monitoring and supervisory mechanism exercised by the Board. As stated by the DJB, though the Project is monitored by a Project Monitoring Unit headed by Member (Drainage) on technical aspects, it is also monitored by the PMU headed by the CEO every month on all aspects. Chief Secretary also monitors it every quarter.. The fact that despite all these mechanisms there have been delays calls for a critical relook at the mechanisms for project monitoring within DJB. This has been emphasized by the YMC repeatedly in its meetings with the Board Officials. No accountability for such undue delay has ever been attributed to any Officials or the Concessionaires. Excuses will always be forthcoming but the goal of stopping the flow of sewage will not be attained particularly when COVID related delays and the non-assignment of funds are new and unforeseen problems.

During the meeting of YMC with the officials of DJB it was brought up that in addition to 108 drains which ISP plans to trap, an additional 204 drains have been found carrying sewage in the catchment of the Najafgarh and Shahdara drains. This, as explained by the DJB, is due to new colonies and the expansion of existing colonies having taken place over the years. On the directions of YMC the DJB has submitted an Action Plan for plugging these additional 204 drains. Though 141 out of 204 drains were to be trapped by March 20, due to lockdown the target date for trapping has again been revised. The revised Action Plan for trapping 204 drains is given below:

Status of trapping/Plugging of 204 drains not covered under the ISP.

Out of 204, 34 are claimed to have already been trapped and 141 were to be trapped by 31.3.20.

Action Plan for trapping of the 204 drains in the catchment of Najafgarh and Shahdara drains is as under:

Drains already trapped:	36 Nos
Trapping not required:	10 Nos
Pertains to Haryana and DDA:	03 Nos

Drains to be trapped by Dec 2020: 138 Nos

Drains to be trapped by Dec 2021: 17 Nos

The sewerage system is being laid in the command area of these drains which is expected to be completed as per the above timelines. Once the sewerage network is commissioned / notified the flow will be trapped in sewage system.

Directions sought from NGT:

Considering that it a flagship project, DJB be directed to submit quarterly progress report to the Tribunal against milestones.

The completion of ISP and the plugging of drains have been given much room for elasticity and reasons for further delay are already available. But when the magnitude of environmental damage is as overwhelming as the quantum of pollution shows, funds have to be assigned. It is not a new requirement and policy makers have to evaluate the risk of giving room for extended delays. As directed by the Hon'ble Tribunal in order dated 08.5.2015, shortage of funds, if any, should be made up by invoking Polluter Pays Principle.

NGT may kindly consider passing orders that the completion of these projects may be given overriding priority on grounds of public health and ecological safety.

Chapter – 6

Repair and maintenance of Drains

Hon'ble NGT's direction in judgment dated 13.1.15

We direct all concerned to make every 11 Item Nos. 03 to 10 July 25, 2018 SS & R possible effort to ensure that the storm water drains do not carry sewage. Sewage may be carried through those drains upon which the STP's have already been installed, till the completion of the project. After the completion of the project, steps shall be taken so that only minimal quantity of treated water from the STPs reaches Yamuna.

Hon'ble NGT's order dated 18.12.17:

The Delhi Jal Board shall ensure that all the 10 drains that have been trapped/intercepted should be totally sealed by taking appropriate measures to ensure that there is no leakage from the point of interception /tapping to river Yamuna in any case

Hon'ble NGT's order dated 11.9.19

- a) *The DJB and NDMC to identify and plug the sources of sewage within two months positively and report compliance to Monitoring Committee.*
- b) *Tapping of Drains:*
 - i. *Qudasiabagh+ Mori Gate drain(Flow: 43.2 MLD):DJB to make an assessment of sewage coming from sewered areas and prepare an action plan with timelines for plugging the discharge into storm water. New STPs be established only for non-sewered areas.*
 - ii. *Barapulla Drain (Flow: 145.15 MLD): DJB to submit action taken on Action Plan which it had submitted to NGT in 2014 in terms of actions on short term, medium term and long terms measures envisaged.*
 - iii. *Maharani Bagh Drain (30.24 MID):DJB to indicate proposal to stop the flow in the drain with specific timelines in terms of tapping or laying of sewer lines in un-authorised colonies.*

- iv. *Najafgarh Drain (2056 MID) and Shahdara outfall drain (475 MID): The DJB is directed to attend to the observation of Monitoring Committee so that all the intercepted sewage is treated. The States of Haryana and UP are directed to submit their Action Plan with specific timeline to attend the flow of untreated sewage into said drains.*
 - v. *Status of other storm water drains carrying sewage: The DJB is directed to submit a specific timelines with specific accountability so that no sewage finds its ways from sewerage areas into the storm water drain.*
 - vi. *Status of Punctured Sewers: DJB to ensure that such instances are attended on priority with specific accountability.*
 - vii. *Ameliorative measures for cleaning drains & Constructed Wetlands and In-situ Bioremediation Technology: The Irrigation and Flood Control Department to develop a mechanism of third party verification report on the ameliorative measures undertaken by it.*
 - viii. *Controlled Dredging in River Yamuna: The finding of the study undertaken by NEERI to assess slug deposition on river bed of Yamuna be evaluated and appropriate decisions by undertaken by IFCB (The Irrigation and Flood Control Department).*
- c) *For failures in tapping the drains, environmental compensation at the rate of Rs. 5 lakh per drain per month will be paid by the DJB or concerned department to the CPCB for environmental restoration. Entries in the record of 37 the erring officers also be recorded consistent with the earlier directions.*

Status as in August 2018:

There are in all 22 drains joining Yamuna downstream of Wazirabad which discharge sewage and industrial waste into the river. Out of 3026 MLD of flow discharged into river Yamuna through all the drains, Najafgarh and Shahdara drain account for about 1967 MLD and 508 MLD respectively. A reference was also made to 11 drains in the order of 18.12.17 which the DJB claimed to have trapped. These were:

1. Magazine Road Drain
2. Sweepers Colony Drain
3. Khyber Pass Drain

4. Metcalf House Drain
5. Tonga Stand Drain
6. Moat Drain (Vijay Ghat)
7. Civil Mill Drain
8. Delhi Gate Drain
9. Dr Sen N.H. drain
10. Drain No. 14
11. Tuglakabad Drain

However CPCB disputed this claim and informed the Tribunal that most of these drains actually contained sewage even after trapping. In addition, NGT was informed that DJB was required to prepare plans for preventing sewage flowing in the following six drains:

1. Shahdara Outfall drain
2. Quadasia bagh+ Mori gate drain
3. Barapula Drain
4. Maharani bagh Drain
5. Kalkaji Drain
6. Tekhand drain

YMC also took note of the fact that in as many as 144 places, there was intermixing of sewage with storm water due to puncturing of sewer line. NGT had in its judgment dated 13.1.15 and 26.7.18 directed that on a pilot scale dredging in the river Yamuna be undertaken to remove historical sludge deposited on the river bed. NGT order of 26.7.18 also directed that in-situ remediation be undertaken through ozonation /aeration as interim measure for improving the water quality in the drains. Also, floating booms be installed at the mouth of the drains to prevent floating waste reaching Yamuna.

Progress Achieved:

1. Trapping of 17(11+6) drains:

Taking note of the specificity in NGT's order that storm water drains should not carry any sewage, YMC has been monitoring the status of each of the storm water drains with outfall into Yamuna and the action that is required to prevent flow of sewage in the drain. Though DJB had

claimed before the NGT on 18.12.17 that 11 drains out of the above 17 drains have been trapped and that there is no sewage downstream of the trapping point on verification by the CPCB, a number of drains were found carrying sewage. YMC therefore, mounted an independent verification through a team from the Faculty of the Delhi Technical University (DTU) along with Shri Tyagi Member (Drainage) (Retd) from DJB. This team of Independent experts has been undertaking spot verification of the trapping points of the drains and their reports have formed part of the Three Interim Reports which the YMC submitted to the NGT.

The Status Report dated 08.06.20 submitted by the DJB has reiterated that all the 11 drains have been trapped and that there is no flow from these drains into Yamuna. YMC asked Mr Tyagi to again undertake a joint inspection along with the team of DJB official to verify the claims of DJB. Based on the inspection of 13 drains undertaken on 18th, 19th and 20th June 2020 along with the DJB officers, the following drains have been found completely trapped except for some minor maintenance issues and encroachments in the surrounding area:

1. Magazine Road Drain
2. Sweeper Colony drain
3. Khyber Pass Drain
4. Metcalf House Drain
5. Moat Drain(Vijay Ghat)
6. Civil Military Drain
7. Delhi Gate drain
8. Drain No 14
9. Tughalaqabad Drain
10. Kalkaji Drain
11. Tekhand Drain(Sarita Vihar Drain)

It has also been stated that Kalkaji drain and Tughlakabad drain are actually one drain. So in effect there are actually 10 drains that have been trapped. The sewage from the above drains, which carried around 150 to 160 MLD of waste water (as per CPCB measurement of flow), has been trapped into sewerage system thus decreasing pollution into the river and achieving better utilization of STP capacities. This has been possible due to constant oversight through independent experts and periodic monitoring by YMC. The YMC recommends periodic maintenance and proper watch and ward to prevent encroachment needs to be ensured to

sustain the effort of zero discharge beyond the point of trappings. The inspection report is enclosed at **Annexure – C-6/1**. Due to paucity of time, it was not possible to subject these drains to fresh inspections through DPCC or CPCB. **YMC recommends that Hon'ble NGT may consider directing DPCC to monitor these drains with regard to the effectiveness of trapping. In some places some JJ s clusters/isolated jhuggies have sprung up which release sewage directly into the drains. Such encroachment on drains should be stopped by the drain owning agencies and the DSUIB directed to provide amenities like community latrines in such JJ clusters. Permitting JJ clusters to come up downstream of the point of trapping defeats the very purpose of trapping of drains.**

2. Drains Requiring Trapping/Preventing Sewage in the Drains:

The status of remaining drains, DJB's Action Plan for trapping/preventing flow of sewage in these drains and YMC's comments and roadmap are discussed in the following paragraphs:

Tonga Stand drain (7.8 MLD): This drain carries waste water from Old Delhi Rly station area, Lothian Bridge and adjoining area. Though partially trapped into Nigam Bodh SPS however local discharge from the Yamuna Bazaar is still flowing into this drain. DJB Board has proposed a small STP at the mouth of this drain for which DDA has been asked to allot the land to DJB for setting up the STP. There is no clarity on if and when the land will be allotted by DDA. No timelines have been given because land has not been identified/allotted. **YMC recommends directions to DDA for allotment of land to DJB for setting up of the plant at the mouth of Mori Gate Drain within next three months.**

Dr Sen Nursing Home drain (35 MLD): Presently, DJB is drawing 10 MLD of sewage from Dr Sen Nursing Home drain for treatment at existing STP and supplying treated effluent to PPCL for thermal power plant, and the remaining sewage is overflowing into Yamuna River. As per the advice of YMC, DJB is constructing a weir across the Dr Sen Nursing Home drain so that excess waste water after drawing at 10 MLD waster into existing STP, is diverted to the Ring Road Trunk Sewer. The work was to be completed by 31.3.20 however due to lockdown there is dislocation in the work. DJB now confirms that the work will be completed after two months of lockdown being fully lifted. **Since this drain is passing through NDMC and DJB areas, both of them were**

asked to divert the sewage of Railway colony and Deen Dayal Upadhyaya Marg Institutional area into sewerage system, which has not yet been done by DJB or NDMC. This will need to be monitored by the IDMC headed by Chief Secretary as it pertains to pollution caused to Yamuna due to sewage in drains. Both agencies have been called by YMC, joint inspections have been carried out and still the stalemate continues after giving repeated assurances. **NGT may consider issuing directions to IDMC on this.**

Mori Gate & Qudsia Bagh drain (33 MLD): Since most of the catchment area of this drain is sewered, there should normally be no waste water in the drains. YMC had asked DJB to find out the feasibility of diverting waste water into existing sewerage system of the walled city area so that waste water in Morigate drain is eliminated/reduced and then set up capacity based on the reduced flow, if any. DJB informed that this is not feasible since the sewerage system in the walled city is very old and it is not possible to divert this flow in the drain to that sewerage system. DJB therefore insists that there is no alternative but to set up STP at the mouth of Morigate drain after allotment of land by DDA. **YMC recommends for allotment of land to Delhi Jal Board for setting up of the plant at the mouth of Mori Gate Drain within next three months and IDMC to monitor plan for land allotment and setting up STP.**

Maharani Bagh Drain (39MLD). This drain has been partially trapped into existing C.V.Raman Marg trunk sewer to the extent of 9-10 MLD and the remaining discharge of 39 MLD is flowing into River Yamuna. DJB has submitted that for balance flow, the work of sewer network has been awarded in Batla House GOC, Phase-II, which will trap the same and pump to Okhla STP. The revised time lines for the same is April 2022 against original time line of Dec 2021 due to stoppage of work during March to May 2020. The work also got delayed due to Shaheen Bagh protest and lock down due to Covid19. **YMC recommends that Hon'ble Tribunal may direct the DJB to squeeze the timelines for completion of this work and the IDMC be directed to monitor this. DJB should ensure that along with laying of sewer line individual household connectivity must also be provided.**

Barapulla drain (145 MLD): This drain receives 145 MLD of sewage coming from unauthorized colonies, and slums, and some even from sewered authorised colonies due to poor maintenance of sewer network. DJB had submitted an Action Plan for diverting/preventing sewage in Barapulla

drain before the Hon'ble NGT in 2014. As per that all the work in short, medium and long term were to be completed by 2017. Since these timelines were not met, YMC had asked the revised time lines related to the action plan. After discussion with the DJB officials, and Technical Adviser Shri Tyagi, YMC advised the DJB to divert the flow of Barapulla drain into the existing sewerage system, preventing sewage flowing into the drains from seweried colonies. Also by laying of sewerage systems in the catchment of the unauthorized colonies, the capacity of the proposed STP at the mouth of Barapulla drain can be reduced considerably. After conducting an extensive survey along with Shri Tyagi, Delhi Jal Board had submitted the action plan as given below:

A1	Trapping of unauthorized colonies at Ratia Marg (16 Colonies)	Already achieved 30.6.2019	2
A2	Trapping of unauthorized colonies at Mangal Bazar Road.	Already achieved 30.6.2019	1
A3	Trapping of unauthorized colonies (20) of at Tigri Road, Devil and Dr. Ambedkar Nagar	May-20	1.25
A4	Trapping of 25 unauthorised colonies (25) IGNOU road is to be trapped.	Jun-20	2
A5	Trapping of unauthorised colonies (11) at Deoli Road.	Dec-20	1.25
B1	Rehabilitation of Peripheral trunk sewer at press enclave Road	Jun-20	4
B2	Rehabilitation of Peripheral trunk sewer at Chirag Delhi Flyover	Jun-20	1
B3	Damage 600 dia. Sewer line at Chirag Delhi Drain.	Jun-20	1
B4	Trapping of drain at Chirag Enclave. SPS.	Jun-20	0.5
C1	Trapping of Nallah at Krishi Vihar (450 mm dia for trapping)	MAY-20	1.5
C2	Trapping of Nallah at Andrews Ganj (900 mm dia for trapping)	May-20	6.42
C3	Trapping of Nallah at Pant Nagar (900 mm dia for trapping)	May-20	6.42

A total of 28.30 MGD (about 129 MLD) of sewage is expected to be reduced through trapping and providing sewerage network in unsewered colonies. Minutes of meeting held by YMC with DJB and representatives of the RWAs of GK-1, Defence Colony and Nizamuddin West

on the measures required to be taken for preventing sewage in Kushak and Sunehari bagh (both tributaries of Barapula drain) held on 5.3.20 are placed at **Annexure – C-6/2**. Due to Covid lockdown, the consequent dislocation of work and budgetary constraints the timelines have not been met. The DJB be directed to submit revised timelines which are realistic and can fix accountability on the officers responsible for the projects. **Delhi Jal Board must also take a decision on the capacity of proposed STP after considering the discharge proposed to be trapped from Kushak and Sunheri Bagh Drain into sewerage system. IDMC be directed to monitor this.**

Sunheri Bagh drain: This is a major tributary of Barapulla drain and joins the Barapulla drain near Nizamuddin just before its outfall into Yamuna. It carries huge waste water which comes from New Delhi Municipal council and DJB areas. Accordingly, both DJB and NDMC were asked to divert the waste water of Sunheri Bagh drain into their respective sewerage system. NDMC has already certified that they have diverted entire waste water into their sewer network which is yet to be verified. After conducting intensive survey by Shri Tyagi of the Sunheri Bagh drain and DJB installations from Pragati Vihar to Okhla STP on 18th, 19th and 20th March 2020, it was found that sewage from CGO complex under the jurisdiction of DJB is still discharged into Sunheri Bagh drain. This sewage can be instead diverted to the existing Pragati Vihar SPS. But, due to poor maintenance of the entire sewerage infrastructure by DJB, the additional sewage cannot be conveyed to Okhla STP due to silting up of the gravity main carrying sewage to Okhla STP (detailed report is enclosed at **Annexure – C-6/1**). DJB has been asked by YMC to submit the action plan for trapping of waste water from Sunheri Bagh drain. No action plan from DJB has been received so far.

NDMC be directed to plug all the sewage flowing into this drain from the areas under its charge within two months and submit a compliance report before the Tribunal. DJB be directed to take up the work of de-silting of the gravity ducts immediately as a short term measure and rehabilitate these ducts for carrying more discharge as a long term measure. Action plan with definite timelines be called from DJB.

Najafgarh(1967 MLD) and Shahdara(508 MLD) drains: As per ATR submitted by DJB 108 drains in the catchment areas of Najafgarh and Shahdara drains are being trapped by the Interceptor

sewer. It is estimated that 242 MGD (1100 MLD) will be trapped out of which 148.25 MGD has already been trapped and being treated. The progress of trapping of drains under ISP has been discussed in Chapter 5 Interceptor Sewer Project. The discharge coming from UP and Haryana has not been accounted for by DJB. Haryana is discharging around 105 MGD sewage and Industrial waste through Drains at L1, L2, Badshahpur and drain no.6 which meet Najafgarh and Supplementary drains. Supplementary drain also meets Najafgarh drains before the latter joins Yamuna.

Similarly, out of 105 MGT(508 MLD) of waste water in Shahdara drains about 50 MGD(227 MLD) is discharged by Drain no. 1 of UP State and Gazipur drain through Sahibabad, Indirapuri and Noida drains. The action plan from these two states has been discussed in Chapter 12 and Chapter13.

After commissioning of the Interceptor Sewer Project by Aug, 2020 and notification of various sewerage schemes in unauthorized colonies, Yamuna Vihar STP is expected to trap around 18% sewage of which and 9% of the flow is already being treated through Chilla STP.

After commissioning of Kondli Phase-I, II & III STPs, untreated flow of 25 MGD (23%) will also be treated by July, 2022. The balance untreated flow that will remain is projected as only about 6 MGD. i.e. 5%. To take care of unsewered areas, Delhi Govt. has already notified Septage Regulations in November, 2018 which will reduce further pollution in Shahdara drain/river Yamuna.

There are vague assurances about completion of ISP, STPs and providing sewerage network in unsewered areas. These will have to be monitored with greater degree of specificity. YMC recommends that IDMC may be directed to monitor these two drains by going into detail as together they contribute two third of pollution in Yamuna. IDMC will also have to coordinate with the States of UP and Haryana to organise measures to prevent flow of sewage entering into Najafgarh and Shahdara drains.

3. Status of Other Storm Water drains carrying sewage:

In addition to the 11+6 drains, CPCB has also reported 7 additional small drains discharging sewage into the river. These are:

1. Sonia Vihar drain
2. Shastri Park drain
3. Kailashnagar drain
4. AbulFazal drain
5. Jaitpur drain
6. Agra Canal near Okhla
7. Old Agra Canal Okhla

Drain-wise Action Plan is as under: DJB had submitted Action Plan for trapping sewage in these 7 drains in January 2020. This attached as **Annexure – C-6/3**. The timelines have however been revised due to the lockdown post Covid 19 pandemic.

Sonia Vihar Drain(25.50 MLD):Delhi Jal Board has decided to treat the sewage through the use of Bio-Enzymes in the pond for reduction of BOD. The tender was invited and the work was likely to start by the end of February 2020, however, in response of the tender, only a single bid was received. It was therefore decided to re-invite the tender with relaxation in eligibility criteria to attract more participants and get most competitive rates. The tender has been invited and the technical bid is due for opening in second week of June, 2020.

The block estimate for setting up an STP and laying of sewer network have already been approved by Delhi Jal Board. Tenders for providing laying internal system in its command have already been invited wherein land is available. Tenders for consultancy for Sonia Vihar STP is also likely to be invited shortly. Tenders for laying of internal sewerage system in balance command area shall be taken up after allotment of land for construction of SPS by Police Authority

Shastri Park Drain (4.3 MLD) The drain has been trapped into the sewerage system

Kailash Nagar Drain(7.8 MLD)- As per DJB's Action Plan, the matter is being taken up with DUSIB and EDMC to carry wastewater to Geeta Colony Sewage Pumping Station or take any alternative proposal to treat wastewater of the drain.

Abu Fazal Drain (35 MLD) There is no sewerage system in the area. The work of providing and laying internal sewer has been awarded and the flow will be trapped by April 2022 subject to lifting of the ban on construction and labour movement.

Jaitpur Drain (23.3 MLD): Unauthorized colonies of Badarpur area and some discharge from Faridabad. Jaitpur drain is joining the river Yamuna on the downstream side of Okhla barrage.

At present there is no sewerage system in Badarpur area. DJB proposes to provide sewerage network in Badarpur area along with construction of decentralized STP of 45.46MLD (10MGD) capacity for which the land is under allocation.

The sewer network along with STP is to be completed in 3 years' time after allotment of land for STP

Agra Canal near Okhla and Old Agra canal Okhla: Both are canals and do not require setting up STPs.

YMC recommends directions to Chief Secretary Govt of NCT Delhi to strengthen the monitoring of these projects which impact the health of public at large and fix accountability of the officers for adherence to the timelines.

4. Status of Punctured Sewers joining Storm Water Drains at 79 places.

YMC had asked DJB to submit an Action Plan to plug 79 points in their sewer network where the sewer lines had been punctured and have been connected to storm water drains. As per DJB's Action taken Report, 42 points out of 79 points where sewage was flowing into storm water drains by puncturing sewer lines have been plugged , two points pertain to DUSIB and one point to DDA. In the remaining points, the work is in progress and will be completed by 31.12.2020 in a phased manner. **IDMC may be directed to have independent random checks done as puncturing is resorted to as a short cut to respond to public pressures. Unless this is overseen the local engineers will again resort to short cuts.**

The updated status of these 79 locations is as under:

S.N.	Discription	Locations	Target Date
1	Work Completed by DJB	47	Completed
2	Work to be completed by DJB	2	30.06.2020
		2	30.09.2020

		4	31.10.2020
		17	31.12.2020
		2	31.03.2021
3	Works pertaining to other departments	2	DUSIB
		1	DDA
		1	Permission from RAILWAY is awaited.
		1	CPWD
	Total	79	

5. Controlled dredging in the River Yamuna:

The study on dredging has since been completed by NEERI in collaboration with the IFCD. The draft report received from NEERI is attached at **Annexure – C-6/4**. The study was commissioned in pursuance of Hon'ble NGT's direction to undertake controlled dredging in the Yamuna to remove the historical sludge from the river bed. This would have been deposited over time due to continuous flow of domestic and industrial effluent waste water going into the river. Only after the findings of the study are received, was it planned to undertake controlled dredging. **The Draft report received from NEERI be gone into by the IFCD, Govt of NCT Delhi, NMCG, CPCB and DPCC and further action may be taken on the NEERI report. Alternatively, NGT may consider asking the Principal Committee to go in to this and give its recommendations for appropriate directions by the Tribunal.**

6. Ozonation /Aeration in drains:

Comprehensive Guidelines have been developed by CPCB on Phyto/Bio remediation in drains. CPCB had been directed by the Hon'ble Tribunal to prepare representative models of bio/phyto-remediation these are discussed in the Chapter 4-Sewage Treatment Plants. The Status reports received from CPCB, DMCs and DJB have been discussed in Chapter 4- Sewage treatment Plants. IDMC under the Chief Secretary Govt of NCT Delhi has been mandated to monitor in- situ Phyto/Bio remediation in drains through the drain owning agencies.

Directions sought from Hon'ble NGT:

1. Hon'ble NGT may consider directing DPCC to monitor 11 drains which have been trapped with regard to the effectiveness of trapping. In some places (viz. Sweepers Colony drain, Magazine drain, Drain no. 14 and Barapula drain) some JJ clusters/isolated jhuggis have started coming up which release sewage directly into the drains. Such encroachment on drains should be stopped by the drain owning agencies and the DSUIB directed to provide amenities like community latrines in such JJ clusters. Permitting JJ clusters to come up downstream of the point of trapping defeats the very purpose of trapping of drains.
2. MC recommends directions to DDA for allotment of land to DJB for setting up of the plant at the mouth of Mori Gate Drain, Mori gate drain and Barapula Drain within next three months. Allotment of land for setting up STPs on these drains has been hanging fire for the last two years if not longer. The process of allotment must be done on priority and Chief Secretary and VC DDA be directed to personally oversee this and submit compliance to NGT within three months.
3. The DJB be directed to submit revised timelines which are realistic and will fasten accountability on the officers responsible for the projects. Delhi Jal Board must also take a decision on the capacity of proposed STP after considering the discharge proposed to be trapped from Kushak and Sunheri Bagh Drain into sewerage system. IDMC be directed to monitor this.
4. NDMC be directed to plug all the sewage flowing into this drain from the areas under its charge within two months and submit a compliance report before the Tribunal. DJB be directed to take up the work of de-silting of Gravity ducts immediately as short term measure and rehabilitate these ducts for carrying more discharge as a long term measure. Action plan with definite timelines be called from DJB
5. YMC recommends directions to Chief Secretary Govt of NCT Delhi to strengthen the monitoring of these projects which impact the health of public at large and fix accountability of the officers for adherence to the timelines.

Chapter – 7

Industrial Pollution and CETPs

NGT's order dated 02.03.15:

- I. *All the industries in 17 clusters should be connected to CETPs. Industries not connected should be asked to connect through conduit pipes to CETPs and in event of failure such industries should be ordered to be closed by DPCC.*
- II. *Eleven clusters which do not have CETPs are stated to be dry industries and do not consume water in the process. Such Industrial clusters will be subjected to joint inspection by CPCB, DPCC and DSIIDC and MCDs verify the claim and also assess the manner in which hazardous waste like used oil, lubricants and grease if any used in the process it is disposed of.*
- III. *No drains should carry industrial effluent and if found in the drains CETPs should be set upto treat the effluent before being taken to STPs as the STPs are not capable of treating industrial effluent.*
- IV. *Hazardous waste generated at the CETPs should be disposed of at the designated hazardous waste sites*
- V. *NGT vide order dated 19th may 2017 and later through an order dated 23-08-2018 in OA no. 601 of 2018 has directed the MC to monitor functioning of the industries located in non- conforming / residential areas.*

NGT's order dated 11.9 19:

- a) ***DPCC is directed to continue with the survey and monitoring of industries both in confirming and non-confirming areas and take action in accordance with law against polluting units and file report of action three months besides recovery of EC. In case of non-compliance Delhi Govt will be liable to pay Rs. 5 lakh per month from 01.01.2020***

Status as in August 2018:

In the first meeting held on 20.11.18 by the YMC the status of implementation of NGT's directions for control of industrial pollution in the drains leading to Yamuna was reviewed with Commissioner Industries, MD DSIIDC and DPCC. The YMC was informed that, there are in all 28 industrial clusters in Delhi, out of which 17 Industrial clusters have water consuming industries and are connected to 13 CETPs. The remaining 11 industrial clusters are not connected to any of

the CETP as they do not generate significant effluent. Besides, there are 51837 industries functioning from non-conforming/residential areas.

The YMC was also informed that 7 CETPs out of 13 were not meeting prescribed standards. CETPs were receiving only 52 MLD of effluent against a capacity of 212 MLD, only 9 out of 13 had OLMS installed and the hazardous sludge was being stored at the CETPs causing environmental hazard and there was no attempt towards achieving ZLD as directed by the NGT. Also despite Delhi having a CETP Act 2020, the enforcement towards better compliance was virtually absent. Pursuant to the orders of the NGT, YMC issued a slew of directions including undertaking survey of all the industries both in 17 industrial clusters connected to CETPs and in 11 clusters claimed to be having only dry industries. The compliance of the directions issued in pursuance of NGT's directions have been thereafter reviewed in meetings held on 27.9.18, 20.11.18, 18.7.19 and 11.12.19 including visit to the Wazirpur CETP.

1. Status of Survey and Enforcement Action against Polluting Industries

YMC asked DSIIDC and DPCC to undertake a joint survey the survey of the industries located in 17 Industrial areas to find out the defaulting units not discharging their effluent into the conveyance system/sewerage system of CETPs and also not following environmental laws resulting in CETPs being underutilized on the one hand and pollution being caused in the drains on the other.

Survey of 11 industrial clusters which were claimed to be dry industries was also carried out. The summary of survey is furnished below:

a) Status of Survey in 17 industrial Areas connected to 13 CETPs

Survey of the industries situated in 17 industrial areas (Bawana, Narela, Rajasthani Udyog Nagar, Shahdara Manufacturing Association (SMA), Small Scale Industries (SSI), Badli, GTK, Nangloi, Lawrence Road, Mangolpuri, Mayapuri, Udyog Nagar, Naraina, Wazirpur, Okhla Ph-I& II, Jhilmil, and Friends Colony) was started in September 2018 and completed in May, 2019. The survey was carried out by a Joint team comprising of the members from DPCC and DSIIDC for ascertaining whether industrial units are connected to the conveyance system of CETPs or not. A

total of 31985 industrial units were surveyed, out of which 1966 units were found defaulting which were either not connected to conveyance system of CETP or discharging solid waste into the conveyance system/open drains.

Notices were issued to the defaulting industries and environmental compensation was imposed by DSIIDC on 1885 no. of defaulting industries. The remaining 81 cases pertaining to Shahdara Manufacturing Association (SMA), SSI, Okhla Ph-I & II and Friends Colony were referred to DPCC/Industries Department for taking action as these industrial areas did not come under the purview of DSIIDC. DPCC and Industries Department GNCTD issued notices to such defaulting units and imposed Environmental Compensation (EC)/penalties on these 81 defaulting industries. Against the notices issued and EC imposed by DSIIDC, Rs 5.72 crore has been realised till now. For the recovery of balance amount of EC, reminders have been sent to the defaulting industries. The delay in realization, as claimed by DSIIDC, is due to elections for Assembly during January /February 2020 and thereafter due to lockdown following Covid19 pandemic. Further necessary action such as sealing, closure of industries etc has been promised to be taken after industries resume operation post Covid19.

Details of survey summarized in table given below:

i. Status of Survey conducted for the period from 01.08.2018 to 31.08.2019

No of Industrial units surveyed	Total no. of industrial units found violating environmental norms	No. of units on which Environmental compensation imposed	EC imposed (Rs in crores)	EC received (Rs in crores)
31985	1966	1885	9.425	5.72

ii. Status of Survey conducted between 01.09.2019 and 29.02.2020

A random survey of industries of Bawana and Narela Industrial areas was also undertaken during the period under consideration and 29 industries were found to be as defaulters discharging their waste water into storm water drain. EC of Rs 14.50 lakhs @ Rs. 50,000 was imposed on the defaulting units, out of which 10 industries have so far paid EC of Rs 5 lakhs. Balance EC, as promised by DSIIDC is proposed to be realised once the lock down is fully lifted.

iii. **Outcome of Enforcement Action:**

DSIIDC has furnished a comparative statement of effluent reaching the CETPs before and after survey and enforcement action taken by DSIIDC. The Table below shows the effluent reaching the CETP in the month of November 2018 and November 2019.

S.No.	Name of Industrial Area	Average volume of effluent reaching CETPs In November 2018 (MLD)	Average volume of effluent reaching CETPs in November 2019 (MLD)	Percentage Increase after enforcement action
1	Bawana	13.46	24.91	85.06 %
2	Narela	4.9	10.368	111.42 %
3	Badli	0.86	2.25	161.62 %
4	Naraina	4.09	4.33	5.86 %
5	Nangloi	2.6	2.872	10.38 %
6	Mayapuri	3.13	2.974	-
7	Mangolpuri	1.77	1.49	-
8	GTK	2.47	2.52	-
9	Lawrence Road	1.05	1.2	14.28 %
10	Jhilmil	5.16	5.54	7.36%
11	SMA	1.29	1.685	30.23 %
12	Okhla	1.14	1.99	74.56 %
13	Wazirpur	2.91	2.14	-26.46 %

From the above table, it can be seen that subsequent to the enforcement action, the inflow of water to CETPs through conveyance system has increased considerably, indicating reduction in discharge of waste water/ Industrial effluents by industrial units in drains/ other systems. However, decrease in effluent at Wazirpur Industrial Area as informed by DSIIDC is due to closure of pickling industries. This will need to be verified by DPCC.

b) **Status of Survey of 11 industrial clusters.**

The survey of 11 industrial areas (i.e. Jhandewalan Industrial Area, Patparganj Industrial Area, Okhla FFC Industrial Area, Mohan Co-operative Industrial Area, Shahzada Bagh Industrial Area, Okhla Industrial Estate (Ph-III), Kirti Nagar Industrial area, Keshopur Industrial area, Moti

Nagar Industrial Area, Najafgarh Road Industrial Area and Tilak Nagar Industrial Area), was carried out by DSIIDC between 01.08.2019 and 31.12.2019. A total of 4443 industries were surveyed in these 11 industrial areas. Out of which, 38 units have been found as defaulters not complying with the requirements of environmental laws. The notices were issued to these defaulting units along with imposition of EC of Rs. 50,000/- each. Rs 9.00 lac has been deposited by 18 Industries on account of EC. The Details of survey is summarized in table given below:

Status of Survey conducted for the period from 01.08.2018 to 31.12.2019

No of Industrial units surveyed	Total no. of industrial units found violating environmental norms	No. of units on which Environmental compensation imposed	Environmental compensation received (in Rs)
4443	38	38	9 lac

2. Enforcement Action by DPCC:

YMC has also been monitoring enforcement action taken by the DPCC under the Water Act of 1974, Environment Protection Act 1986 and levy of Environmental Compensation for the breach of environmental laws and standards committed by the industries. As per the Status Report submitted by the DPCC, action has been taken against 2181 industries in conforming areas and 2155 in non-conforming area. In respect of Water Polluting industries, which is the prime concern under the mandate of the YMC, show cause notices were issued to 1658 industries and closure ordered issued in respect of 1140 industries during the period from 01.08.18 to 31.05 2020. In addition, during the same period, EC of Rs 218 crores was levied on industries that were found in violation of the various environmental laws, both in conforming areas and non-conforming areas, and Rs 12.83 crore realised. **(Annexure C-7/1)**

In addition, cases of 688 industries referred to DPCC by DSIIDC were taken up by DPCC and closure orders issued. Concerned SDMs have been directed to ensure that the industries are actually sealed. This will need to be monitored. Also DPCC will have to evolve mechanism to ensure recovery of EC from industries and in the event of non-payment of EC order closure of such industries.

3. Industries in Non-Conforming areas:

There are 51837 industries reported to be functioning from residential/non- conforming areas. This issue is being separately monitored by a Committee headed by the Chief Secretary, GNCT Delhi and being reported to the Hon'ble Supreme Court. Therefore YMC has chosen not to monitor this issue. As reported by the DSII DC, the matter regarding closure of industries is being dealt in three steps, namely, Step-I, Step-II, and Step-III.

Step-I: - The Municipal Corporations directed by GNCTD that the industrial units under their respective jurisdiction out of the list of 21960 industrial units whom industrial plot were allotted under the Relocation Scheme of 1996, are closed. Further, sealing of premises, disconnection of electricity & water supply were done, wherever required in respect of those industries which were found operating.

Step-II: - Municipal Corporations were further directed that the premises of applicants numbering 29877 (i.e. 51837 applicants less 21960 successful allottees who had applied for alternate plots under the Relocation Scheme) should not have impermissible industrial activity. Further, sealing of premises, disconnection of electricity & water supply were done, wherever impermissible activity was going on.

Step-III: - 3 Municipal Corporations/DDA are carrying out the comprehensive mapping/survey to find out details of industries functioning without obtaining proper Municipal license in respect of their respective jurisdiction and to seal them along with disconnection of electricity and water supply. Step-III is still going on.

Action Taken Report as on 15.01.2020 received from three Municipal Corporations regarding Step-3 is furnished in the table given below:

Name of Corporations	Total Nos. of Units surveyed	Nos. of Units applied for House hold license	Nos. of Units Closed on their own after 48 hrs notice	Number of Units sealed in Step- 3
EDMC	3832	731	2607	494
SDMC	5445	842	3289	304
NDMC	5757	531	4640	617
TOTAL	15034	2104	10536	1415

Since the number of units is quite substantial and these units release their effluent directly in to the drains, they can be a source of severe pollution in the river. This was evident during the lockdown imposed due to Covid19 pandemic when the water quality in the river saw considerable improvement as reported by CPCB. **Therefore monitoring their activity and their eventual closure should be an important ingredient of the strategy to clean river Yamuna.**

4. Engagement of NEERI for the Up-gradation of CETPs and Related matters:

The inspection reports of DPCC have been pointing to malfunctioning of most of the CETPs. Principal Committee appointed by the NGT had in its review of CETPs brought out that 7 CETPs out of 13 were not meeting standards. Even the report of DPCC report for November 2019 revealed that only 2 out of 13 CETPs were meeting standards and all other CETPs were non-compliant on one or more parameters. As per the DPCC report for February 2020 also, only three CETPs, namely, Wazirpur, Narayana and GTK are meeting standards. Also against a total installed capacity of 212 MLD, the effluent reaching the CETPs was only about 52 MLD. Despite NGT directions, there was no attempt to achieve zero Liquid discharge (ZLD) and the reuse of treated waste water was low.

Accordingly on the direction of YMC DSIIDC and Industries Department ordered a technical review of functioning of all the CETPs through NEERI. DSIIDC has entered into Memorandum of Understanding with NEERI on 05.11.19.

Under the provisions of MoU, besides providing solutions, CSIR-NEERI has been also been engaged as a Project Management Consultant (PMC) for the up-gradation of CETPs and waste water management in industrial areas. The scope of work includes action plan for CETPs, up-gradation and retrofitting of CETPs, management of hazardous waste, capacity utilization (use of CETP as STP), utilization of treated water, action plan for management of waste water of 11 industrial areas etc. The time for completion of work has been projected as 27 months. However, DSIIDC has requested NEERI to squeeze the timelines for the study.

Out of 13 CETPs, NEERI has started the study of CETP Wazirpur and CETP SMA and collected the preliminary data in respect of these CETPs. NEERI has informed that interim Reports

on CETP, Wazirpur and SMA will be submitted by them in June, 2020. Besides this, out of 11 industrial areas, the study of the Tilak Nagar Industrial Area has also been taken up by the NEERI. Due to Covid 19, work was held up and after opening of lock down, collection of field data and other activities has been undertaken to be started.

Further, for the implementation of the recommendation of NEERI towards the improvements/up-gradation of the CETPs, agencies such as CPCB and DPCC have been approached for providing financial assistance. DSIIDC has informed that Delhi government has set aside a budget of Rs 6 crores for this activity. This is a legitimate charge on the CPCB and DPCC and to start with DPCC may be directed by NGT to defray the cost.

Hazardous Waste Management Facility:

Delhi does not have a Hazardous waste management facility and all the CETPs store hazardous waste generated within the premises of the CETPs. Over the years huge quantities of hazardous waste is being stored at the different CETP sites, and if not properly stored has the potential to causes environmental hazard and thereby affect the health of the residents in the surrounding areas. YMC visited one of the CETP, namely, Wazirpur CETPs and found large dumps of hazardous waste at the site. This is unacceptable.

YMC therefore directed YMC to attend to this work on priority. DSIIDC has informed that it has awarded the work for the development of Treatment, Storage and Development Facility (TSDF) for Hazardous waste in Bawana at Delhi to M/s Tamil Nadu Waste Management Ltd. (M/s TNWML) on 30.11.2019. TNWML had applied to MoEF & CC for approval of Terms of Reference (TOR) for grant of Environmental Clearance (EC) for the aforesaid project. The case was placed before Expert Appraisal Committee (EAC) of MoEF & CC for consideration on 26.12.2019 and EAC has approved the same. Terms of Reference (ToR) were issued on 06.01.2020 by the MoEF & CC.

Further, draft EIA report was submitted to DPCC by project proponent M/s TNWML. On 26.02.2020. Public hearing for environmental clearance for the said project was fixed on 09.04.2020 but it could not be held due to lock down in Delhi due to lockdown during COVID -19 pandemic and, therefore, cancelled.

In this regard, a letter was written by DPCC on 03.04.2020 to MoEF & CC requesting whether another date for public hearing is required to be given after the lock down period as notified date is over, or forward the suggestions/objections so received by DPCC upto 09.04.2020 in response to the public notice. Objections/Clarifications/representations received w.r.t said project in the period of 06.03.2020 to 09.04.2020 along with the Reply/Clarifications given by the Project Proponent M/s TNWML were forwarded to MoEF & CC by DPCC and MoEF & CC was requested to convey its decision regarding holding of public hearing to DPCC for further necessary action.

The decision regarding public hearing is pending with MoEF & CC. Only after grant of Environmental Clearance can M/s TNWML can commence construction / facilities.

5. Supervision, control and accountability:

For compliance and implementation on various activities which were in the original action plan dated 16.10.18, an oversight system was to have been set up to function under the supervision of Chief Engineer of Industrial Areas under whose control the monitoring and evaluation of various actions like recovery of environmental compensation, functioning of OLMS, up-gradation of CETPs etc was to be done. DSIIDC has informed that concerned Executive Engineers will monitor the progress of various actions pertaining to their division on regular basis under the overall supervision and control of the Chief Engineer and report periodic compliance to DPCC.

Directions sought from NGT:

1. Directions may be issued to Commissioner Industries and MD DSIIDC to furnish a quarterly Progress Report to the Tribunal on the study underway for up-gradation of the CETPs and for effective and time bound implementation of the recommendations of NEERI report.
2. Establishment of the Hazardous waste management Facility. This was directed to be set up by GNCTD by June 2020, however, due to Covid19 lockdown and the delay in grant of Environment Clearance the work of establishing the Hazardous waste site will be delayed. Considering that Delhi does not have any Hazardous waste Treatment facility, directions

may be issued to the GNCTD and DSIIDC to set up the facility by December 2020 and the authorities be directed to submit quarterly report to the Tribunal.

3. NGT may also kindly consider directing the MOEF&CC to expedite grant of Environmental Clearance considering the urgency of the matter.

CHAPETR – 8

Sewage and Fecal Sludge Management

NGT's order dated 08.5.15

“Delhi Jal Board has to provide itself or through appropriate agency de-sludging vehicles which will collect sludge from the septic tanks in the colonies and take it to the nearest STP. Such vehicle should be provided with GPS to ensure proper collection and transportation to the designated location.”

NGT's order dated 11.9.19

“a) An incremental progress of collecting 2 MGD of septage in 120 days needs to be quantified by DJB in terms of the number of households with pit latrines, map the SPS' where the collected septage has to be deposited colony wise and sub-district wise and monitor licenses issued at a disaggregated level. DJB to assign responsibility to an organization which can collect and furnish incremental progress.

b) DJB may prepare an Action Plan for providing unauthorized colonies with sewerage systems.

c) Govt. of NCT Delhi, DJB, DMCs and DDA to collectively undertake advance planning for location of STPs, SPS', peripheral and trunk lines before new populations settle in.

d) Chief Secretary, Govt. of NCT Delhi make it mandatory for those provided with piped water supply and those having a sewage conveyance system in the vicinity to take sewer connections.

e) Chief Secretary, Govt. of NCT Delhi, DJB and DMCs to introduce the regime of levy sewerage charges as presently no such charges are being levied within two months including areas where network has been laid (whole of East Delhi).

f) Considering that tens of thousands of households spew their garbage into the storm water drains and pay nothing for the environmental damage caused, the CEO, DJB and DMCs to ensure sever connectivity where sever network has been laid before 31.12.2019 failing which both these agencies shall be saddled with environment compensation to the tune of Rs. 10 lakh per month and disciplinary action against the Zonal Officer responsible for his zone.

g) The Chief Secretary, GNCT Delhi, DJB and DMCs to ensure that a mechanism is evolved where by raw sewage from unauthorized colonies gets collected and taken to some central STP facility

for treatment till the time sewer line network is laid in unauthorized colonies within three months and six months thereafter ensure implementation of laying of sewer line network failing which Environmental Compensation of Rs. 10 lacs per month shall be levied on each of them.

h) An institutional mechanism be established by the Chief Secretaries, GNCT Delhi, DJB and DMCs whereby the collection, transportation and disposal of septic tank waste is monitored.

i) Accountability of the officers may be determined in the manner mentioned earlier. The Committee may monitor this aspect.”

Status as in August 2018:

Delhi has a population of about 20 million of which almost 6-7 million live in 1799 unauthorized colonies and another 2 million in slums/JhuggiJhopri clusters. Only about 14% of the Un-authorized colonies had been notified as sewerage colonies. Even here, in a large number of colonies individual household had not taken sewerage connection and continued to release their sewage and septage either directly into the drains or used septic tanks which until 2018 were emptied through private tankers devoid of regulation by any public authority. As a result most of septage was getting deposited in drains which outfall into river Yamuna or getting discharged surreptitiously into low lying water bodies resulting in contamination of ground and surface water.

Govt of NCT Delhi had prepared a draft Septage management Policy in 2015 for collection, transportation and treatment of septage from septic tanks but the draft policy had made no headway and had not been approved by the Government. As a result there was no control or regulation on collection and dumping of septage which was completely in the hands of tanker mafia causing pollution of water bodies and the river Yamuna. There was no enforcement action either by the DJB, or the drain owning agencies or the District Magistrates who had powers under the Environment Protection Act 1986.

Progress achieved:

Progress of sewerage network:

Absence of sewerage network in most of the unauthorized colonies has been and continues to be a major contributing factor to the pollution of river Yamuna. According to the

Action Taken Report of DJB, there is no authentic data on number of households and the total population living in these unauthorized colonies. An estimate of 12 lakh households with a population of 56 lakhs (@4.5 persons per household) (based on 2015 data) has been assumed to be living in these 1799 unauthorized colonies as per the data provided by M/s GSDL. The population of these colonies could safely be assumed to be 70 lakhs today.

Out of 1799, the status of sewerage network is as follows;

i.	Colonies where sewerage network is completed and notified;	561
ii.	Colonies where sewerage network is under execution:	467
iii.	Colonies where work is at the stage of tendering:	617
iv.	Colonies where NOC from Forest, Archeology Dept. and under "O: zone" restriction under the DDA Act is pending:	154

Total no. of U/A colonies, households and U/A that have been sewerage district wise:

S.no.	Districts	Total U/A colonies and Households		U/A Colonies sewerage and households	
		Colonies	Households	Colonies	Households
1	Central	71	77,579	6	657
2	East	86	42,045	85	41404
3	New Delhi	27	13,252	1	56
4	North	180	1,07,749	28	9580
5	North East	123	1,59,566	66	74464
6	North West	196	1,92,572	16	8636
7	Shahdara	51	33,387	34	21991
8	South	178	1,01,530	11	6509
9	South East	154	1,28,618	12	8486
10	South West	416	1,70,184	134	56690
11	West	317	2,21,038	168	118995
	Total	1799	1243520	561	347468

As is evident from the above table, out of 1799 U/a colonies, sewer network has been notified in 561 colonies and is at various stages of execution in 467 colonies and is expected to be completed only by December 2022. Out of the remaining 771 colonies the work of laying sewer network is at different stages of tendering for 115 colonies and is expected to be awarded by August 2020. DJB has also sought clearances from Forest Department, ASI and the DDA (for

areas falling in 'O' zone) in respect of 154 colonies. Further action in the case of these colonies will be possible only after clearances from these Departments are received. For the remaining 502 colonies there is no clarity at present as to when these areas will be brought under sewerage network. The Action Plan for laying the sewerage network as submitted by the DJB is placed at **Annexure C-8/1**.

The issue of sewage generated by unplanned/unauthorized colonies and slums/jhuggis where about 35 to 40% of the population of Delhi resides is a major source of pollution as the sewage is released directly into open drains. The Delhi Slum Improvement Board (DSUIB) has claimed before YMC that the Board has installed community toilets and no sewage goes into drains. This statement can only be checked by an external agency which does a random check but judging from the complaints of people residing around Chirag Delhi and Nizamuddin West the sewage from the jhuggis is flowing into the drains causing an intolerable stench.

The response of DJB, as noticed in all the meetings ever since YMC held its first meeting on 11.9.18, has been to state that sewer networks have been planned as a long term solution and in the short term it is planned to intercept the sewage at the outfall point of drain, and convey it through the trunk sewer to the STPs under the Interceptor Sewerage project (ISP). DJB has been targeting the interception of sewage flowing in the drains in the catchment areas of Najafgarh and Shahdara drains. The project when fully commissioned will intercept 242 MGD(1100 MLD) of sewage flowing through 108 tributary drains joining Najafgarh and Shahdara drains and will be treated at various STPs which are under various stages of construction. This has been discussed in Chapter 5 of this report.

The DJB in its Action Taken Report has informed that sewage from 1173 unauthorized colonies, which is presently released into Yamuna through Najafgarh and Shahdara will be trapped and treated once ISP is fully commissioned. However till all the STPs linked to these 108 drains passing through these 1173 colonies are commissioned in December 2022, the sewage from these colonies will continue to pollute the river.

Out of the 626 U/A colonies, which are not covered by the ISP, while some are proposed to be brought under sewerage network, there is no clarity about 502 colonies, as pointed out in

earlier paragraph, as to when the sewerage network will be taken up in these colonies **(Annexure-C-8/2)**. It is, therefore, incumbent upon DJB and Govt of NCT Delhi to explore alternative ways of management of the sewage flowing through these drains in the U/A colonies. Elsewhere in the report, it has been mentioned that in the interim two pronged approach of in-situ phyto/bio- remediation on the one hand and septage management on the other will have to be pursued if the river is to have any chance of revival.

The first requirement is to have a survey of colonies and households which are having pit latrines and collection services and those who have no sewerage system private or linked to a Government scheme. Without a colony and household level plan the discharge of sewage into drains will continue. Government of NCT Delhi therefore needs to prepare monitorable action plan with timelines for completing the sewerage network and for sewage management /septage collection, transportation and treatment of the septage generated by unauthorized colonies. In the interregnum in-situ phyto/bio remediation backed by an efficient Septage Management system are the only short –term measures available. Without linking it to populations covered colony wise there is a risk that high priority areas may get ignored in looking for alternatives that are easy to implement.

Govt of NCT Delhi must also prepare a master plan for locating land for laying a Sewerage network. Clearances from Forests, ASI and DDA will not come without follow up and in the event that these alternatives do not succeed a Plan B has to be ready. DJB is taking routine interest in follow up and therefore efforts need to be reinforced at a Government level.

Septage Collection, Transportation and Treatment:

YMC's review of sewage and septage management in unauthorized unsewered colonies revealed that though the Govt of NCT Delhi had a drafted a regulation called the Septage Management Regulations, this had not been pursued by the concerned agencies/Departments. Through constant persuasion by the YMC, the Septage Management Regulations were got notified on 21.11.18.

On the suggestion of the YMC to the CS, a seminar was got organized 21.11.18 by DJB where different stakeholders, mainly the Municipal Corporation, DJB officials and Revenue functionaries participated. The seminar was for sensitizing the stakeholders about the importance of septage management in the context of Delhi which has a large number of unauthorized colonies where households are using onsite sanitation system. The responsibilities of different authorities under the Septage Management Regulation of 2018 were explained. YMC attended the Seminar and addressed the participants.

Finding the response to the seminar to be inadequate, YMC held a meeting with the Chief Secretary Delhi on 14.12.18 requesting him to organize an inter-departmental meeting. That meeting took place on 18.01.19 where all departmental heads/secretaries were represented. The roles and responsibilities of each department was spelt out and the heads of the departments made accountable. Clear instructions were issued to all the Secretaries/heads of departments on the implementation of the Regulations and Executive Engineers of the areas were made accountable for preventing sewage and other pollution finding its way into the storm water drains.

During the last one and a half years of the implementation of the Septage Management Regulations there has been considerable progress on identification of Sewage Pumping Stations and STPs by district so that Septage collected from the septic tanks can be deposited at designated points. It required preparation of infrastructure at the SPSs for receiving the septage, and registration of Emptiers /vehicles. So far DJB has identified and designated 86 SPSs for receiving septage and conveying it to the STPs for treatment 206 vendors/vehicles have been registered for collecting and transporting septage. However, the progress on actual spread of the scheme and volume of septage collected has not been satisfactory.

The matter was also discussed in the inter-departmental meetings held at the level of Chief Secretary which was attended by the YMC Members. It was also re-emphasized in a one to one meeting with the Chief Secretary. The progress furnished by DJB on District wise monthly collection of septage for the last 5 months from January to May 2020 is given in the table below:

Name of District	Volume of Septic Tank Waste (Ltrs.) Jan-2020	Volume of Septic Tank Waste (Ltrs.) Feb-2020	Volume of Septic Tank Waste (Ltrs.) Mar-2020	Volume of Septic Tank Waste (Ltrs.) April -2020	Volume of Septic Tank Waste (Ltrs.) May-2020	Total
West	4,500	13,500	0	0	0	18,000
South-West	65,33,300	46,67,400	37,48,000	42,87,000	29,77,000	2,22,12,700
North-East	1,32,000	1,24,000	1,00,000	52,000	1,48,000	5,56,000
South-East	72,92,000	56,56,000	67,28,000	76,72,000	54,23,000	3,27,71,000
North-West	1,39,83,000	1,27,18,000	1,06,87,000	1,01,32,000	67,03,000	5,42,23,000
TOTAL	2,79,44,800	2,31,78,900	2,12,63,000	2,21,43,000	1,52,51,000	10,97,80,700

The reasons for lesser collection of septage in the month of May 2020 as submitted by DJB are as under:-

1. Some of the vendors are not keen to continue this work and have opted for other works of their interest.
2. Some of the vehicles were reported to be under breakdown maintenance.
3. Due to ongoing COVID -19 Pandemic the respective District Magistrates are busy with handling various issues connected with containment of COVID-19 and hence due attention could not have been paid to Enforcement action in respect of Septage Management Regulations.

These issues need to be addressed at the level of the Chief Secretary if the tempo built up over the last one and a half year on implementation of Septage regulations is to be maintained and scaled up. The details of unauthorized colonies along with household and populations in the above districts from where septage has been received vis a vis total districts and unauthorized colonies are as follows:-

S No.	District	No. of UCs	Household (Plot/Building)	No. of U/A colonies from which septage received	No. of households involved
1	Central	71	77,579	-	-

2	East	86	42,045	-	-
3	New Delhi	27	13,252	-	-
4	North	180	1,07,749	-	-
5	North East	123	1,59,566	5	27686
6	North West	196	1,92,572	3	2676
7	Shahdara	51	33,387	-	-
8	South	178	1,01,530	-	-
9	South East	154	1,28,618	153	127977
10	South West	416	1,70,184	251	79416
11	West	317	2,21,038	4	1024
	Total	1799	1243520	416	238779

It is clear that presently, average monthly collection, and transportation and treatment septage of 20 to 22 ML, to about 6 lakh litres per day. Considering the size of the population, DJB had earlier stated that daily generation of septage from these areas is of the order of 6 MLD. Present collection transportation and treatment is only about 10% of the septage generated. Also against about 9 lakh households in 1238 unauthorized colonies in 11 districts, septage was being received from only 416 U/A colonies covering 2.39 lakh households' colonies. This needs to be scaled up.

On collection of sewage and enforcement in unsewered unauthorized, the DJB has been consistently taking the stand that the Board has no legal authority to take any action against households not complying with the Septage regulations for emptying the septage through registered/licensed vendors. For identical reasons DJB has been taking the stand that preventing flow of sewage or septage in drains in unauthorized colonies which have not yet been brought under sewerage network is the responsibility of the Municipal Corporations. The Corporations on the other hand took the stand that sewage and septage is the responsibility of DJB and hence they have no role to play. YMC has also been monitoring this through joint meetings of DJB officials and District magistrates for better enforcement of Septage Regulations but quite often there is shifting of blame and evasion of responsibilities. The matter was flagged before the CS and also brought to the notice of NGT in the Second Interim Report dated 27.5.19 and Third Interim report dated 5.2.20.

Government of NCT Delhi has finally issued detailed Standard Operating Procedures vide their order dated 31.3.2020 wherein responsibilities of Municipal Corporations, District Magistrates and the DJB have been clearly spelt out for the purpose of effective implementation and enforcement of Septage Management Regulations. **(Annexure – C-4/3)**

Faced with poor response to the Septage Regulation and absence of effective enforcement by the Authorities the Government of NCT Delhi has brought out a new scheme called the Mukhya Mantri Free Septage collection scheme. Under the Scheme, the DJB has plans to hire private tankers and use them for the purpose of collecting septage from households free of cost. The Board had earlier informed the YMC that the scheme will be put into operation by June 2020. However due to the lockdown following Covid 19 pandemic and the dislocation of work, the scheme has got delayed. The Board now envisages to implement the scheme only in 2021 and till that time existing scheme of registered /licensed Emptiers/vehicles will be continued for collection and transportation to the SPSSs.

Household Sewer Connections in the Notified Sewered Colonies:

During the various reviews conducted by the YMC with the officials of DJB it was revealed that even though DJB had laid sewer network in some colonies, individual households refused to take household connectivity to the sewer network as it involved payment of development charges, besides payment of sewerage charges. YMC was informed that out of 416 colonies that had been sewerred about 2.30 lakh households had not taken sewer connection or taken illegal connections. In fact it was also brought out that though entire East Delhi has 100 percent sewerage network, only about 30% of the individual households had taken connections to the sewerage network. By way of illustration, YMC was told that one of the colonies, namely, West Jyoti nagar only 12% of the households had taken connections to the sewer network. This issue was also brought out in the Second and Third Interim Reports of YMC submitted to NGT on 27.5.19 and 5.2 20 respectively.

From the tenor of the discussions in the meeting with the DJB officials, they generally looked helpless and even suggested that no coercive action can be taken against such households. It was only after YMC's constant persuasion and prodding that the DJB started

pursuing the idea of a survey and issued notices to those who had not taken connections. In the meantime Govt of NCT Delhi also brought out a new scheme called the Mukhya Mantri Free Sewerage scheme under which Government decided to provide free sewer connection to individual households and regularize illegal connections. DJB was asked to undertake a survey and after verification and grant sewage connections to the households by 31.3.20. However, due to Delhi Assembly elections and afterward due to the dislocation caused due to the Covid 19 pandemic the work has got disrupted. The new timelines for the remaining work of sewerage connectivity now indicated by the DJB are given at **Annexure—C-8/3**. It has been stated due to uncertainty of mobilizing labour and budgetary constraints, this work would now get extended up to 31.3.21.

As per Delhi Economic Survey 2016-17, almost 30 lakh people live slums and jhuggis/Jhopdis. Most of the JJ clusters are serviced by community latrines run by the Delhi Urban Slum Improvement Board (DUSIB) – but the coverage and efficiency of the arrangements are reported to be of varying standards. Moreover these areas release grey water using the drains going into river Yamuna

YMC is, therefore, of the view that regardless of when the individual household gets connected to the sewer network, Govt of NCT Delhi should start levying sewerage charges on all the households, whether located in sewered/unsewered unauthorized colonies or even slums under Polluter Pays principle.

Invoking “Polluter Pays Principle’ for payment for Sewage generation:

Right to clean and healthy environment, is recognized as a right to life under Article 21 of the Indian Constitution. While Citizens have a right to decent environment, under Article 51(A) (g) every citizen has a fundamental duty to protect and improve the natural environment including rivers. Extending this principle, every citizen has a duty not to pollute environment and if he or she does pollute, should compensate for causing such pollution. Polluter Pays principle therefore must be invoked and applied to all citizens whether living in organized colonies, unauthorized colonies (whether sewered or not). DUSIB should be asked to pay by number of

toilets not connected to a pipe going to an SPS. This survey can be got conducted by DPCC by outsourcing the task of checking connectivity to a regular sewage network.

NGT vide its order dated 08.5.15 had directed levy of sewage charges on all citizens in Delhi. This has been reiterated by the Hon'ble Tribunal in its order dated 11.9.19 directing the GNCTD to introduce within a period of two months a regime of levying sewerage charges as presently no sewerage charges are being levied, meaning thereby that it should be for all the household regardless of whether the area is sewered or not to have to pay sewage charges. This was reiterated in order dated 05.3.20. However, despite repeated directions by the NGT and confirmed by the Hon'ble Supreme Court, Govt of NCT Delhi has neither implemented this direction nor has come up with any intent to implement this direction.

When it comes to organized colonies, these are of two types– colonies with houses built on individual plots like Lajpat Nagar, Greater Kailash, and all the Vikas Marg colonies like Preet Vihar and Group Housing Colonies like Dwarka, Rohini etc. Among these some 40% - 50% of the households in colonies like Greater Kailash and Lajpat Nagar and 50-60% in colonies like Rohini, Dwarka, RK Puram have been paying “Nil” charges for water and even for sewage collection and treatment despite causing daily pollution. This works against the polluter pays principle. The percentage of organized colonies whether on individual plots or in Group Housing Societies having less than 20 KL consumption is very high and it is not clear whether the increase in numbers is purely due to water conservation or there are other reasons. It has come to notice that in some of the Group Housing Societies, the per household consumption works out to an incredibly low consumption which raises the question of whether such meager consumption points to other malpractices like using bore well water unauthorizedly. The possibility of DJB having sanctioned more than one connection to a dwelling unit or overlooking the operation of unauthorized bore-wells also arises. **The number of household water meters has increased from 17 lakhs to 23.70 lakhs (40% increase) in around 4 years after the launch of 20 KL free policy** and the possibility of different ploys being used and people installing multiple connections within the same premises to avail of 20 KL free water cannot be ruled out. From a pollution point of

view keeping water bills low may be leading to careful use of water but it is giving amnesty against having to pay for water and for sewage treatment as environmental compensation.

Applying the polluter pays principle, every individual household causing pollution by release of sewage into the open environment or in the sewer network should be liable for payment for its treatment irrespective of whether the sewage is conveyed through a sewer network or by way interception under the Interceptor project or through septage management. The Government had been asked by NGT to revisit its policy of subsidizing polluters. Since there is no response –not even a mention of this direction having been discussed it is apparent that there is no intention to pay heed. This requires an order that cannot be parried by the authorities which has been done from 2015 and more recently since September 2019. The fact that it stems from a principle enunciated by the Supreme Court has been simply ignored and NGT's repeated exhortations have evoked no response.

Environmental Compensation:

Environmental Compensation: The Statement of Enforcement action against pollution in the drains taken by different Municipal Corporations and other drain owning agencies is tabulated below:

Agency	EC imposed from 01.01.20 to 31.05.20		Remarks
	EC levied	EC realised	
SDMC	40.50	1.00	
EDMC	33.11	1.55	
North DMC	32.74	33.34	
PWD			
DCB	1.50		
DSIIDC	420.64	312.84	
IFCD	1.50		I&FC has forwarded 204 cases to DMCs for taking enforcement action.

The Realization in South DMC and East DMC is extremely poor. YMC has asked the UD and DMCs to evolve a credible mechanism for improving realization of EC levied on the offenders. The response, however, is ambivalent except in case of North DMC. South DMC has also come up with some mechanism for recovery of EC recently but unless there is seriousness and is monitored by the Urban Development Department, not much headway is expected. The matter was also brought up in the meeting taken by the Chief Secretary on 8.1.20. In the absence of a response from GNCT Delhi, to the Tribunal's order dated 11.9.19, YMC is not in a position to comment further. YMC recommends Chief Secretary being directed to fix the accountability on officers for their lackadaisical implementation of the Polluter Pays Principle so far as pollution in the drains is concerned.

Directions Needed from NGT

1. Regardless of when the individual household gets connected to the sewer network, Govt of NCT Delhi should start levying sewerage charges on all the households, whether located in sewerage/unsewered unauthorized colonies or even slums. DUSIB can subsidise the poor but all others must be made to pay for the pollution created by whatever name the levy may be called.
2. The Delhi Slum Improvement Board (DSUIB) has claimed before YMC that the Board has installed community toilets and no sewage goes into drains. This statement can only be checked by an external agency which does a random check. Judging from the complaints of people residing around Chirag Delhi and Nizamuddin West the sewage from the jhuggis is flowing into the drains causing an intolerable stench.
3. Out of the 626 U/A colonies, which are not covered by the ISP, while some are proposed to be brought under sewerage network, there is no clarity about 502 colonies. NGT may direct the IDMC to have a three-pronged approach and while in-situ phyto/bio-remediation and septage management must continue there is also need for oversight of the implementation of an SOP which casts responsibility for sewage in drains on the local bodies. NGT's direction is needed to clinch need for all 3 strategies to be used -the bottom line being the stoppage of sewage in storm water drains.

4. NGT may direct the IDMC to mount a survey of colonies and households which are having pit latrines/collection services and those who have no sewerage system and are discharging into the drains. Without linking strategies to populations in the colonies people will continue to pollute.
5. Applying the polluter pays principle, every individual household causing pollution by release of sewage into the open environment or in the sewer network has been already made liable for payment for its treatment irrespective of whether the sewage is conveyed through a sewer network or by way interception under the Interceptor project or through septage management. NGT may direct that a response be given to the Tribunal's order to revisit the policy of subsidizing polluters as there is no response .Orders of the Tribunal starting 2015 and last reiterated in September 2019 have been ignored.

Chapter - 9

Online Monitoring of STPs, CETPs and Yamuna

Compliance of environmental standards by all the STPs and CETPs is essential for ensuring that the treated waste water/effluent after its release from STPs/CETPs does not pollute the river Yamuna. Continuous monitoring of the performance of all the STPs and CETPs is, therefore, is necessary to ensure that the treated effluent of the STPs and CETPs conform to the discharge standards prescribed in the Environment Protection Rules 1986.

NGT's order dated 13.1.15:

"It shall be ensured that the functional data of all the STPs is on line and is connected to the Delhi Pollution Control Committee as well as the Central Pollution Control Board particularly in respect of COD, TDS, TSS and pH and shall be ensured that they are operational even during the power failures."

NGT's order dated 8.5.15.

The directions relating to OLMS were reiterated as follows:

"14. The Delhi Jal Board and DSIDC through DPCC or otherwise shall introduce Online Monitoring System (OLMS) particularly at the specified observation points or locations where the STP's and CETP's are located. This information shall be put in the public domain informing the public at large in regard to the performance of the STP's."

NGT's order dated 11.9.19

After considering the 2nd Interim Report of YMC dated 27.5.19, the Hon'ble Tribunal in an order dated 11.9.19 directed as under:

"Regular calibration of OLMS in Sewage Treatment Plants and CETPs to validate sensor results with lab results to be overseen by DPCC and DJB and report submitted to the Chief Secretary Delhi and Monitoring Committee on Quarterly basis."

Status as in August 2018:

Despite a lapse of three and a half years since the original orders on OLMS were issued by NGT in 2015, online connectivity of STPs and CETPs with DPCC and CPCB servers had not been established. Only 9 out of 13 CETPs had OLMS installed but were not connected to the servers of DPCC and CPCB. The OLMS data of CETPs and STPs was also not in public domain. There was no system of generating alerts if the CETP/STP parameters exceeded the standards. This was thus not only a failure on the part of the DJB and DSIIDC, but more importantly of the CPCB and DPCC- the regulatory bodies.

Progress achieved:**OLMS in Sewage Treatment Plants (STPs) and Common Effluent Treatment Plants (CETPs)**

YMC after observing that there has been no progress on OLMS, issued directions to DJB, DSIIDC and Commissioner Industries to install OLMS at all the STPs,/CETPs and connect the OLMS to servers of CPCB and DPCC. YMC even organized meetings with NIC to facilitate connectivity to the DPCC/CPCB servers (**Annexures–C-9/1**). Detailed directions were also issued asking the DJB/DSIIDC/Industries Department to develop a system of generating alerts through SMS whenever parameters exceeded the prescribed standards. This was asked to be sent to the senior functionaries for management intervention. The departments were also directed to develop a set of SOPs for addressing alerts communicating different levels of shortcomings of the management. YMC held series of meeting with DSIIDC, Commissioner Industries and DJB officials during the last 23 months. The record of discussion held and directions issued by YMC have been incorporated in the three Interim Reports which the YMC submitted to NGT. These are not being reproduced here.

STPs:

There are 35 functional STPs operated by the DJB. All 35 STPs have now installed OLMS and are connected to the servers of DPCC and CPCB. DJB has also provided a system of generating alerts whenever parameters exceed the prescribed standards and the SMS is received by the concerned senior officers. SOPs have also been developed for handling alerts so as to address

problems at the plant level. However, during monitoring meetings when the YMC asked for a demonstration of how the system was actually functioning, messages sent and interventions made DJB was unable to show examples except for Whatsapp messages. This was also verified at the DPCC office at Interstate Bus Terminal (ISBT) to observe real time alerts and response but the performance of those in charge was highly deficient. Tangible improvements in using OLMS as a tool for management will be possible if the STP wise alerts and time taken to intervene and make correctives are collated and analysed. Only if this is watched over every month STP wise, will the authenticity and usefulness of reporting become worthwhile.

Both CPCB and DPCC must monitor this monthly and report aberrations and laxness to the monitoring committee under Chief Secretary. Otherwise it will deteriorate into a symbolic exercise. Ideally the results with red marking should go on a website and the newspapers having environmental reporters asked to see the data and report on it for public satisfaction.

CETPs:

There are 13 CETPs which are under operation in 17 industrial estates under the overall supervision of DSIIDC. It has been confirmed that all 13 CETPs have installed OLMS and have been connected to the servers of DPCC and CPCB. On the directions of YMC, the DSIIDC has additionally installed flow meters at the inlet of the CETPs and these flow meters have been linked to the servers of DPCC and CPCB. On the question of calibration since neither the CETPs nor the DSIIDC have a dedicated laboratory of their own and nor do they have a tie up with any NABL laboratory, the YMC had on 22.7.19 directed that calibration of OLMS should periodically be done as prescribed in the CPCB guidelines (**Annexures-C-9/1**). DSIIDC has now confirmed that each CETP has been directed to have a tie up with NABL laboratory for the purpose of manual testing of samples collected from the CETPs undertaking periodic calibration. The DSIIDC has also informed that they have prepared a Standard Operating Procedures (SOPs) so that alerts received through OLMS, are attended at the management level

Calibration of OLS:

OLMS being a sensor based system requires periodic calibration by validating the results of OLMS through laboratory tests. Though CPCB has issued detailed guidelines for periodic calibration of OLMS it was observed that there were large variations between the lab results and

those recorded by the OLMS. YMC in its Third Interim Report had highlighted the issue of how even after calibration the difference in the OLMS and Lab results in some cases, both in STPs and CETPs, was more than 100%, in some CETPs even as high as 300%. Despite NGT's directions of 11.9.19 the supervisory authorities of DJB, DSII DC/ Industries Department and the DPCC who possess immense authority have not used it to take corrective action which has resulted in no improvement in reducing the discrepancies which question the very foundation of installing an on line system for monitoring. The wide variation between the lab results and OLMS also questions the usefulness of an On Line System as a monitoring mechanism in the absence of willingness to look at the results, question high discrepancies and introduce correction. More importantly the OLMS and lab verification are mere tools to assist quality control. Unless the maintenance engineers from the side of Industry and the project managers / STP in-charges are made accountable if such variation persists this will not be used as a tool for monitoring. Some variation in the range of 10-15% can be permissible but repeated high variation even after calibration has been done means that exercise is not being used as a tool for worthwhile correction. YMC finds that OLMS is not achieving the intended objective due the absence of professionalism and commitment.

Separately, YMC had asked the CPCB to undertake a Technical appraisal of the OLMS both for the STPs and CETPs and submit a set of Standard Operating Procedures (SOPs). Apart from conducting the technical audits, CPCB needs to see that the engineers in charge are trained in using the systems which have been set up to enhance professional management.

The CPCB has since submitted a report on the SOPs prepared after carrying out a technical audit for removing the variance in the results of OLMS and lab tests. A copy of CPCB's report on SOPs for OLMS is at **Annexure-C-9/2**. CPCB has also been asked to issue directions to the DJB and DSII DC asking them to follow the SOPs for calibration failing which responsibility should be lie on the senior most officers who manage the system. If the problem of large variance between OLMS results and lab tests continues, the Commissioner Industries, the Chairman and Member Secretary of DPCC and the CEO DJB would have to be held responsible for failing to institute and oversee the systems which have been established under NGT's repeated orders. OLMS as a tool is being used for continuous real time monitoring across the board and by now the Industries

Commissioner, the Secretary Environment and the CEO DJB should have taken steps to have the officers trained by speaking to the counterparts in other states which have more experience. CPCB may be made the nodal authority to spearhead this as the Board is knowledgeable about good practices in other states.

Directions Sought from NGT:

NGT may consider issuing the following directions

1. To provide statutory backing to the SOPs, CPCB be directed to issue directions under Environmental Protection Act 1986 to DJB, DSIIDC, and Commissioner Industries for comply with the SOPs in letter and spirit and also fix accountability for any dereliction.. In the absence of such statutory backing, it is doubtful whether the SOPs will get implemented effectively.
2. To DJB, DSIIDC/Industries Department to fix accountability on the supervisory officers for failing to ensure periodic calibration and for not imparting training to those in charge of using the OLMS.

Chapter - 10

Use of treated Waste water

Directions of the Hon'ble National Green Tribunal (NGT) dated 11.9.19

DJB and park owning societies like DDA, DMCs, PWD to mandatorily use the treated water from STPs for all parks within 5 km radius of STPs and pending laying of pipelines, such treated water to be transported through tankers. Compliance be reported by 31.12.2019 failing which DJB, DDA, DMCs, PWD and others shall each be charged Environmental Compensation at the rate of Rs. 5 lakh per month till compliance is reported. This shall be overseen by the Chief Secretary, Govt. of NCT, Delhi and the Monitoring Committee as this colossal waste of treated water cannot be allowed.

Status as in August 2018:

DJB generates about 525 MGD of treated waste water from its 35 functional STPs. Out of this, about 90 MGD is used for irrigating parks and gardens including 9.50 MGD of treated waste water being used for the PPCL Power plants for cooling purposes. The rest of the treated waste water is released in the drains with untreated sewage which eventually joins Yamuna.

The YMC had identified use of treated waste water as one of the important activities so as to promote better utilization of treated waste water, some of which is of standards fit enough for a number of non-potable uses. Recycling of waste water, both domestic and industrial, will promote water conservation, reduce demand on both surface and ground water resources and make efficient use of treated waste water some of which is treated to very high standards of TSS/BOD of less than 10 mg/L, most of which presently is released into the drains where it gets mixed with untreated waste water before joining river Yamuna.

Progress achieved:

The DJB was directed to prepare an action plan for use of treated waste water, in consultation with different bulk consumers of water, as well as to give mile stones to be achieved in short,

medium and long term. One of the short term measures suggested by YMC was that, all parks and gardens belonging to different agencies like DDA, DMCs, PWD etc. located within a radius of 5 KM of existing STPs should mandatorily use treated waste water for irrigation, and pending laying of pipelines, such treated waste water should be lifted through tankers by all park owning agencies.

This measure was also suggested in the light of the alarming decline in the water level in Delhi. Out of 34 blocks in Delhi, 22 are already categorized as "over-exploited", 8 are "critical/semi-critical" and only 4 blocks are categorized as "safe" by the Central Ground Water Board (CGWB) in its report of 2017. At the macro level the CGWB report of 2017 also brings out that against a recharge of 0.32 bcm, withdrawal is 0.36 bcm and ground water extraction has been pegged at 120%. In other words, the excess withdrawal of ground water per year is of the order of 0.04 bcm (about 24 MGD).

Considering the criticality of conserving ground water and promoting recycling of waste water, YMC drew attention of the Chief Secretary GNCT Delhi to the notification issued by the Lt Governor Delhi under Section 5 of the EPA 1986 on 12.7.2010 for regulation and management of ground water which *inter alia* mandated use of recycled water both at the time of granting permission for new bore wells as well as for the continued use of existing bore wells water for commercial and industrial uses. Pursuant to the suggestion of the YMC, Chief Secretary issued directions on 09.3.19 to all the Departmental Secretaries/heads to ensure increasing use of treated waste water.

The Hon'ble NGT in its order dated 11.9.19, while taking on record the recommendations contained in the Second Interim report of 27.5.19 of YMC, had directed that all the parks owning agencies should start using treated waste water in lieu of ground water and make arrangement of transportation through tankers. The issue was also discussed in a series of meetings with park owning agencies held on 19th, 26th and 30th December 2019 (**Annexure C-10/1**). Initially there was considerable reluctance and even DJB appeared not to be serious as the amount of water to be lifted and used in the parks would cover just a fraction of the treated waste water. However,

what is important is the realization at the community level that recycling waste water for uses like horticulture needs to be promoted to serve the larger objective of water conservation.

Subsequent to the meetings held with major stake holders and based on the Action Taken Report received in May 2020, information has been compiled and is tabulated below:

S. No	Name of the Stake holder Department	No. of Parks	Requirement of treated effluent (MLD)	No. of 10 KL Tankers required @10 trips per day
1	SDMC	6807	16.198 (16000KLD)	160
2	EDMC	1076	5.735 (6000 KLD)	60
3	NDMC	35	5.000(5000 KLD)	50
4	North DMC	4331	19.961(20000 KLD)	200
5	CPWD	136	28.244(28000 KLD)	280
6	DDA	810	16.608(17000 KLD)	170
7	DUSIB(Shishu Vatika)	226	0.303(30 KLD)	01
8	ASI	55	6.752(7000 KLD)	70
	Total	11335		991

Number of Borewells Sealed and Tankers Deployed

Agency	Total no. of parks	No. of parks within 5 km of STP	No. of parks irrigated by treated waste water	No. of tankers engaged	No. of Tube-wells closed	Whether the Tube-wells closed were /functional or defunct	Remarks
SDMC	6803	1966	352	9	123	Functional	—
EDMC	1076	444	372	40	473	Defunct & Functional	In 72 No. of Parks treated waste water could not be transported due to narrow lanes
North DMC	401	401	401	16	99	Functional	

DCB	18 parks plus 10 green strips along the road	Nil	3green strips of about 5 Acres area.	4 Tanker of 8000 Ltrs. Each	01	Functional	Treated waste water from MES STPs being used
DDA	810	129	126 (73 through DJB line, 53 through tankers)	117	181	Defunct	
PWD	429932 sqm in area	-----	PWD is maintaining the greenly at Central verge & Side verge	55	-----	-----	-----
DTC	----	----	----	17	30	21 working 09 Defunct	DTC is using treated waste water for washing of buses.
NDMC	15	15	15	02	02	01 Working 01 Defunct	
Forest	20	03	18	56	21	20 Defunct 01 Working	

From the statement above it is observed that there are in all 11,335 parks within 5 KM radius of the STPs which belong to Government agencies. If all these parks are supplied treated waste water through tankers the total usage of treated waste water would be of the order of 22 MGD and would require 991 tankers per day. In addition, the Department of Forest and Wild Life which presently uses 56 tankers for its nurseries and plantation activities can use treated waste water.

The DJB has, in consultation with different stake holders, prepared an estimate for laying pipelines to different parks and gardens. The total estimated cost is of the order of Rs. 850 crores of which the cost for the Forest Department alone is in excess of Rs 500 crores. The YMC, however, does not support the proposal of incurring such high capital cost on creating infrastructure of dedicated pipelines for treated waste water and recommends that alternatives

should be explored before going in for pipelines over long distances. Such projects will require extensive digging and will add to dust pollution and inconvenience citizens.

DDA has stated that pipelines have been laid in 73 parks leading to closure of 181 bore-wells. Another 114 parks are proposed to be covered with pipeline and will result in closure of 139 bore-wells in next 6 months to two years. DDA also has planned to set up 41 small sized STPs by October '20 and another 85 STPs by January '21. During the next financial year another 60 STP are proposed to be set up in parks. Setting up of these 186 decentralized STPs in the parks will result in closure of 218 borewells. In the meantime, DDA is engaging 117 tankers for transport of Treated sewage to 94 places/parks. This will result in closure 53 bore wells by July'20

DDA also plans to use the technology of constructed wetlands to replicate Neela Hauz Model in parks that are receiving water from STPs which is not of very good quality and undertake in-situ phyto/bio-remediation and polishing before its use for irrigation. This will need to be monitored and also direct other agencies to follow the approach of DDA.

The DJB has also proposed the following policy initiatives for enhanced utilization of treated waste water:

1. 70 MGD of water from Coronation STP after micro filtration is proposed to be conveyed to Palla and thereafter released into the River Yamuna for treatment at Wazirabad Water Treatment Plant. DJB has sought approval of Upper Yamuna River Board (UYRB) where it is pending presently. The YMC had earlier recommended that this proposal needs examination by some expert body considering treated waste water after being subjected to microfiltration is proposed to be used for drinking purposes. YMC reiterates its earlier recommendation for study of scientific as well as social acceptability aspects, before giving green signal to the proposal.
2. DJB also proposes to trade 20 MGD out of 51 cusecs of fresh water of Yamuna at Auchandi and Jaunti Regulator with the state of Haryana and in lieu thereof provide treated waste water. As informed by DJB, the matter is still pending with the UYRB and formal concurrence from Haryana has also not been received.

3. DJB has another proposal for supply of treated water to UP Irrigation Department and in lieu thereof seek 112 MGD of fresh water from the share of the state of UP. A request has been made to the UP-Irrigation Department and Rs 70 lakhs released for a feasibility study for this exchange of treated water in lieu of the fresh water out of the share of UP Government. YMC has been informed that the report of consultants has not yet been received and once that is received matter will be taken up with UYRB for approval.
4. DJB's proposal also includes release of 267 MGD of water in the river Yamuna as return flow which is stated to be in terms of water sharing agreement. However, YMC has not been furnished the details of the clauses of the agreement and whether it is mandatorily required to supply only treated waste water or even untreated water could also meet the requirement of the Agreement. This has not yet been responded to by DJB

Directions sought from Hon'ble NGT:

YMC recommends the following to the NGT for issue of directions to the stakeholders:

1. DJB needs to work with Divisional Commissioner and the 11 District Magistrates to see that the directions issued by Lt Governor in notification dated 12.7.2010 and reiterated by the Chief Secretary vide his letter dated 09.03.19 are strictly enforced. Presently there is shifting of blame between the District Magistrates and the DJB on the enforcing this important provision of law. The District Magistrates need to give monthly figures of sealing to the authority which monitors this. It should be shared with DJB. Presently only cumulative totals were being given to YMC.
2. Other bulk users of water like the Railways, DMRC and Transport Department should also be directed to use treated waste water for washings and construction, by more polishing if required which will reduce use of ground water which is reported to be used. **This will need to be monitored. An NGT direction is needed as these bodies have not generally shown any enthusiasm to attend meetings called on this subject.**

3. Construction and installation of de-centralized modular STPs of Kiloliter capacity range to be installed adjacent to parks and gardens and using sewage flowing in the drains or erected along the sewer lines. This has been done by the SDMC in Vasant Kunj Park and few other areas
4. Creating root zone treatment system in vacant portions of the parks and gardens by diverting sewage in the drains from the man- holes. This will have both demonstrative effect and help meet water needs of the parks without resorting to use of machinery. DDA proposes to undertake phyto-bioremediation in parks/gardens where the treated waste water received from DJB is not of good quality. The phyto/bio-remediation should help polish the treated waste water to better standards.
5. The bad odour from the treated waste water, high mineral content and presence of Fecal Coliform which are harmful to plant growth and human health becomes the bone of contention and DJB must see that public fears are addressed and allayed properly through the District Magistrates and also the MCDs which are in charge of conservancy. RWAs should be convinced that the water is odourless and safe for being used in neighborhood parks. There is a need for NGT's direction as this becomes no man's land and results in the park owning agencies refusing to use the water. If there is a quality benchmark for treated waste water to be used in colony parks, and an independent agency can be called by the RWA to test the water quality being supplied it will allay public apprehensions and end disputes with the RWAs and residents.

Chapter - 11

Idol Immersion

Directions of the Hon'ble National Green Tribunal (NGT) dated 26.7.18. The mandate of the Monitoring Committee is to ensure requisite level of standard of water at the entry point and the exit point of river Yamuna as well as the in drains which meet river Yamuna so that there are no pollutants beyond the determined standards. The Committee will also issue directions to deal with the problems of idol immersion in the river Yamuna taking into account the guidelines of the CPCB to ensure that no pollution is caused in Yamuna at Delhi.

Directions of the Hon'ble National Green Tribunal (NGT) dated 11.09.19. The Divisional Commissioner and the DMCs which have the responsibility and accountability for implementation of mandate with respond to idol immersion must ensure that such activities are scientifically regulated and non-compliance strictly dealt with by imposition of Environmental Compensation to be decided jointly by CPCB and DPCC.

Report of YMC: History of previous directions of NGT and YMC's.

YMC had given a detailed report on idol immersion in its third interim report dated 5.2.20. The festival season 2020 will start only in September 2020. The management of idol immersion in Delhi during the last festival season was successfully managed and needs to be repeated this year although the present health concerns may deter holding processions and immersions. Since this is a final report YMC is recapitulating the salient points recounted earlier.

Status in 2018

By the time the YMC took charge on 4.8.18 its efforts to prevent the practice of idol immersion in the River Yamuna could not make a dent as it had become an annual practice and there was poor receptivity from all stakeholders like the District Magistrates who had nodal responsibility for management of the procession and the immersions. Also the Ganesh Chathurti and even Dussehra festivals, were too close for YMC with very little time available to be able to

make any meaningful effort at planning and regulating the activity with a large number of stakeholders, Pooja samitis, Municipal Corporations, Police, DPCC and the Divisional Commissioner. YMC also visited the idol immersion site and even took a boat ride to understand the preparation that is made by the public authorities for immersion and the manner in which the immersion is actually carried out and how the site looks after the immersion has actually happened with idols, their clothes, flowers and other decorations all spread around on the river bank and the floodplains.

Reports from CPCB and DPCC had pointed to an enormous increase in toxicity levels caused by the presence of heavy metals. Post-immersion, the chromium content increased by 11 times from the Bureau of Indian Standards (BIS) limit of 0.05mg/l, while the iron concentration shot up 71 times compared with the BIS standard of 0.3mg/l. Similarly, the nickel and lead content also increased substantially.

It was apparent that the authorities under the nodal responsibility of the Divisional Commissioner were following a set drill in a routine manner without concern for the pollution related aspects. Public convenience was given overriding importance with hardly any emphasis on protecting the river from the pollution caused by human footfalls and idol immersion. During September 2018 the newspapers were rife with photographs and stories about heavily painted idols, pooja samagri, idol's clothes, plastic bags and flowers floating in the river or lying on the banks of the river because the DMCs had not removed the material.

Achievements during the Festival Season 2019

The YMC started a series of meetings by asking the Divisional Commissioner and other authorities like DMCs, IFCD, DDA, CPCB and DPCC how the NGT's orders and CPCB's findings had been ignored.

The YMC placed emphasis on the following:

1. Need for issue of a Government notification directing that only designated ponds would be permitted to be used for immersion.

2. Undertakings needed to be obtained from the organizers of the Ganesh/Pooja pandals to adhere to the CPCB guidelines.
3. Delhi needed to create sufficient artificial ponds by district looking at past data of immersions.
4. GNCT Delhi and regulatory bodies had to proactively propagate the use of colony pits by building public awareness through the RWAs.

The YMC got in touch with the Surat city Police Commissioner who explained their success in preventing over 60,000 idols being immersed in the Tapti River in Surat, Gujarat. These details were shared with the Divisional Commissioner who then had a detailed plan prepared.

The Divisional Commissioner was asked to see that the entry of POP murties from the neighboring districts should be checked. The YMC at his request wrote to the Chief Secretaries of UP and Haryana to depute the DMs of neighboring NCR districts to attend a meeting with the Divisional Commissioner by using NGT's orders as the basis for making the request.

Steps taken to move to the Use of Pits instead of the River.

1. DPCC issued a direction under Section 5 of the Environment Protection Act 1986 making it incumbent on the idol makers, sellers, Pooja sanities, local bodies/ authorities to comply with the NGT's order places as **Annexure – C-11/1**.
2. 116 ponds were erected for Ganesh immersion and 89 for Durga immersion.
3. DJB provided clean water to fill the ponds.
4. Around 24,000 idols were immersed by over 20,000 people.
5. After immersion all ponds were emptied by the DJB and the MCDs.
6. Monitoring was done at 10 ghats for Ganesh visarjan and 7 Ghats for Durga visarjan.
7. Awareness advertisements and public notices regarding idol immersion were published in 11 newspapers from 9.8.19 to 12.9.19 for Ganesh visarjan .and from 15.9.19 to 18.9.19 for Durga visarjan.
8. Public Awareness campaigns included hoardings, advertisements on buses and bus queue shelters , metro panels, Bridges, and pillars, on Steel Street Furniture, Police Booths, Information Panels and vending Kiosks.

9. The Eco Clubs issued instructions/ guidelines on Idol Immersion by emailing 2027 schools, 174 educational institutions/colleges, for being relayed at assemblies and gatherings.
10. Nukkad Nataks/ Workshops /rallies/ were held and posters, banners were distributed. Through the Deputy Commissioners.
11. An awareness Workshop was conducted for 175 Eco club teachers.

Outcomes: Trend Analysis for the Years 2018 and 2019

The findings showed a significant reduction in almost all parameters at all stations as no toxic metals/ paints dyes and chemicals were allowed to enter the water in 2019.

The samples were taken from a depth of 0.3 meters and collected pre and post immersion.

All the key quality parameters, namely, like pH, DO, BOD, COD, TSS, TDS and heavy metals i.e. Copper, Chromium, lead, Zinc, Iron, Cadmium and Nickel were tested at the DPCC laboratory.

- During Ganesh idol immersion the water quality of river Yamuna was found to be less polluted (except Hathi Ghat) in the year 2019 w.r.t. BOD, COD, TSS & heavy Metals as compared to year 2018.
- During Durga idol immersion water quality of river Yamuna was found to be less polluted (except Kalindi Ghat) in the year 2019 w.r.t. BOD, COD, TSS & Toxic Metals as compared to year 2018.
- Idol immersion done in artificial pond had a positive impact on the quality of Yamuna river water.

The measures taken in 2019 may not be required with the same vigour in 2020 due to the pandemic and restrictions on gatherings. None the less it is necessary that the practice of immersion in the River is completely disallowed even by small groups. There needs to be a check as was done in 2019 to stop the erection and sale of idols which are not complying with the CPCB instructions. YMC had asked the Divisional Commissioner to document the SOPs followed by him, and all other stakeholders so that the SOPs get institutionalized and are followed in future. The

environmental friendly way of idol immersion should not become one off effort but must be sustained and improved in future.

NGT may consider directing the Govt of NCT Delhi to follow the SOPs developed and practiced for idol immersion during 2019.

Compared to what had been happening over the last several years when the immersion of idols inside bamboo barricades erected at different ghats along the Yamuna, the management in 2019 was completely different.

Chapter – 12

State of Haryana and Pollution of the River Yamuna

Hon'ble National Green Tribunal vide their order dated 26.7.18 had inter alia directed that the Monitoring Committee constituted by the Tribunal shall coordinate with the states of Haryana and UP with regard to the pollution caused in the river Yamuna and the drains which join the river. Both States were directed by NGT to set up their own whole time Monitoring Committee of at least two members who can work in coordination with the Monitoring Committee appointed by the Tribunal.

In compliance with the orders of the Tribunal a Monitoring Committee was set up by the state of Haryana on 23.8.18 but it started functioning in October 2018. The Haryana Monitoring Committee (HYMC), has been undertaking extensive field visits of STPs, CETPs and holding discussions with various public authorities, namely, HSVP, GMDA, Municipal Corporations, HSDIIC and the HSPCB and periodically monitoring the timelines for different projects and activities covering the matters referred by the NGT.

The Comments of the HYMC on the Status report received from the different public authorities are appended in the pages that follow this Chapter. However, much as the HYMC would have wanted to no independent field verification of the progress achieved according to agreed time lines could be undertaken due to the lockdown. It can be presumed that the earlier timelines furnished by different public authorities and given in the Third Interim Report of the YMC will need to be revisited. The projects/activities will have to be monitored by the state government in addition to the Haryana Monitoring Committee so that the momentum that had been achieved does not slow down. That will affect the quality of river water adversely.

Response of Haryana Monitoring Committee on action taken report of

Govt. of Haryana received on 25.6.2020.

River Yamuna is receiving 1165 MLD domestic effluent and 377 MLD industrial effluent from 11 towns through 11 Drains. Faridabad, Gurugram, Yamuna Nagar, Karnal, Panipat and Sonapat Towns are contributing significant quantum of pollution load to the River Yamuna. The Hon'ble NGT in its various Orders directed the State to take corrective measures for abatement of Pollution in River Yamuna. The directions are reproduced below.

NGT's Order dated 08.05.2015

"21. Director of Environment, State of Haryana submitted that he has instructions from the Government to assure that they would establish the STP at Gurgaon border where the drain from Haryana joins with the Najafgarh drain in Delhi. They will submit within two weeks from today the complete action plan and the timeframe for completion and operationalization of that STP."

Status of implementation of Order 08.05.2015

The Government of Haryana had submitted an incomplete Action Plan for completion and operationalisation of STPs.

NGT's Order dated 11.06.2015

"As far as the drain of Badshapur joining Najafgarh is concerned, we have directed the state of Haryana to establish STP of 500 MLD to treat the effluent that is generated and put into Najafgarh drain. It is submitted on behalf of the state of Haryana that state of Haryana has established three numbers of STPs at the catchment area of this drain which would become operational. The effluent in the drain will not contain any pollutants thereafter. He further submits that the state has proposed to recycle the entire treated water for various activities in the district to Gurgaon including supply to industrial area."

Status of implementation of Order dated 11.06.2015

Erstwhile Haryana Urban Development Authority (HUDA) presently renamed as Haryana Shari Vikas Pradhikaran (HSVP) had handed over all developmental work to Gurugram Metropolitan Development Authority (GMDA), who has failed to installed 500 MLD STP at Sector 107, Gurugram.

The three number of STP installed in the catchment area of Badshapur Drain though made operational had failed to achieve the prescribed standards and still discharging untreated/partially treated effluent to the Najafgarh Drain basin.

A small portion of the treated water was recycled for Industrial purpose.

NGT's Order dated 26.07.2018

"7 xvii. The States of Haryana and Uttar Pradesh may consult the members of the Monitoring Committee appointed by this Tribunal for constituting their own full time committees. Members of the Committees of States of Haryana and Uttar Pradesh may also have a joint meeting with the members of the Monitoring Committee appointed by this Tribunal, after making mutual arrangements. The State of Uttar Pradesh will be at liberty to assign work of Phase-II of Ganga to the same Committee depending on the performance."

Status of implementation of Order dated 26.07.2018

The Additional Chief Secretary to Government Haryana, Environment & Climate Change Department had appointed two full time Members of River Yamuna Monitoring Committee, Haryana vide Endst. No. 16/12/2018 – 3Env., dated 23/08/2018 to assist the Yamuna Monitoring Committee by Hon'ble Tribunal. The HYMC is regularly submitting its interim reports to the Yamuna Monitoring Committee.

NGT's Order dated 11.09.2019

"vi. Compensation and accountability: Directions on the subject in respect of NCT Delhi will apply to the State of Haryana also. Bioremediation and/or phytoremediation or any other

remediation measures may start as an interim measure positively from 01.01.2020, failing which the Govt. of Haryana may be liable to pay compensation of Rs. 5 Lakhs per month per drain to be deposited with the CPCB. This however, is not to be taken as an excuse to delay the installation of STPs, sewerage network and its connectivity. For delay of the work, the Chief Secretary, Govt. of Haryana must identify the officers responsible and assign specific accountability. Wherever there are violations, adverse entries in the ACRs must be made in respect of such identified officers for delay in setting up of STPs, sewerage network and its connectivity\ by the concerned head of the department.

i) The Govt. of Haryana will be liable to pay Environment Compensation if defaults take place as under:

- a) The operational deficiencies of the existing STPs must be rectified within three months failing which Environmental compensation of Rs. 5 Lacs per month for STP shall be deposited with CPCB.*
- b) With regard to works under construction, after 01.07.2020, direction for payment of environmental compensation of Rs. 10 lakhs per month to CPCB for discharging untreated sewage in any drain connected to river Yamuna and Rs. 10 lakhs per month to CPCB per incomplete STP, sewerage network and its connectivity will apply.*
- c) With regard to the situation where works with regard to STP, sewerage network and its connectivity have not yet started, the Govt. of Haryana has to pay an Environmental Compensation at the rate of Rs. 10 lakhs per month per STP, Sewerage network and its connectivity after 31.12.2020 for the delay in setting up of the same. It will be open to Govt. of Haryana to recover the said amount from erring officers/contractors.*
- d) The state of Haryana is not shown to have to furnished performance guarantee in terms of order dated 29.01.2019. The same may now be furnished with additional sum of Rs. 1 crore for the delay within one month failing which coercive method have to be adopted for enforcement of the order.*

Status of implementation of Order dated 11.09.2019

The HYMC has submitted the third interim report identifying inadequate problems in compliance to the Order dated 11.09.2019. In which issues were flagged for direction from Hon'ble Tribunal to the State of Haryana.

NGT's Order dated 05.03.2020

- a) *"In the light of observations in the third report of the YMC dated 05.02.2020 showing inadequate progress in compliance of orders of this Tribunal dated 11.09.2019, all concerned authorities (in Delhi, Haryana and U.P.) need to take further action expeditiously on the issues of sewage management, industrial pollutants, solid waste management and other issues, as per laid down timelines and to pay compensation wherever timelines have not been met which may be ensured by the CPCB. CPCB may issue notice to the entities accountable to pay compensation and in case of non-payment and seek execution by moving this Tribunal. Wherever coercive measures are required to be taken in terms of orders of this Tribunal dated 11.09.2019 and have not been taken against official lethargy, action may be taken as already directed by the concerned administrative heads. In case of any failure, this Tribunal may have to take further action for strict compliance. The Authorities may give their progress reports of the status as on 30.04.2020 to this Tribunal by email at judicial-ngt@gov.in before the next date.*
- b) *The DDA may constitute a Special Purpose Vehicle (SPV) preferably within two weeks from today for rejuvenation of river Yamuna. The functions of such entity will include ecological restoration of the flood plain zones, setting up of bio-diversity parks, artificial wetlands, phytoremediation of drains at the river mouth locations, maintaining the vigil and undertaking flow measurement, creating ecological services, removing encroachments and undertaking other activities, including river front development. It may also take steps to attract and educate the citizens and nature enthusiasts for nature related activities, including building environmental temper amongst citizenry, without in any manner causing any damage to the flood plains.*
- c) *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.

- d) CPCB may revise its report on 'Alternate Technologies for Management of Waste Water in Drains' in the light of comments of the YMC dated 17.02.2020 and forward the same to the Ministry of Urban Development, Jal Shakti, Govt. of India, NMCG, Governments of Delhi, Haryana and U.P. within one week from today for further necessary action on their part for making a policy which may be finalized within one month from today. CPCB may file a compliance report after collecting status of compliance from the said authorities by e-mail at judicial-ngt@gov.in before the next date. Revised CPCB report may be placed on its website and also circulated to all States/UTs and PCBs/PCCs.*
- e) The 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 the 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 the Chief Secretary, Delhi. It is made clear that this direction 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.*
- f) Chief Secretaries of Haryana and U.P. may also ensure action on the pattern of direction 'e' above in their respective jurisdiction within three weeks from today.*
- g) The Government of Delhi may review its 'free sewer scheme' referred to in para 22, 51 to 52 above, in the light of the order of the Hon'ble Supreme Court dated 24.10.2019 in Civil*

Appeal No. 9276-9290 of 2015 (Tata Power Delhi Distribution Ltd. v. Manoj Mishra), referred to in para 8 above, earlier orders of this Tribunal dated 08.05.2015 (referred to in para 22 above) and dated 11.09.2019 [para 15 (viii) (e)] and recommendations of the YMC (para 22 above). h. A joint Committee comprising CPCB, NMCG, NEERI, IIT Roorkee and IIT Delhi may assess damage to environment, in monetary terms after the date of order of this Tribunal 13.01.2015, on account of degradation of river Yamuna, by continued inaction of the authorities in Delhi, Haryana (from Hathnikund till entry in State of UP), U.P. (upto Mathura), within three months from today. CPCB will be the nodal agency for coordination and compliance. The Committee will be at liberty to take such assistance from any individual(s)/institutions as may be necessary. We place on record our sincere gratitude and appreciation to the YMC for its outstanding contribution in endeavours for rejuvenation of river Yamuna. Once setting up of SPV for River Front Management and constitution of IDMC as a single agency for remediation and management of all the drains in Delhi takes place, it should be possible for such SPV set up by the DDA and the Chief Secretaries of Delhi, U.P. and Haryana to directly monitor further steps, extensively laid down in the order of this Tribunal dated 11.09.2019 and the present order, in a time bound manner. The YMC may accordingly submit its final report on the status of compliance as on 30.04.2020, before the next date so that thereafter monitoring of progress of rejuvenation of river Yamuna and related issues is taken over by the SPV and the Chief Secretary, Delhi, by constituting an appropriate effective institutional mechanism directly under him for exhaustively monitoring all issues relating to rejuvenation of river Yamuna. It will also be open to the Chief Secretaries of U.P. and Haryana to have their own appropriate mechanism for monitoring. The Chief Secretaries of Delhi, U.P. and Haryana may place the mechanism so evolved before this Tribunal before the next date. On conclusion of proceedings of the YMC constituted by this Tribunal, the record and database may be taken over by the SPV and the Chief Secretaries, Delhi, Haryana and U.P.”

Status of implementation of Order dated 05.03.2020

The Government of Haryana has constituted Integrated Drain Management Cell (IDMC) and Under Chief Secretary Haryana and Special Purpose Vehicle (SPV) for the State of Haryana vide Letter dated 10.06.2020. It has also been decided that Yamuna Monitoring Committee constituted by the State of Haryana shall work under IDMC. The Letter dated 10.06.2020 issued by Additional Chief Secretary, Government of Haryana, Environment and Climate Change Department is annexed as **Annexure C-12/1**.

NGT's Order dated 06.05.2020

"3. We are of the opinion that time needs to be extended. The concerned parties may now furnish their response to the YMC expeditiously but positively on or before 31.05.2020. The Committee may give its report thereafter at the earliest and but latest by 30.06.2020 by e-mail at judicial-ngt@gov.in. even if response of concerned parties is not received as expected. The Report may indicate in tabular form the progress achieved, the issues which still remain pending and the roadmap for further course of action with timelines."

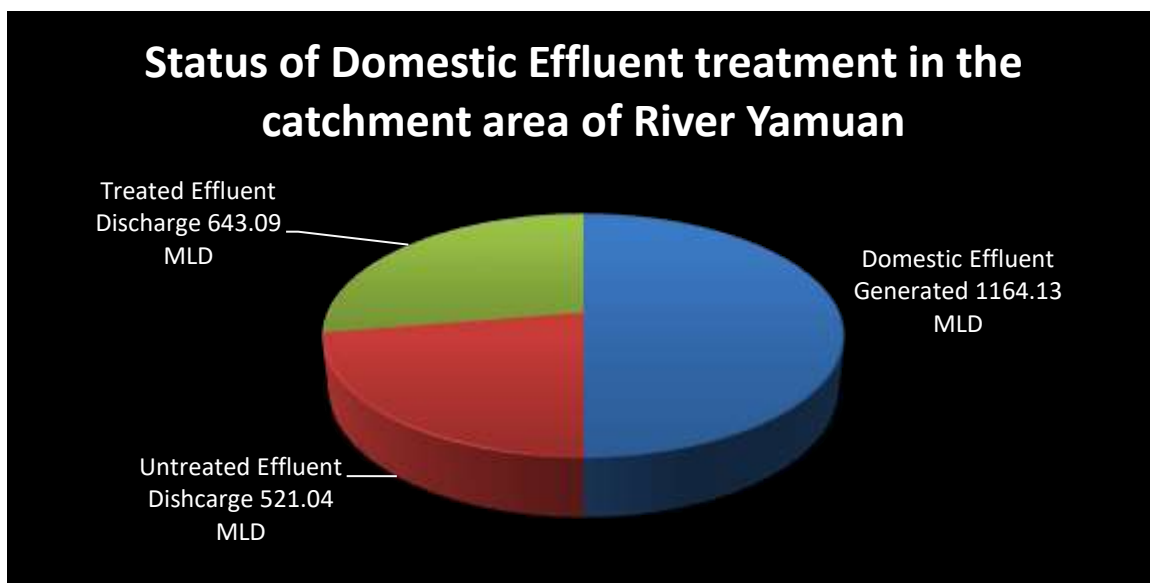
Status of implementation of Order dated 06.05.2020

Till the submission of this report (25.06.2020) the Action Taken Report in compliance of the above mentioned Order was not submitted by the State of Haryana. The HYMC has compiled the present report after collecting status report from the line departments. Progress achieved by the line departments after intensive monitoring by HYMC is given below:

1. Status of Sewage Treatment Plant in the catchment area of River Yamuna.

The status gathered from the line departments by HYMC in compliance to the Orders of Hon'ble Tribunal in tabulated form is annexed at **Annexure C-12/2**. The HYMC is not in a position to inspect and verify the compliance status of Existing STPs and STPs under construction/upgradation at site due to Lockdown for COVID-19 pandemic. The abstract giving below indicating that 1163.1 MLD domestic effluent generated from 11 Districts and 521.04 MLD Untreated effluent is still being discharged to River Yamuna through 11 Drains.

Name of the District/Town	Domestic Sewage Generated (MLD)	Existing Sewerage Treatment Plant Capacity in MLD	Capacity Utilization in Existing STP in MLD	Untreated/partially treated domestic effluent presently reaching to River Yamuna In MLD	Proposed Sewerage Treatment Plant Capacity in MLD	Target date for completion of Proposed STPs
Gurugram	450	388	350	100	151.5	31.12.2022
Faridabad	220	45	10	210	227.5	31.12.2022
Yamuna Nagar	99.21	67.5	63.3	35.91	35	30.06.2020
Panipat	83.35	125.8	56	27.35	0	-
Sonipat	67.06	85.3	17.29	49.77	18	31.12.2020
Karnal	77.43	40.5	21	56.43	82	31.12.2020
Rohtak	90.95	96	66.1	24.85	47	30.06.2021
Bahadurgarh and Jhajjar	38.3	74.5	33.85	4.45	2	31.12.2021
Palwal and Nuh	37.83	43.1	25.55	12.28	27.5	31.12.2020
Total	1164.13	965.7	643.09	521.04	590.5	



Following are the Concern of HYMC about the untreated effluent being discharged in Drains.

- Gurugram Town - 100 MLD untreated sewage being discharged through Strom Water Drain Leg-I, Leg-II and Leg-III (Badshapur Drain) because of slow progress in diversion of sewage.

- Faridabad Town – 210 MLD untreated sewage and 80 MLD of partially treated industrial effluent being discharged directly to River Yamuna to Budia Nalaha and Gouchi Drain. Further, the HSVP has failed to install terminal STP in Grater Faridabad area. All the residential colonies are disposing untreated/partially treated effluent illegally into adjoining Canals and Drains.
- Yamuna Nagar Jagadhri Town – 35.91 MLD untreated sewage is not being owned by PHED and ULB Department. ULB Department failed to obtain NOC from Irrigation and Forest Department consequently the work of diversion of sewage is not progressing.
- Panipat Town – 27.35 MLD untreated sewage is being discharged into Drain No. 1 & 2 of Panipat Town. The ULB Department failed to obtain Administrative and financial approval for laying of 180 KM sewer line in newly approved residential areas.

2. **Status of Diversion of Sewage in approved areas.**

The status submitted by the line departments in compliance to the Orders of Hon'ble Tribunal in tabulated form is annexed at **Annexure C-12/3**.

- Out of 1516 KM of sewer line proposed to be laid for diversion of sewage 934 km of sewer line has already been laid and rest 582 km will not be completed by 31.12.2020. The HYMC is opinion that the target date for laying of sewer line is not achievable within the target date fixed by the Tribunal including Beri, Panipat Town, Faridabad and Yamuna Nagar-Jagadhri Town.
- Beri Town - The PHED has failed to acquire land for MPS and IPS, consequently delay in laying of sewer line in Beri Town.
- Panipat Town – The ULB Department is failed to accord Administrative and financial approval for laying of 180 KM sewer line in newly approved residential areas.
- Faridabad Town –The ULB Department is failed to accord Administrative and financial approval for laying of sewer line in approved residential areas.
- Yamuna Nagar- Jagadhri Town – ULB Department failed to obtained NOC from Irrigation and Forest Department consequently the work of diversion of sewage is not progressing.

PHED and ULB Department are responsible for delay in execution of diversion of sewer in Beri, Panipat and Faridabad town.

3. **Status of Diversion of Sewage in unapproved areas**

The status submitted by the line departments in compliance to the Orders of Hon'ble Tribunal in tabulated form is annexed at **Annexure C-12/4**.

The GMDA and ULB Department are responsible for not diverting 238.4 MLD sewage generated from unapproved areas of towns in the catchment area of River Yamuna. The work of diversion of sewage in all the Towns will not be completed by 31.12.2020 due to the Lockdown for COVID-19. The GMDA and ULB Department are responsible for the delay.

4. **Status of Sewage Treatment and laying of sewer line in Faridabad.**

The ULB Department has failed to submit comprehensive date bound Action Plan for treatment and diversion of sewerage from approved and unapproved areas within 02 months from the date of Order of Hon'ble NGT dated 11.09.2019. The existing 03 STPs are abandoned and 01 STP is nonfunctional. Untreated effluent is being discharged to River Yamuna.

The administrative and financial sanction for treatment and diversion of sewer from approved and unapproved areas of Faridabad Town from Principal Secretary ULB and Chief Administrator HSVP are yet to be accorded.

HYMC is the opinion that the ULB and HSVP Department are responsible for the delay.

5. **Status of Sewage Treatment and laying of sewer line in Gurugram**

- a) The GMDA has submitted Action Plan to stop the discharge of untreated effluent into Storm Water Drain, Leg-I, Leg-II and Leg-III (Badshapur Drain) with a target date of 31.12.2020. Till then these Storm Water Drains will carry 75 MLD of untreated/partially treated effluent. There is no significant reduction of discharge noticed in these 3 Storm Water Drains. The HYMC is the opinion that the target date for diversion of sewerage may not be achieved by 31.12.2020 without expeditious action and strict enforcement by officers of GMDA and MCG department.
- b) Gurugram being a Metropolitan City discharging effluent through Najafgarh Drain, the following are the observations of HYMC for effective waste water management of the City.

- There is no verifiable data available regarding area wise waste water generation in Gurugram. In absence of such information it is not possible for gap assessment between waste water generation and disposal after treatment.
- GMDA may be directed to undertake area wise critical assessment of waste water generation and disposal after treatment.

6. Status of Industrial Waste Water Pollution.

Status of Industrial Waste Water Pollution in the catchment area of River Yamuna

- Quantum of Industrial Effluent generated 377 MLD
- 60 MLD Effluent is being treated through Stand Alone ETPs.
- 317 MLD Effluent will be treated through existing and proposed CETPs
- 14 existing CETP with cumulative treatment capacity of 160 MLD
- 11 CETPs requires removal of operational deficiencies/capacity augmentation
- 8 CETPs are proposed to be installed but may not be completed before 31.12.2020

A. Status of CETPs

The status of Existing and Proposed CETPs submitted by the Haryana State Industrial Infrastructure Development Corporation (HSIIDC) and HSVP in compliance to the Orders of Hon'ble Tribunal in tabulated form is annexed at **Annexure C-12/5**.

Sr. No.	Department	Existing CETP	Complying	Not Complying	Proposed CETP
1	HSIIDC	9	0	9	7
2	HSVP	2	0	2	0
3	GMDA	1	1	0	1
4	Private Agency	2	2	0	0
	Total	14	3	11	8

- Out of 14 existing CETPs 12 existing CETPs are installed and operated by Government Agencies such as HSIIDC (09 CETPs), HSVP (02 CETPs) and GMDA (01 CETP).
- 02 small CETPs are operated by Electroplating Industries Association of Faridabad and Gurugram.
- 09 CETPs of HSIIDC and 02 CETPs of HSVP are not complying the standards prescribed under Water Act, 1974.

- 11 non complying CETPs are discharging 192.9 MLD of untreated/partially treated Industrial Effluent to the River Yamuna through adjoining Drains.
- The information gathered from GMDA indicating that corrective measures suggested by IIT Roorkee have been taken.

The HYMC could not inspect and assess the efficacy of these complying STPs due to Lockdown for COVID-19 pandemic.

B. Status of Stand Alone ETPs

HSPCB is regularly monitoring Stand Alone ETPs. Environmental Compensation of Rs. 22514813/- has been imposed on 21 non complying units and collected Rs. 7547500/- as environmental compensation. The HYMC is of the opinion that the progress in this regard is far from satisfactory. The HSPCB failed to submit the quarterly monitoring report pertaining to compliance status of Stand Alone ETPs of industries, directly or indirectly discharging their effluent into River Yamuna.

7. Septage Management Policy

25 ULB out of 34 Towns in the catchment area of River Yamuna have notified their Septage Management Policy. Rest of the 9 ULBs is yet to notify the same. The information submitted by the line departments pertaining to the Septage Management in unapproved residential colonies are too sketchy indicating non compliance of the Provisions of Policy Notification by Government of Haryana and Order of the Tribunal dated 11.09.2019. There are huge gap in the quantum of domestic effluent generated and quantum of effluent disposed through tankers to the adjoining Sewage Treatment Plant. The ULBs are not monitoring the movement of tankers collecting and disposing Septage. This is a cause of concern as the tankers owners usually illegally disposed the Septage in adjoining drains or even on open land. Even after intensive monitoring, all the ULBs have failed to take deterrent punitive action against the large scale illegal tanker owners operating in the State of Haryana.

8. Diversion and reutilization of Domestic Sewage generated from Villages.

There are 277 villages in the catchment area of River Yamuna. Action Plan for diversion, treatment and reutilization of domestic sewage has been prepared and submitted by Development and Panchayat Department of Haryana. The work of diversion and treatment in 21 villages out of 277 villages has been completed. Month wise action plan submitted by the department and the target date for completion of diversion, treatment and reutilization of domestic sewage by 31.12.2020 seems to be unachievable because of the Lockdown for COVID-19 and may extend beyond the target date.

9. Status of Online monitoring Devices (OLMS) in Industries, STPs and CETPs.

The observations of HYMC about the efficacy and reliability of data generated by OLMS are still not addressed by Haryana State Pollution Control Board.

- The devices are not calibrated regularly. The data generated by these online monitoring devices do not reflect the actual status of treatment.
- The State Pollution Control Board does not have any mechanism to verify the authenticity of the data generated from these OLMS.
- Further, no mechanism with the regulatory authority (HSPCB) to take cognizance of any reported violation.

In the absence of strong monitoring mechanism in place the purpose of installation of OLMS is defeated.

10. Compensation and accountability.

The Government of Haryana has not submitted any progress regarding Bioremediation and/or phytoremediation or any other remediation measures taken in any of the drains carrying effluent to River Yamuna with effect from 01.01.2020.

11. Domestic Effluent Treatment (Sewage Treatment Plant)

A. Public Health Engineering Department (PHED)

The Status report gathered from PHED indicating that all 37 Existing STPs are complying after rectifying the deficiencies indicated by HYMC and performance evaluation study carried out by Dr. Abid Ali Khan, Assistant Professor, Department of Civil Engineering Jamia Milia Islamia

University, Delhi. The HYMC could not inspect and assess the efficacy of these complying STPs due to Lockdown for COVID-19 pandemic.

B. Urban Local Bodies Department (ULB)

The Status report gathered from ULB indicating that out of 5 existing STPs 3 STPs are still non complying and 02 STPs are reported to be complying. The HYMC could not inspect and assess the efficacy of these complying STPs due to Lockdown for COVID-19 pandemic. Environment compensation should be imposed on ULB Department for not complying the direction of Hon'ble Tribunal dated 11.09.2019.

C. Haryana Shehri Vikas Pradhikaran Department (HSVP)

The Status report gathered from HSVP indicating that out of 5 existing STPs 2 STPs are still non complying and 03 STPs are reported to be complying. The HYMC could not inspect and assess the efficacy of these complying STPs due to Lockdown for COVID-19 pandemic. Environment compensation should be imposed on HSVP Department for not complying the direction of Hon'ble Tribunal dated 11.09.2019.

D. Gurugram Metropolitan Development Authority (GMDA)

The Status report gathered from GMDA indicating that all 5 existing STPs are reported to be complying. The HYMC could not inspect and assess the efficacy of these complying STPs due to Lockdown for COVID-19 pandemic.

The compliance status of 52 Existing STPs including 05 not complying STPs as mentioned above will be ascertained after inspection and efficacy assessment by HYMC. The environmental compensation with shall be imposed in compliance to the Order of Hon'ble Tribunal dated 11.09.2019 if the STPs found not complying.

12. Industrial Effluent Treatment (Common Effluent Treatment Plant)

A. Haryana State Industrial Infrastructure Development Corporation (HSIIDC)

The reports gathered from HSIIDC indicating that the performance evaluation and technical audit carried out by IIT Delhi for all existing CETPs. HSIIDC will. Upgradation, modification and construction of new CETP if required will be carried out after receiving the performance evaluation report.

B. Haryana Shehri Vikas Pradhikaran Department (HSVP)

The HSVP is operating 02 CETP of 21 MLD Capacity each at Panipat are reported to be non complying. The work of modification of old 21 MLD CETP will be completed by 31.12.2020. The HSVP is laying sewer lines to divert Industrial Effluent to the New CETP of 21 MLD at Panipat. The HYMC could not inspect and assess the efficacy of these complying CETPs due to Lockdown for COVID-19 pandemic. Environment compensation should be imposed on HSVP Department for not complying the direction of Hon'ble Tribunal dated 11.09.2019.

C. Gurugram Metropolitan Development Authority (GMDA)

Performance evaluation and technical audit carried the rectification/modification work suggested by Jamia Milia Islamia University for 02 CETPs (30 MLD and 25 MLD) at IMT Manesar. The GMDA stated that the CETP is now complying.

The compliance status of all these CETPs will be ascertained after inspection and efficacy assessment by HYMC. The environmental compensation with retrospective effect shall be imposed in compliance to the Order of Hon'ble NGT dated 11.09.2019 if the CETPs are not found complying.

Achievements of River Yamuna Monitoring Committee, Haryana

- The HYMC under the guidance of River Yamuna Monitoring Committee, New Delhi appointed Hon'ble NGT, successfully sensitized all the line departments for taking effective steps in the abatement of pollution in River Yamuna.
- The HYMC visited all the 81 STPs and 14 CETPs installed and operated by PHED, ULB, GMDA, HSVP and HSIIDC.
- Standards Operating Procedures (SOP) formulated by the line department for effective operation of ETPs and CETPs under the guidance of HYMC.
- The operational deficiencies found in all these STPs and CETPs were communicated to the respective Head of the Departments with the request to give necessary directions for removing all the deficiencies in a time bound manner.
- The Public Health Engineering Department and Urban Local Bodies Department started laying sewer line in approved residential area and diverting sewage from the unapproved residential area to the STP for treatment.

- The domestic effluent which is being discharged to River Yamuna will be diverted to the STPs. Wherever the identified gaps are still persisting the matter was brought to the notice of Chief Secretary, Haryana in various meeting and requested to issue direction to the concern department.
- The HYMC also conducted onsite interactions with the field officers responsible for operation and maintenance of STP and CETP.
- Inter departmental meeting were organized with field officers of the line department to discuss the shortcoming pertaining to each department.
- The Panchayati Raj Department was asked to expedite the projects for reusing treated domestic effluent generated from villages for irrigation purposes.
- The HYMC was instrumental in formulating Septage Management Policy of Government of Haryana.
- **1 STP was complying the standards before the appointment of HYMC. Intensive monitoring and interaction with the line department has resulted in increase in the compliance status of STPs. It is reported that 47 STPs are now complying out of total 81 STPs.**

Chapter 13

State of Uttar Pradesh and Pollution of the Yamuna

Directions of the Hon'ble National Green Tribunal (NGT) dated 11.9.19

(i) Sewage Management. (In respect of Uttar Pradesh)

- a) *The Principal Secretaries, Environment and Forest and Urban Developments are required to prepare short and long term plans to control flow of sewage from UP into the river Yamuna at Ghaziabad with time lines for execution. U.P. Chief Secretary to monitor it.*
- b) *Chief Secretary U.P to ensure that clarity in terms of execution of time lines are given and action taken on ground with regard to interception and diversion of Banthala and Indira Canal drains.*
- c) *Chief Secretary, U.P to review the matter with regard to sewerage area, un-sewered areas and leakages in the sewer networks etc. and fix timelines for execution of same.*
- d) *Chief Secretary U.P to review the matter with regard to upgradation of STPs which are not meeting the norms and ensure coordination amongst departments.*

(ii) Industrial Pollution:

- a) *State PCB to evolve a mechanism to recover the EC from those refusing to pay.*
- b) *Complete inventory of industries both in conforming and non- conforming areas be prepared by State PCB within one month.*
- c) *Report be submitted on performance of CETPs and ETPs of industries by UPSIDC and PCB.*

(iii) Demarcation, Protection and Rejuvenation of Floodplains

The floodplain should be demarcated and developed through wetlands and biodiversity parks. Vice Chairman DDA and Principal Secretary, Irrigation, U.P to give specific timelines for setting up of same. The Chief Secretary UP shall supervise and monitor the same.

(iv) Compensation and Accountability: *Directions on the subject in respect of NCT Delhi and Haryana will apply to the State of Uttar Pradesh also. Bioremediation and/or phytoremediation or any other remediation measures may start as an interim measure positively from 01.01.2020,*

failing which the State of Uttar Pradesh may be liable to pay compensation of Rs. 5 Lakhs per month per drain to be deposited with the CPCB. This however, is not to be taken as an excuse to delay the installation of STPs, sewerage network and its connectivity. For delay of the work, the Chief Secretary, State of Uttar Pradesh must identify the officers responsible and assign specific accountability. Wherever there are violations, adverse entries in the ACRs must be made in respect of such identified officers for delay in setting up of STPs, sewerage network and its connectivity by the concerned head of the department.

i) The State of Uttar Pradesh will be liable to pay Environment Compensation if defaults take place as under:

- a) The operational deficiencies of the existing STPs must be rectified within three months failing which Environmental compensation of Rs. 5 Lacs per month for STP shall be deposited with CPCB.*
- b) With regard to works under construction, after 01.07.2020, direction for payment of environmental compensation of Rs. 10 lakhs per month to CPCB for discharging untreated sewage in any drain connected to river Yamuna and Rs. 10 lakhs per month to CPCB per incomplete STP, sewerage network and its connectivity will apply.*
- c) With regard to the situation where works with regard to STP, sewerage network and its connectivity have not yet started, the State of Uttar Pradesh has to pay an Environmental Compensation at the rate of Rs. 10 lakhs per month per STP, Sewerage network and its connectivity after 31.12.2020 for the delay in setting up of the same. It will be open to State of Uttar Pradesh to recover the said amount from erring officers/contractors.*
- d) The State of UP is not shown to have to furnished performance guarantee in terms of order dated 29.01.2019. The same may now be furnished with additional sum of Rs. 1 crore for the delay within one month failing which coercive method have to be adopted for enforcement of the order.*
- e) The State of UP may cooperate and coordinate with the committee constituted by this Tribunal in absence of any satisfactory mechanism constituted by the State.*

16. *The Monitoring Committee may continue to monitor compliance of directions of this Tribunal and furnish its next status report as on 31.12.2019 by 31.01.2020 with comments on the affidavits of the concerned authorities. The same may also be uploaded on its website. We further direct the NCT Delhi, the States of Haryana and UP, DDA to file affidavits of compliance of the directions of this Tribunal as on 31.12.2019 before the Committee as well as this Tribunal on or before 15.01.2020. The registry may upload them on website as soon as received so that all concerned can access the same before the hearing to avoid the situation which arose on 12.7.2019 as noted in para 7 above.*

NGT's order dated 5.3.20:

It will also be open to the Chief Secretaries of U.P. and Haryana to have their own appropriate mechanism for monitoring. The Chief Secretaries of Delhi, U.P. and Haryana may place the mechanism so evolved before this Tribunal before the next date.

Status as in August 2018:

The main sources of pollution in Delhi stretch of river Yamuna from UP are the towns of Ghaziabad, Sahibabad and Loni and Noida. The cities of Sahibabad and Loni Generate 575 MLD of sewage for which there are 7 STPs of a total capacity of 427 MLD. This leaves 148 MLD of untreated sewage which gets released into Sahibabad drain. Where it gets mixed with industrial effluent. It is estimated that in all Sahahibad drain carries 166 MLD of sewage and industrial effluent. O amt of this 74 MLD is treated at Indira Puram STP and the balance 92 MLD released in the drain which eventually reaches Yamuna. Indirapuri drain which originates in Loni also carries 78 MLD of out of which only 30 MLD is taken to Indirapuri STP which was found non-functional during the visit of Mr Tyagi, Technical Expert assisting the YMC, and the remaining 48 MLD is discharged into river Yamuna through Shahdara Drain. In addition Noida drain discharges 354 MLD of sewage into river Yamuna. As per the CPCB report on pollution in drains out of 514 MLD of waste water in Shahdara drain 105 MLD.

There are 108 industries in Sahibabad industrial estate which generate 8650 KLD of industrial effluent. In addition, Loni has 88 industries in the catchment area of the Loni drain. Though most of these units have their standalone ETPs a lot of industrial effluent from industries

operating in non- conforming/residential finds its way into the storm water drains where it gets mixed with Sewage. The STPs which are designed to for biological treatment are unable to treat mixed waste water and as a result most of the STPs in the Cities of Ghaziabad and Shahabad are non-compliant to the environmental standards.

On floodplains demarcation and rejuvenation, the state of UP had informed the tribunal in that almost 75% of the floodplains is demarcated and that balance will also be demarcated. Non-attendance in the meeting by senior officers proved to be a major impediment in getting a clear picture on the action plan, if any, for protection and rejuvenation of the floodplains. The junior officials who attended the review meeting could not give any assessment of the size of the floodplains which UP controlled, its status, legal cases if any pending in the Courts and the plan for its rejuvenation.

Progress Achieved:

The YMC has relentlessly pursued the implementation of the NGT order with State Government through letters addressed to Chief Secretary and the Principal Secretaries over the last two years. Directions contained in NGT orders dated 11.9.19 were reiterated. YMC wrote series of letters to the Chief Secretary, UP on 28.10.19, 7.11.19, 28.11.19 and 12.12.19 requesting for one time presence of Principal Secretaries of Concerned Departments in time meeting convened by YMC as the earlier meetings held with the Engineers and other officers of relatively junior levels had not yielded any definite commitment on the action proposed by the state government and the timelines for stoppage of flow of sewage and industrial reaching river Yamuna through drains originating or passing through UP. Not getting any response from the State government, YMC visited Sahibabad drain in UP in December 2018 and had discussion with District Magistrate and the officers of Ghaziabad Municipal Corporations, UP Jal Nigam and the UPPCB and certain timelines were given for the Action Plan to plug sewage, set up STPs, also take action on closure of industries operating in residential/non- conforming areas, and start septage management in unauthorized unsewered colonies.

As regards setting up a state specific Monitoring Committee, the state first set up a committee of serving Chief Engineers of Irrigation Department/Jal Nigam who were found mostly busy with their normal schedule of work and were not able to do any monitoring or provide any

meaningful assistance to the YMC. Some were stationed in Lucknow and some had no conversance with the subject. This Committee was later wound up and as a result YMC has been greatly handicapped in being able to do any effective monitoring of the work that was required to be taken in compliance of NGT's directions.

The review meeting with Principal Secretaries finally took place on 30.12.19. The Principal Secretary (UD), Principal Secretary (E&F), GM, Jal ka Nagar Nigam, CE, UP Jal Nigam, Chief Engineer (Irrigation), UP, Executive Director, UPSIDA and Municipal Commissioner, Ghaziabad among others were present all for the first time in 15 months.

Why pollution abatement of drains from UP is important

The CPCB in its report dated 27.12.19 submitted to the YMC has informed that the cities of Sahibabad and Loni Generate 575 MLD of sewage for which there are seven(7) STPs of a total capacity of 427 MLD. However out of these, only 2 STPs are functioning properly treating 80 MLD to the prescribed standards. Consequently there is large quantity of sewage flowing through the Sahibabad and Indrapuri drains. In addition, Noida drain, which originates in Delhi and thereafter flows through Noida before joining river Yamuna discharges 354 MLD of sewage into river Yamuna. The details of flow and pollution load are as as given in the statement below:

S.No.	Name of the drain	Discharge	BOD mg/L	COD mg/L	TSS mg/m
1	Sahibabad Drain	40 MLD	744	1615	1189
2	Indrapuri Drain	31 MLD	743	1463	647
3	Noida	354	46	163	83

In compliance of the order of Hon'ble NGT, the Secretary, UPPCB has submitted the progress report to YMC vide his letter no. G-32902/NGT-53/C-1/2020 dated: 12.06.2020. After perusal of Status Report received from the State Government, after having meeting with the concerned C.E., U.P. Jal Nigam and the senior officers of UPPCB, the YMC has the following observations to make:

1. Functioning of STPs/CETs/ETPs

- The cities of Sahibabad and Loni Generate 575 MLD of sewage for which there are 7 STPs of a total capacity of 427 MLD. However out of these, only 2 STPs are functioning properly treating 80 MLD to the prescribed standards. Consequently there is large quantity of sewage flowing through the Sahibabad and Indirapuri drains contributing the pollution in River Yamuna. What is required is for the Jal Nigam/Ghaziabad Nagar Nigam to ensure proper functioning of STPs and upgrade those that require rehabilitation/upgradation.
 - It has been informed that the In Ghaziabad, 9 STPs have been constructed, out of which 4 STPs are maintained by Ghaziabad Development Authority, remaining five STPs are maintained by UP Jal Nigam. A contract has been given by state Govt. to M/s VA- TECH WABAG LTD under “one city one operator Scheme” to maintain these STPs along with sewerage network in Ghaziabad and Loni. M/s VA- TECH WABAG LTD has started maintenance work in Ghaziabad w.e.f. 6-12-2019. The Company is also responsible for repair & maintenance of all short coming in the STPs, collection of entire sewage and its treatment. Due to lockdown, the work has been delayed. This remains an unfulfilled undertaking. It is important because unless the third party actually implements what has been committed it is premature to treat it as a solution to the sewage problem.
 - EC of Rs 35,62,500/- has been imposed on 30 MLD STP at Loni and show cause notice issued to levy EC of Rs.56,50,000/- on 74 MLD STP at Indirapuram for not meeting prescribed quality of treated effluent. Rs 5.21 Crore EC has been imposed on 12 group housing projects in NOIDA for non- compliance of discharge norms of STPs. There is no clarity about the realisation of EC.
 - There is no CETP under the command of River Yamuna. As per direction of YMC, one CETP in Apparel Park Tronica City Loni was inspected and quality of effluent was checked. Only one parameter i.e. Lead content was high i.e.0.109 against required 0.10 and thus exceeding the prescribed parameters. Notice has been issued to EE in charge of the plant.
2. **Stoppage of sewage flowing through the Sahibabad, Indrapuri and Banthala drains from sewered areas:** It has now been reported that by December 2020 (against previous timeline of June 2020), entire sewage flowing from sewered areas into Sahibabad drain will be plugged with the following schemes:

- a) The flow in Sahibabad drain was earlier measured as 166 MLD by M/S WAPCOS. However, C.E., UPJN clarified that they have measured flow in the drain as 90 MLD which is correct. The existing STP of 74 MLD capacity in Indirapuram is not being operated at its full capacity due to inadequate capacity of the final treated effluent channel which carries combined effluent from three STPs discharging total effluent of 186 MLD, if all the three STPs run at full capacity. In order to solve this problem, the work of laying of 1800 mm diameter effluent line from 74 MLD STP Indirapuram to storm water drain situated along NH-24 is being undertaken for disposing combined effluent of all three STPs. A total of 600 mtr pipe line has been laid out of total 2500 metres. **The work was stopped due to Covid -19 from 25-03-2020 to 20.05.2020. Due to Covid-19 and forthcoming rains, the work will now be completed only by Dec. 2020 in place of June 2020.**
- b) Remaining 16 MLD discharge (90-74) will be pumped through Intermediate Pumping Station of 17 MLD capacity (under construction at Vijay Park in Shalimar Garden) into regular sewerage network instead of Sahibabad drain at present. 80 % civil work has been completed but due to covid19, the construction of this work was stopped. Now civil and E&M work for this IPS will be completed **by Dec- 2020.**
- c) Earlier study by WAPCOS showed that there was 166 MLD of flow in Sahibabad drain out of which 74 was being treated at Indira puram STP leaving 92 MLD of untreated sewage. This has been disputed by the UP Jal Nigam saying that entire sewage in the drains is being treated at Indira puram STP and that there is no requirement for a new STP. This issue was also flagged in the Third Interim report of YMC. Even the CPCB data at the table above gives the quantum of sewage as 40 MLD. Since there is a dispute in the flow present in Sahibabad drain a third party assessment needs to be done to decide on the capacity of STP required to be set up for waste water in Sahibabad drain. A direction from NGT in this behalf is necessary to ensure compliance by UP Jal Nigam.
- **Indirapuri & Banthala drain:** The proposal of setting up new STP of 60 MLD capacity is sent for seeking financial assistance from NMCG, Govt of India. As soon as proposal is cleared, the work will be completed within two years after award.
 - **There is no definite time lines given by UPJN for executing the work**

- These drains carry a huge quantity of chemical (COD varies from 1200 to 1600 ppm) which cannot be treated by the conventional method of treatment. Hence, UPJN doesn't have plan for pre-treatment of chemicals or set up CETP in place of STP resulting into bad quality of treated effluent. Directions needs to be given to the Ghaziabad Municipal Corporations, UP SIIDC, UP PCB and UP Jal Nigam to prevent industrial effluent entering these drains and prevent industrial effluent getting mixed with sewage.
- 3. **Septage Management:** The U.P. Government has also formulated a Septage Management Policy in October 2019 which seeks to cover all the unsewered areas. The septage management projects presently are under implementation and expected to be completed by November 2020.
- 4. **Phytoremediation/Bioremediation:** The U.P. Government has submitted a DPR for bioremediation in 459 drains using NEERI technology to the NMCG for approval. The State Government has also agreed to contribute 50% of the budgetary requirement towards this scheme out of its own financial resources.
- 5. **Industrial Pollution:** Pursuant to the directions of the Tribunal, following action has been taken since August 2019 to May 2020:

Conforming area:

- Environmental compensation (EC) of Rs. 3.16 Crores in Sahibabad & Loni out of which only Rs 1.67 Crores lacs has been realised.
 - 14 Industries in Loni, 8 industries in Sahibabad and 1 in NOIDA, have been closed on account of pollution or not having valid documents.
 - In compliance of NGT orders, UPPCB has also evolved a Policy under which the "consent to operate" for the defaulting unit is not being renewed until the EC has been paid. Besides, EC if not paid is purposed to be recovered as arrears of land revenue.
- UPPCB has requested YMC for recommending to Hon'ble NGT to pass an order for recovery of EC as arrear of land revenue so that it has a legal back up and process will be expedited.**
- 6. **Industries in Non-Conforming areas:** since August 2019 till May 2020, following action has been taken by UP Govt.:

- Loni area: 530 illegal industries are either closed or demolished. Rs.1.35 lacs fine has been imposed and recovered from illegal industries.
- Sahibabad area: 45 illegal industries were sealed and demolished.
- Barola area: 10 illegal industries have been sealed.

7. Flood Plain Rejuvenation; as per previous report

“167 Hectare flood plain of river Yamuna falling within UP is proposed to be rejuvenated by creating wetlands and biodiversity parks through DDA and funds for this purpose has been agreed to be provided by the state of UP in the meeting held on 30.12.19, the Engineer in Chief UP Irrigation Department informed the YMC that the Finance department has since concurred in the payment of Rs. 35 Crores to DDA for flood plain rejuvenation as a deposit work on the lines of 10 projects that are being implemented by DDA on flood plains under its control. The DDA has on its part already completed the tendering process and once funds are received from the state of UP, the implementation of flood plain rejuvenation activities as per the project prepared by DDA can commence on the ground”.

Despite assurances given by the Engineer- in- Chief UP Irrigation to YMC in October 2019, the funds required for floodplains rejuvenation through DDA have not yet been transferred to DDA. This has also been brought out in Chapter 2: Floodplains protection and rejuvenation. A strong direction in this behalf from the NGT is requested on this and has been expressly requested in the DDA chapter.

Directions sought from NGT:

Hon’ble NGT may consider issuing the following directions:

1. Independent assessment of flow in all the drains reaching Yamuna be undertaken within next two months and thereafter submit action plan for setting up STPs to bridge the gap with definite and monitorable timelines.
2. Out of 427 MLD of treatment capacity in Sahibabad and Loni STPs with only 80 MLD capacity are compliant to standards. A direction to UP Jal Nigam, Ghaziabad MDA and Ghaziabad Municipal Corporations to upgrade/rehabilitate the STPs to meet revised

environmental standards of TSS/BOD: 10/10 mg/L within next two years and the authorities being directed to submit Action plan to achieve this within next three months.

3. Stoppage of all sewage from sewered areas of Sahibabad Banthala and Indira Puri as per the Action Plan prepared by the State Government by December 20.
4. Implementation of Septage management by December 20 in all areas which are not sewered.
5. UPSIIDC be directed to ensure setting up CETPs and ensure their proper functioning. UPPCB be directed to put in place policy for realizations in case the industries failed to pay. As requested by the UP PCB the arrears of unpaid EC be directed to be realized as arrears of land revenue.
6. The YMC is unable to comment on the omnibus compendium submitted for NMCG funding pertaining to Phyto and Bio remediation. However when approved the drains which are polluting the Sahibabad and its tributary drains need to be taken up if feasible. The reply of UP on in- situ bio/phyto remediation is vague and does not inspire confidence about the seriousness of the intent.
7. A direction is required to be given to the UP Irrigation Engineer in Chief and the Principal Secretary Irrigation relating to the inordinate delay in paying DDA for undertaking the rejuvenation of the flood plains on the UP side as a deposit work which was promised on several occasions but has not made any headway in the last 7 months when one months time had been sought.

Chapter – 14

Creating Public Awareness Through Information Dissemination Strategies

NGT had passed orders on 26th July *“about the need to build public awareness and the need to involve educational institutions for conveying expectations from citizens, build awareness and provide feedback on the results.”*

In its order dated 25th July 2019 the Tribunal had observed as follows:

“All authorities have to take up the job as a mission for service to society and in such a situation there can be no issue of any conflict arising in the working of the Bodies.

“We direct all public authorities, Municipal Corporations and concerned Departments ----to take effective steps to educate all sections of society to co-operate and not to do any acts or deeds which are prohibited under this judgment and would have adverse consequences. These authorities should place large sized dustbins---and make concerted efforts both by the ones who are governing and ones who are governed. They shall issue circulars, display signages, and may take recourse to Print and Electronic media for educating people at large.”

Status in August 2018 Report of YMC

Although the specter of “Maily Yamuna” was a phenomenon which was well understood by all citizens of Delhi there was no ownership or involvement in revitalizing the river. It was not a political priority except seen through the lens of different Yamuna Action Plans created and executed with JICA loan for infrastructure projects. Although thousands of crores has been spent in the process, nothing tangible in reducing water pollution levels caused mainly by sewage, solid construction waste and industrial effluent. Although the Yamuna Action Plans are founded with the objective of “bringing the water quality of the river back to bathing level,” in addition to several gaps in execution, no one had given any importance to the need to build public awareness. Citizens had become inured to seeing the dumping of solid waste and garbage into

the drains and the river bed, annual reports of visible industrial effluent polluting the river and the stench of sewage originating from several drains.

Need for Political Ownership a Pre-requisite

Building awareness required comprehensive policy direction at the political level to leverage different arms of the administration to reach out to citizens. Delhi has a heterogeneous population and what might work in organized colonies does not get accepted in congested localities which form more than half the city's population. Earlier successful examples of building cross-cutting public awareness had all rested on the strength of community involvement –initially garnered through the educational system and school children who when guided properly become strong agents of change. Campaigns such as “Clean Delhi, Green Delhi”, Bhagidari, “Say No to Firecrackers”, and “Play Holi Naturally” were all successful because they were backed by a plan which was discussed, generated and funded by the Government (GNCT). Through these campaigns it became possible to almost eliminate the use of chemical colors during Holi and reduce the sale of firecrackers drastically because their use was eschewed by school children, motivated through the efforts of hundreds of School Eco- Clubs. The Department of Environment worked directly with the Chief Minister's office and all were publicity campaigns were administered by the Directorate of Public Relations.

In the case of the River Yamuna it was largely seen as an Urban Development project oriented towards the construction of a network of Sewage Treatment Plants to be implemented by the Delhi Jal Board. Abatement of pollution was seen as the primary means of river rejuvenation which is a misunderstanding of riverine ecology. Text books did not cover the difference and for citizens the Yamuna was just a drain or an open sewer. There was an absence of any worthwhile activities except by committed birders and naturalists. The river was stagnant nine months of the year and only in the festival season post monsoon, it was used for idol immersion or a receptacle for throwing the remnants of *Pooja samagri*.

Even the wire meshing erected across all the Yamuna Bridges had been vandalised and public would stop to throw their religious offerings into the river undeterred by the warnings. The PWD who maintained the bridges seemed to be overawed by public need to deposit religious

offerings in the river. Why this and many other violations were environmentally and in terms of civic consciousness unclean practices was not understood by most citizens.

YMC's Approach

In several meetings YMC asked the Member Secretary DPCC to assign funds to various NGOs who could start awareness projects aimed at building public awareness against dumping of debris in the drains and river, reacting to industrial pollution which was visible and educate the public about not throwing garbage into drains or Pooja remnants into the river. This was agreed to but the outcomes were not inspiring.

While NGT had given YMC immense authority to monitor what the Departments of the Delhi Government and DDA were doing to implement the Tribunal's NGT's orders on public awareness but when nothing was even on the drawing board, the YMC had to find a way to first involve the political leadership without whom the response of the Delhi schools and Eco-clubs would have been at best routine.. The involvement of the Department of Environment too was critical as planning and funding would be needed. At the YMC's early meetings it was apparent that no one shared much enthusiasm- essentially viewed as something which was not close to the public imagination.

Involvement of the Political Leadership

YMC was called by the Chief Minister, Delhi and the members used the opportunity to apprise him about several aspects of the management of the sewerage systems of the Delhi Jal Board which were not getting primacy. The CM was the Chairman of DJB at that time..

During the meeting the members also brought up the issue of public awareness referred by NGT. The CM spoke to the Deputy CM and asked the YMC to follow up. The YMC then met the Deputy CM and told him that the involvement of the schools, eco clubs was very necessary and activities needed to be owed by the Environment and Education Departments. YMC issued the minutes of the meeting in the form of a letter **Annexure – C-14/1**. From then on, some activity was noticeable and from a subject of no consequence progress began to be made – slowly at first but it gathered momentum as the months passed. The outcomes are measurable and are recounted in the Annexure of the Education Department at **Annexure – C-14/2**.

Involvement of Key Central Agencies

A meeting of the Expert Members of the Principal Committee and the Yamuna Monitoring Committee was held on 18.10.18 under the chairmanship of the Secretary MoWR, RD&GR now MoJS.

YMC brought up the need to build greater public ownership for the Yamuna at the meeting pointing out that presently there was little interest in the rejuvenation of the river. Portions of land which lie above and beyond the flood plains needed to be used to organize cultural events. (YMC had noted that DDA's projects would take at least 18 months to two years and until then some activities could be generated.) It was suggested that the Principal Committee and NMCG could get several cultural institutions working under the aegis of the Ministry of Culture to use their rich repository of exhibition material on the Yamuna to organize cultural functions,. The point that there was a need to create public awareness about the historical and mythological importance of the Yamuna and to draw up a well-structured media campaign to heighten interest among students promote safe, ecologically friendly activities like birding, cycling, was recognized. Whatever YMC suggested was included in the minutes issued by the Ministry but it was clear that it would take more effort to make this a reality.

YMC then got the Secretary Art and Culture of Delhi Government to organize a mega event at the Central Park in Connaught Place using the resources of the Indira Gandhi National Centre for the Arts (IGNCA) under Ministry of Culture. The Head of the Kalindi Division of IGNCA was told about the need and the Secretary Art and Culture of GNCT put in touch. An event was planned in January 2020 at the Central Park devoted to the Yamuna but was called off because of declaration of elections of Delhi Legislatively Assembly.

Significant Contribution of the Departments of Education and Environment.

YMC motivated the Secretaries of the Education and Environment Departments of Delhi Government over more than six meetings to pursue the Action plans which had been made after the meeting with the Deputy CM.

It took time but the State Council of Educational Training and Research (SCERT) Delhi managed to execute a splendid job worthy of being recognized.

It was kicked off with a one day orientation programme held on 7.6.19 at Tyagaraja Stadium for all heads of Schools; Eco Club in-charges, Programme Officers for Environment, NSS in-charges when a booklet and brochure prepared using the pictures and data on YMC's website were distributed and subject experts gave talks on different aspects related to river rejuvenation. Some of the experts were recommended by YMC particularly on birding which would be of interest to students.

A detailed compendium with photographs, locations, names of participating schools and including a wide range of activities undertaken by the Eco clubs, schools as well as samples and periodicity of the advertisements issued in national dailies was got compiled by YMC which was appended to the third Interim Report of YMC submitted in February 2020. It is available on the website.

Awareness Activities Undertaken.

Although it was a slow beginning, YMC was successful in seeing that awareness workshops on the river Yamuna began to be conducted using NGOs, scores of awareness advertisements were issued in the national dailies, specific programs were taken up for cultivators, the Public Works Department and covering the industrial areas. All Government schools were engaged throughout the working months including the teachers, school heads and pupils in 1026 Government schools involving 10, 39,735 students.

More than 84 activities were undertaken including Painting Competitions, Demonstrations regarding Drainage and Industrial Waste, Pledge taking, Tree Plantation Drives, campaigns to 'Reduce, Reuse and Recycle of Waste Materials', making Eco Friendly Clay Idols in schools, Slogan Writing and Poster Making Competitions, Nukkad Nataks and Rallies, Role Plays and Say No to Plastic campaigns.

Material was sourced from YMC's website and a PPT which was drawn up in consultation with experts was simplified further by SCERT for children's understanding.

Groups of students were taken on visits to the Yamuna Biodiversity Parks at Wazirabad, Aravalli, Tuglaquabad and Tilpat valley. More than 700 schools and 1.67 lakh children have benefitted from these visits.

A Mega Parent Teacher Meeting was organized in all 1027 schools and parents were told about pollution in the Yamuna and their roles as citizens.

Greta Thunberg's speech at the COP24 was shown to all students. A quiz on cleaning the Yamuna was organized at a Zonal level for Class XI and XII Students.

Delhi has 29 Zones and YMC arranged a meeting with MCD Directors of Education who were reportedly not coming for meetings so that SCERT could train the Eco Club in-charges of the MCD Schools on different aspects of the Yamuna. YMC had asked that Private schools (which have almost equal number of students as the Government schools) to be also covered. That was being done according to the official report given to YMC. Unfortunately, all activities have stopped with the closure of schools in the wake of the pandemic and Lockdown.

For this reason, with the closure of schools, Eco clubs and all activities, there is little new to report. By now the programmes would have covered all private and municipal schools which YMC had put on rail by involving all those who could influence awareness. But one good outcome was that at a political level, Yamuna got greater traction than ever before.

Yamuna Became a Political Issue in the 2020 Delhi Elections.

In the run-up to the Delhi Assembly elections 2020, the rejuvenation of the Yamuna became a strong poll plank, quite unlike all previous election campaigns. Chief Minister Arvind Kejriwal promised that the Yamuna would be his Government's priority in the next five years. "A lot of sewer and industrial waste currently flows into the Yamuna. We have identified all of it," the chief minister is reported to have said. "I can say this with complete confidence that Yamuna will be cleaned in the next five years. Before the next elections, you all will be able to take a bath in the Yamuna, and I will take a dip along with you."

Other political parties also included in their election manifesto.

Directions Requested from NGT

- NGT is requested to direct that with the closure of schools, the Action Plan which was in operation both by the Departments of Environment and Education should be redesigned to make it amenable to on line viewing and participation. Webinars should be planned using the themes already identified.

- In the context of distancing the YMC feels that a film should be prepared for the public as well as students which can be viewed on television or you-tube giving the historical, cultural, economic and social significance of the Yamuna; also highlighting the citizen's role by looking inwards at the individual's role and responsibility.
- The Government should ask for periodic evaluation of the impact of the Yamuna awareness programmes which should be filed before NGT along with outcomes which should be evaluated.
- The awareness building programmes necessarily need to include Municipal and private schools.

Chapter - 15

Website Created by the Yamuna Monitoring Committee.

<https://yamuna-revival.nic.in>

NGT's Directions

In NGT's order dated 26.7.18 the Monitoring Committee was directed to set up a website for receiving and giving information and further to involve educational institutions for expectations, awareness and feedback about the results.

Different sections and buttons on the website:

-  Overview/Home Page
-  NGT Judgement & Orders
-  Stakeholders & Agencies
-  PPT on Yamuna
-  Monitoring Committee Reports
-  Reports of Experts
-  Yamuna Today- a technical note created with maps, charts, tables with the help of CPCB, DJB, NMCG.
-  Flood Plain Rejuvenation & Environmental Flow created with inputs from environmentalists, ecology experts and CMDE
-  Wetlands
-  Relevant Laws
-  Suggestions to the Monitoring Committee: This was an interactive platform where institutions, organizations and individuals could upload up to 1000 words describing a situation which required the attention of YMC along with photographs. The template provided a quick system of registering the name, email, address, telephone number and the location of the area where intervention was needed.
-  Training Material for Schools was got created by the SCERT using YMC's material uploaded for students.
-  A separate button was provided for the Haryana MC's reports.

What's New? was hyperlinked to all new events like NGT's latest directions besides matters of current interest to the public.

Besides this the standard buttons like About Us; Contact Us; Meetings of MC; Key Communications; Sitemap were provided.

The Website is an In-house production.

The Website theme was purchased on 02.11.2018 from **Themes Glance** (Rs. 2585/-) and the website was launched on 19.02. 2019. The process of getting NIC approvals required 33 visits to the NIC Office made by the Systems Analyst from 26.09.2018 to 16.07.2019 mainly to fix errors and deploy the website on the NIC server. The NIC team finally hosted the website on NIC Staging Server and provided a permanent domain name (URL: <https://yamuna-revival.nic.in>).

The Website collapsed several times due to load on the NIC server. Hence, as advised the website was deployed to NIC Cloud Server on 17.07.2019. Interest has grown only after the website stabilized and was made mobile compatible.

Sections/buttons in the website:

The website has the following buttons with several drop-down lists:

Overview/Home Page
NGT Judgement & Orders
Stakeholders & Agencies
PPT on Yamuna
Monitoring Committee Reports
Reports of Experts
Yamuna Today
Flood Plain Rejuvenation & Environmental Flow
Wetlands
Relevant Laws
Suggestions to the Monitoring Committee
Training Material for Schools

What's New

About Us

Contact Us

Meetings of MC

Key Communications

Summary of Website Contents

Sitemap

Haryana MC

Utility of the Website

The website was primarily used by Newspapers as all Monitoring Committee Minutes were always uploaded on the website. The website has hyperlinks to all NGT orders and directions pertaining to the Yamuna.

The publication of several news reports has helped build public awareness about the Yamuna and what is being done and also what is in the pipeline to try and save the River. The maximum interest shown has been on setting up bio diversity parks, preventing idol immersion, involvement of students in awareness building and containing industrial pollution.

The Power Point Presentation in 52 slides on the website shows the main causes of pollution and what is being done to address them. The PPT has been used by the Education Department for preparing an Awareness Programme for children in 1022 Government schools who can refer to the website before their forthcoming planned visits to the Sewage Treatment Plants and the Biodiversity Parks .They can view Delhi specific information relating to water pollution in Delhi,, see photographs provided by DDA and ecology and Natural history experts on riverine flora and fauna which enhances awareness building.

The website has a Button “Suggestions to the Monitoring Committee” which is an interactive platform on which institutions and individuals can make suggestions after giving registration information. This facility has been accessed by some RWAs to great advantage. But unless there is a response it will become defunct.

Most people however prefer using Twitter which is quicker. YMC has been putting out frequent tweets and also responding to specific issues raised e.g. large-scale dumping of debris below the

Nizamuddin Bridge. Since the website is linked to Twitter and Facebook it needs to be functional 24x7 which actually necessitated moving to a Cloud server as advised by NIC.

The website is very quick to access and easily navigable. YMC feels that the work that has gone into content creation should be used for public knowledge and interaction. An officer who is computer and social media savvy and has a genuine interest in environment issues may be put in charge to modify and administer the website. Ideally it should be jointly owned by GNCT and DDA which is responsible for the Yamuna flood plains and several rejuvenation projects.

Annexures

to the

Final Report of the Yamuna Monitoring Committee

Appointed by the
Hon'ble National Green Tribunal
Vide order Dated 26th July 2018

Dated 29th June, 2020.

Volume 2

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Related to Chapter 1: Environmental Flow

Chapter 1. Environmental Flow

T-03/2016-17/534/NMCG/Phase-II
National Mission for Clean Ganga
Ministry of Water Resources, River Development &
Ganga Rejuvenation

1st Floor,
Major Dhyan Chand National Stadium
India Gate, New Delhi-110002
Dated: 11th December, 2018

OFFICE MEMORANDUM

Subject: Minutes of Special Meeting of Expert Members of Principal Committee and the Monitoring Committee of NGT in the matter of O.A. No. 06 of 2012 – held on 18.10.2018 at 03.00 PM under the chairmanship of Secretary, MoWR, RD&GR.

A copy of Minutes of Special Meeting of Experts members of Principal Committee and the Monitoring Committee held at Conference Room, MoWR, RD&GR on 18.10.2018 at 03.00 PM under the chairmanship of Shri U. P. Singh, Secretary, Ministry of Water Resources, RD&GR is forwarded herewith for information/necessary action.


T.D. P. Mathuria
Executive Director (Technical)
Member Secretary, Principal Committee

Encl: As above.

To,

1. Shri Shashi Shekhar, C – II/155, Satya Marg, Chanakyapuri, New Delhi – 110021
2. Additional Secretary, Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhavan, Jorbagh Road, New Delhi – 110032
3. Vice Chairman, Delhi Development Authority, Vice-Chairman Office B- Block, 1st Floor Vikas Sadan, New Delhi-110023.
4. Dr. C.R. Babu, Centre for Environmental Management of Degraded Ecosystems, School of Environment Studies, University of Delhi-110007.
5. Principal-CCF, Forest Department of NCT, Delhi, 2nd Floor, A Block, Vikas Bhawan, IP Estate, New Delhi - 110002
6. Dr. A. K. Gosain, Professor of Civil Engineering, Indian Institute of Technology Delhi Hauz Khas, New Delhi - 110 016
7. Shri Manoj Mishra (Petitioner in NGT Case) -178-F, Pocket-4 Mayur Vihar, Phase – I, Delhi - 110091
8. Shri Manu Bhatnagar, Principal Director (INTACH), Natural Heritage Division, 71 Lodhi Estate, New Delhi - 110003

Copy for kind information to:

1. PPS to Secretary, Ministry of Water Resources, RD&GR Shram Shakti Bhavan, Rafi Marg,
Sansad Marg Area, New Delhi, Delhi 110001
2. PS to DG, NMCG
3. Mrs. Shailaja Chandra, Member, Monitoring Committee – Yamuna
4. Shri. B.S. Sajwan, Member, Monitoring Committee - Yamuna
5. PS to ED (Finance/Admin), NMCG

Minutes of the Special Meeting of Expert Members of Principal Committee and the Monitoring Committee of NGT held on 18.10.2018 at Conference Room, MoWR, RD & GR

A meeting regarding rejuvenation of flood plains of river Yamuna (Delhi stretch) was held on 18th October 2018 at 03:00P Min Conference Room, Ministry of Water Resources, (MoWR), RD&GR under the Chairmanship of Shri U.P. Singh, Secretary of the Ministry and Chairman Principal Committee of NGT. This special meeting of the Principal Committee was called at the request of the members of the Monitoring Committee (MC) setup by the NGT vide orders dated 26th July 2018. The list of participants is placed at Annexure-I.

2. Chairman, Principal Committee welcomed those present and asked the new Vice Chairman DDA to indicate the latest status relating to the progress of 'restoration and rejuvenation of floodplains of river Yamuna'. Rejuvenation, wetland development and restoration works has been planned to be carried out in four phases by DDA but in view of the urgency to complete the work within a shorter time span, there is need to revisit the timelines and also ensure that approach adopted is a corrected approach. He indicated that special meeting has been primarily convened to take stock of the progress of the project 'restoration and rejuvenation of flood plains of River Yamuna' being executed by DDA.

3. Shri Tarun Kapur, Vice Chairman DDA, informed that DDA had engaged a Professor from the Jamia Millia Islamia University for planning and supervising the plans and initiatives to create wetlands and undertake the rejuvenation and restoration of the flood plains. The MC members drew attention to reports of unauthorized construction mushrooming on the flood plains which necessitated that DDA should initiate work of wetland development in all phases simultaneously with the involvement of experts with domain knowledge and competence.

4. He agreed with the recommendations of Monitoring Committee of simultaneously initiating the works of the rejuvenation in all phases and submission of timelines to Monitoring Committee. He however highlighted that the flood plain area does not have uniform width along its banks and some of the area is under encroachment and presently under 'Stay' from Hon'ble Supreme Court. The arguments in the matter had concluded and judgment in the matter was due to be announced shortly. The 300m buffer away from the water course was to be protected by developing it as a forest cover while next 150 m and strip could be developed as parks where certain permissible categories of landscaping and other eco-friendly activities are proposed. It was also informed by him that the flood plain area in Eastern Bank of River Yamuna is under the jurisdiction of Irrigation Department Uttar Pradesh. DDA can undertake works for restoration and rejuvenation of this area also under guidance of experts if Government of Uttar Pradesh entrusts DDA with the task. Funding for restoration and rejuvenation of this area has to come either from Government of Uttar Pradesh or NMCG.

5. Vice Chairman DDA informed that concept for wetland development by Jamia Millia Islamia, will be shared with the Monitoring and Expert Committee members and a seminar in this regard shall be conducted on 20th November, 2018. It was, however, suggested by some members that the seminar be held sooner in the first week of November as already considerable time had been lost.

6. Prof.C.R. Babu informed that the proposal of DDA does not follow the principles laid down towards rejuvenation by the Expert Committee of NGT in its report dated 13th October 2014 and also the directions of NGT in its judgements dated 13th January 2015 and 7th December 2017. He also pointed out that the concept of 300m buffer and 150m Park needs to be discussed with Expert Committee in the light of NGT judgement.

Further, Prof. C.R.Babu recommended DDA to verify the area stated in the proposal submitted for the stretch from Barapullah Drain to DND. As per the proposal, out of 300 hectare land, 25 hectare was allotted to Art of Living, while the report submitted by the High Powered Expert Committee after the site visit stated the area damaged due to holding of event by Art of Living to be around 100 hectares.

7. Prof. A.K.Gosain, Expert Member-PC, informed that as per the Hon'ble NGTs judgement, protective buffer of 300m from the river banks was a temporary yard stick that was used in the absence of any demarcation available corresponding to the 1 in 25 year demarcation line. This got replaced once the scientific study was performed to demarcate 1 in 25 year return period inundation line considered upto the identified (extended) flood plains irrespective of existence of cut off in form of embankments or afflux bunds. This is in the interest of preservation of ecology, biodiversity and the river flows. As per the Hon'ble NGT order, the existing structures which fall in the demarcated line of 1 in 25 year return period were to be identified by the Principal Committee to recommend as to which of the structure ought or not ought to be demolished. Further no permanent structure can be developed in the identified flood plains of 1 in 25 year return period.

8. The Member MC (BSS) felt that the proposal could be finalized through a consultative process between the Jamia Millia Consultant and the Experts whose report formed part of the NGT judgment. Other experts may be co-opted instead of waiting to organize a seminar as precious time is being lost and valuable land was at stake. The Member MC (SC) emphasized that the views of experts needed to be harmonised and taken forward expeditiously as the land was very vulnerable to encroachment. The MC needed a firm Action Plan by 15th November as had already been agreed to by the VC DDA.

9. The Convener Principal Committee informed that the works proposed in the DDA proposal against a preliminary estimate of Rs.5 crores included estimates for electrical/ lighting works, temporary fencing with RCC post and barbed wire fencing,

development of tracks etc which were contradictory to Hon'ble NGT's directions in the matter.

10. The Committee recommended that work on the site where World Cultural Festival was hosted by Art of Living Foundation needed to be supervised and specific measures needed to be taken for restoration of the area under guidance of experts. Further, Chairman-Principal Committee said the process had to be expedited and the recommendation of Expert Committee of NGT as contained in their report dated 13th October 2014 had to be followed while conceptualizing plans for the rejuvenation and restoration of flood plains of Yamuna. It was also decided that DDA's activities should not be limited to the funds of Rs. 5 crores.

11. The Member MC (BSS) drew the attention of the Principal Committee to the recommendation of the Expert Committee which forms part of the NGT judgment dated 13-01-2015 that the flood plain zone in the Delhi stretch be notified as Eco-Sensitive zone under the Environment (Protection) Act 1986 and for this, the matter be pursued with the Ministry of Environment Forests and Climate Change. Secretary, MoWR, RD&GR pointed out that the notification of 7th October 2016 conferring the status of Authority to NMCG gave wide powers to NMCG to prohibit and regulate activities in the river and on the flood plains. Member MC (BSS) asked that a formal view should be taken by the Principal Committee in its next meeting after consulting the Ministry of EF&CC. Based on the decision of the Principal Committee a report will be submitted to the Tribunal by the Monitoring Committee in December 2018.

12. On the question of E-Flows in river Yamuna, the Member MC (BSS) pointed out that the E-flow of 10 cumecs presently being released at Hathanikund was completely insufficient to maintain the flow as most of it disappeared after 70-80 Km downstream from Hathanikund during the lean season. The possibility of increasing this flow was difficult as the demand on Yamuna water was increasing. It was necessary to collect data relating to the month to month prevailing flow. A scientific study would require to be conducted on E-flow and attendant issues on the lines of the study done for a specific stretch of the Ganga by the Ministry. It was also pointed out that since the River Ganga under the notification of 2016 includes the Yamuna the Ministry of WR, RD and GR should commission such a study. The Secretary MoWR, RD&GR agreed to look into this.

13. Both MC members referred to the commendable initiative which was reported by deploying a battalion of ex-servicemen called Ganga Vahini as an Ecological Task Force. The MC had already discussed the need to replicate such initiatives before the NMCG representatives and officers from DDA more than 2 months ago. This had been minuted for necessary action. The need for deploying force on similar lines as done at Allahabad and Kanpur was again emphasized as a means to foil constant unauthorized construction. VCDDA was asked to follow the Ganga protection and security strategy with the support of

MIOWR and NMCG and apprise the MC of the outcome. This was already included as an actionable point in the MC's report.

14. MC Member (SC) said that it was necessary to build greater public ownership as presently there was little interest in the rejuvenation of the Yamuna. Portions of land which are beyond the flood plains needed to be used to organize cultural events. It could be under the aegis of the Ministry of Culture's institutions as they had a rich repository of material or done by GNCT authorities. There was also a great need to create public awareness about the extent and type of pollution and to draw up a well-structured media campaign to heighten interest among students promote safe, ecologically friendly activities like birding.

15. Member MC (SC) informed the DG NMCG that the MC needed to undertake several monitoring activities to check the physical progress made on commitments by DDA, Governments of UP and Haryana among others. In GNCT the status of enforcement relating to the natural drains, industrial effluent and sewage discharge had to be checked when CPCB/ DPCC gave adverse reports. The MC did not have any mechanism to pay for services of experts or to compensate people engaged for a few days to inspect and prepare reports. Although the DJB had been requested to pay experts for such services, the response was not forthcoming. She therefore suggested that a pool of funds should be kept available with NMCG through which immediate payment could be released on the basis of a justified proposal from the MC. It would only be before services of experts, or students or faculty engaged in monitoring activities related to Yamuna pollution abatement. There would be no duplication of what is funded by NMCG and the DJB. Payment can be made directly to experts and engaged.

16. Secretary, MoWR, RD&GR informed that regular cleanliness drive are being organized at Chhath Ghat and Kalindi Kunj Barrage by MoWR, RD&GR and NMCG respectively, involving officials and other stake holders. The meeting ended with thanks to the Chair.

Annexure-I

List of participants:

1. Shri. U,P,Singh, Secretary, MoWR, RD&GR- *in chair*
2. Shri. Rajiv Ranjan Mishra, Director General, NMCG
3. Smt. Shailaja Chandra, Member, Monitoring Committee Yamuna
4. Shri. B.S. Sajwan, Member, Monitoring Committee Yamuna
5. Shri Tarun Kapoor, IAS, Vice Chairman, Delhi Development Authority

6. Prof. A.K.Gosain, TIT Delhi, ExpertMember
7. Prof.C.R. Babu, DU, Expert Member
8. Shri. D.P.Mathuria, Executive Director-Technical, NMCG (Member Convener-PC)
- 9.Shri Manu Bhatnagar, Principal Director(INTACH),
- 10.Shri Y.P.Singh, Joint Director, MoEF &CC
- 11.Mrs. Indhu Vijayan, DCF, (P&M) ,Department of Forest & Wildlife (NCT)
12. Mrs. Poonam Dewan, Additional Commissioner, DDA
- 13.Mrs. SavitaBhandari,Advisor(Landscape),DDA
14. Mrs. Neelima Soni, Deputy Director, Landscape, DDA
- 15.Mrs. Ruby Raju, Project Engineer,NMCG

**Environmental Flow Assessment
for Yamuna River
from Hathnikund Barrage to Okhla Barrage**

DRAFT FINAL REPORT



A view of Yamuna River downstream of Hathnikund Barrage

Sponsored by

NATIONAL MISSION FOR CLEAN GANGA (NMCG)

under Namami Gange Program

Submitted by



NATIONAL INSTITUTE OF HYDROLOGY

Jal Vigyan Bhawan, Roorkee

April 2020

Confidential Report
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Invited Expert from Wildlife Institute of India, Dehradun

- Dr. J.A. Johnson, Scientist E & Head, Department of Habitat Ecology

Acknowledgement

The study utilizes data from various Central and State Government agencies: Yamuna Basin Organization, Central Water Commission, New Delhi; Central Ground Water Board, New Delhi; Central Pollution Control Board, New Delhi; Delhi Jal Board, New Delhi; UP Irrigation Department (Okhla); UP Irrigation Department, Saharanpur; Irrigation & Water Resources Department, Panchkula, Haryana; Water Collection Division, Karnal, Haryana; State Pollution Control Board, Haryana. The support and cooperation of all the above agencies is thankfully acknowledged. Special thanks to Dr. J.A. Johnson, Scientist, Wildlife Institute of India, Dehradun, for joining the NIH team in field survey for identification of indicator fish species in the study reach of Yamuna river and for his contribution in Chapter 6 of the study. Sincere thanks to Director NIH for his support and encouragement in completing this study.

EXECUTIVE SUMMARY

River Yamuna during non-monsoon season carries very less flow in its stretch from Hathnikund to Okhla barrage, which adversely affects the quantity and quality of water in the river. The R&D Project titled 'Environmental Flow Assessment for Yamuna River from Hathnikund Barrage to Okhla Barrage' was awarded to National Institute of Hydrology, Roorkee, by National Mission for Clean Ganga under the Namami Gange Program. The work carried out to assess environmental flows (e-flows) in the study reach and recommendations emerging from the study are given below.

Assessment of e-flows for Yamuna river from Hathnikund barrage to Okhla barrage

Field investigations and data analyses: The assessment of e-flows for the study reach is based on integrated hydrodynamic and hydrological modelling using SWAT and HEC-RAS 1D. A variety of datasets are required as model inputs as well as to validate the model outputs. Besides the river water quality, the study also investigates the variation in groundwater levels over a period of more than four decades. All such necessary data were collected from concerned agencies. In addition, exhaustive field surveys were carried out for the following: (1) Identification of the indicator fish species and assessment of their habitat requirement based investigations in the river, and (2) river cross-section surveys for a total of 306 lines at closely spaced intervals.

The analysis of depth to groundwater levels for pre-monsoon and post-monsoon over a period of four decades from 1975 to 2018 has revealed maximum depletion in water levels ranging from 10 to 20 m in the Mawi-Baghpat reach. Receding groundwater levels have in turn affected the baseflow contribution to the flows in Yamuna. Maximum depletion in baseflows is in the reach between Mawi and Baghpat during the months of April and May. For the study reach, the ratio of baseflow to total river flow is found to be higher in the non-monsoon season than in the monsoon season. This pattern is representative of other gauges in the study reach and shows the importance of baseflows in sustaining river flows during non-monsoon period.

Water quality analysis have shown that between the Wazirabad and Okhla barrage, the river receives approx. 6140 kg/hr BOD load out of which around 70% load is contributed through Nazafgarh drain. The average non-monsoonal DO value in this river stretch is 0.4 ± 0.12 mg/l as O_2 . During the field survey by NIH team, the DO value in this stretch was non-detectable indicating the BOD load to the river higher than the assimilative capacity of the river. The water quality up to Wazirabad barrage is good for fish proliferation, however, the reduction in DO values downstream of Mawi is a cause for concern.

Ecology and habitat requirements of indicator fish species: Field surveys have revealed three major fish habitats types such as pools, riffles and runs at the sampling sites in Yamuna river. The identified indicator species, *Bangana dero* and *Raiamas bola* are thriving well in run habitat of channel with depth ranging from 60 to 90 cm and velocity in the range of 0.1 m/s. Hence, ensuring minimum water depth of 60 cm and flow of 0.1 m/s at riffle/run habitat in the river will safeguard the fish diversity in Yamuna river.

Integrated hydrological and hydrodynamic modelling: The integrated hydrologic and hydrodynamic modeling approach has been adopted to assess the e-flows between Hathnikund barrage and Okhla barrage and compute the releases required from Hathnikund barrage for maintaining these e-flows. For converting the habitat suitability depth values into the flow values, depth versus discharge curves have been developed at selected 13 locations covering the whole hydrologic regime using HEC-RAS simulations. Using the developed depth vs discharge curves for different sites, the minimum desirable flow values required for maintaining suitable physical habitat in terms of desirable flow have been estimated. The flows required to be released from Hathnikund barrage for maintaining the minimum desirable amount of flows at different sites during different seasons have been estimated using the flow series simulated by the calibrated hydrologic model SWAT. The release required from Hathnikund barrage during a specific month is computed by taking the maximum of the releases estimated from Hathnikund barrage for meeting the minimum depth requirement of 0.60 m at 13 identified locations corresponding to the specific month.

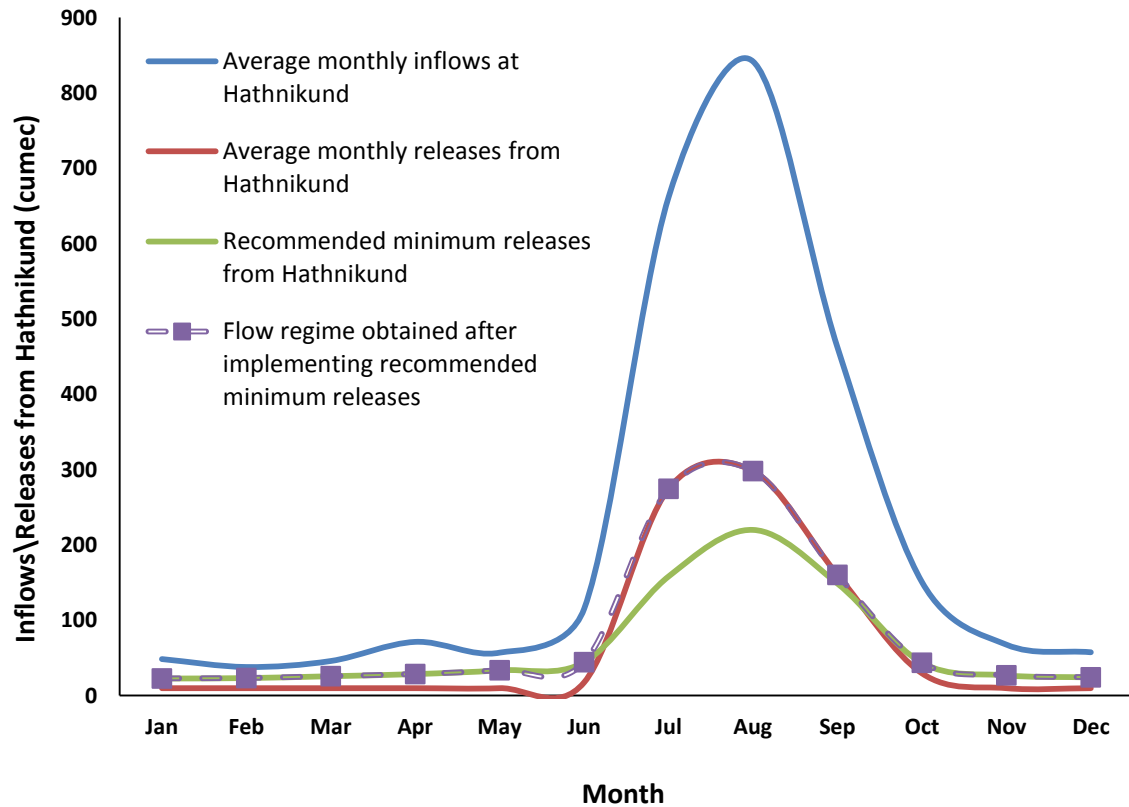
For carrying out various functions, the aquatic ecosystem needs natural flow variability within the year, for its sustenance. Incorporation of natural variability of flows has been carried out by taking the minimum depth of 60 cm for the month of May (being the driest month at all the G&D sites downstream of Hathnikund barrage) and modifying the releases as per the existing natural variability as observed in long-term historical data.

Recommendations

Final recommended releases from Hathnikund barrage for maintaining required habitat conditions between Hathnikund and Okhla barrage during different months of a year:

Month	Average monthly inflows at Hathnikund barrage (cumec)	Average monthly releases from Hathnikund barrage (cumec)	Recommended minimum releases from Hathnikund barrage incorporating natural variability (cumec)	Flow regime obtained after implementing recommended minimum releases (cumec)	For inundating floodplains (cumec) - once a month
Jan	48.49	9.97	22.81	22.81	
Feb	37.96	9.97	23.38	23.38	
Mar	45.93	9.97	25.89	25.89	
Apr	71.31	9.97	28.69	28.69	
May	57.06	9.97	33.73	33.73	
Jun	115.22	17.66	44.45	44.45	
Jul	661.72	274.57	158.16	274.57	1398
Aug	841.81	298.14	219.82	298.14	1631
Sep	462.09	160.31	148.62	160.31	
Oct	150.76	29.73	43.66	43.66	
Nov	67.63	9.97	27.01	27.01	
Dec	57.51	9.97	24.32	24.32	

Recommended releases from Hathnikund Barrage for sustaining downstream ecosystem upto Okhla barrage are illustrated below.



It may be noted here that the e-flow assessment is based on water requirement of indicator fish species, however, the biodiversity, livelihood and spiritual groups can link their requirements to specific features of the river channel at the study sites.

Possible management strategies for maintaining e-flows in the study reach are recommended below:

- Reduction in diversions to WYC/EYC by increasing the irrigation efficiency in WYC and EYC commands, keeping in view the crop water requirement
- Regulate groundwater withdrawal in the basin especially in the Mawi-Baghpat stretch and augment groundwater recharge in order to sustain baseflows
- Augmentation of non-monsoon inflows at Hathnikund barrage by creating storage of monsoon runoff in the upstream reaches
- Treatment of effluent coming through various drains meeting river Yamuna

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Chapter 1

INTRODUCTION

1.1 About the Study

Ministry of Water Resources, River Development & Ganga Rejuvenation, vide its notification no. S.O. 3187 (E) dated 07.10.2016, empowers National Mission for Clean Ganga to determine the magnitude of ecological flows in the river Ganga and its tributaries, required to be maintained at different points in different areas at all times with the aim of ensuring water quality and environmentally sustainable rejuvenation, protection and management of river Ganga and its tributaries and notifying the same and take or direct all such measures necessary to maintain adequate ecological flows. River Yamuna during non-monsoon season carries very less flow in its stretch from Hathnikund to Okhla barrage, which adversely affects the quantity and quality of water in the river.

In the special meeting of the Expert Members of Principal Committee and Monitoring Committee of Hon'ble NGT held on 18.10.2018, the matter was discussed and it was informed that the environmental flow of 10 cumecs observed to be released at Hathnikund, was completely insufficient to maintain the uninterrupted flow of river Yamuna. In view of above, based on the recommendation of the Expert Committee (F. No. TE-16015/38/2018/NMCG of Dec 2018), NMCG approached NIH Roorkee for comprehensive study "to analyze the minimum required environmental flows for river Yamuna in the stretch from downstream of Hathnikund to Okhla barrage". The study proposal describing the objectives, methodology, and data requirement was prepared and submitted to NMCG for approval. Work was initiated on the study by NIH after receiving study sanction letter from NMCG on March 25, 2019.

1.2 Study Objectives

The objectives of the study undertaken by NIH are as follows:

- To assess environmental flows for Yamuna river from Hathnikund barrage to Okhla barrage.
- To suggest management options for maintaining the recommended e-flows.

1.3 Environmental Flows

Rivers are the main source of freshwater globally. The importance of natural functions that rivers provide, and the value of the biodiversity that lives in or is dependent on them is increasingly being recognized worldwide. Flow is taken as the major driver of biodiversity in rivers. During recent decades, sufficient evidence has emerged that a river's flow regime, ranging from low flows to high flows, significantly affects the river ecosystem. River water is used for numerous services such as drinking water, irrigation and industrial water supply, fishing, boating, recreation and cultural activities. On account of the burgeoning human

population, food and energy needs and changing life styles, pressure on rivers has intensified to meet the manifold increase in water demand.

To serve the various water demands, water is stored and diverted through various structures built on rivers that change the flow regime and reduce flow in the downstream reaches. These changes, in turn, lead to degradation in the services that the society gets from rivers. Data have shown that freshwater biodiversity is already suffering from over-abstraction of water, from pollution of rivers, and from poorly-planned water infrastructure. It, therefore, becomes imperative to decide the extent of changes we want in our rivers and how much of the natural regime we would like to maintain. The emerging science of environmental flows (e-flows) aims to ensure a balance between the use and the protection of natural water resources for people by analyzing data from hydrological, hydraulics, social, environmental, biological, and other relevant sectors.

There are many definitions of environmental flows. The International Union for Conservation of Nature (IUCN) (2003) defines “E-flows as the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated”. The IUCN makes a clear conceptual distinction between the water needed to maintain the ecosystem in near pristine condition, and that which is eventually allocated to it, following a process of a holistic assessment for e-flows. According to the widely quoted Brisbane Declaration (2007), “Environmental flows describe the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend upon these ecosystems” (Arthington, 2012).

Considering the above, following definition for e-flows is considered most appropriate and is adopted. The environmental flow requirement is the "acceptable flow regime required to maintain the river in reasonable condition or predetermined state". A trade off between water resources development and river maintenance in healthy or reasonable condition is, in general, an inevitable compulsion. National Water Policy (2012) stipulates that ecological needs of the river should be determined, through scientific study, duly accommodating development needs.

1.4 Organization of the Report

The study report is organized into eight chapters. Chapter 2 describes the study reach between Hathnikund and Okhla barrage, and, brings out the issues and challenges and the need for maintenance of e-flows. Methodology for assessment of e-flows is discussed in Chapter 3. Build-up of database for the study reach and data processing is dealt with in Chapter 4 which also provides details of field investigations undertaken during the course of this study. Chapter 5 deals with integrated hydrological and hydrodynamic modeling in the study reach and discusses results of hydrologic modeling using SWAT and hydrodynamic modeling using HEC-RAS. Chapter 6 on e-flows for sustaining indicator aquatic species discusses fish diversity in study reach, river habitat condition at sampling points, ecology and habitat requirements of indicator fish species, and suggested e-flow regime. Chapter 7 focuses on management options to maintain the recommended e-flows, while the conclusions and recommendations emerging from the study are provided in Chapter 8.

Chapter 2

STUDY REACH BETWEEN HATHNIKUND AND OKHLA BARRAGE

2.1 Yamuna River

The Yamuna River originates from the Yamunotri Glacier near Banderpoonch peaks in the Mussoorie range of the lower Himalayas at an elevation of about 6387 m above msl in Uttarkashi district in the state of Uttarakhand. The river traverses through Himachal Pradesh and Uttarakhand in the upper stretch of 200 km drawing water from several major streams. It enters the plains at DakPathar in Uttarakhand, where the river water is regulated through a weir and diverted into canal for power generation. It then reaches Hathnikund barrage in Yamuna Nagar district of Haryana state, where the river water is diverted into Western Yamuna Canal (WYC) and Eastern Yamuna Canal (EYC) for irrigation. Yamuna river enters Delhi near Palla village after traversing a route of about 224 km. The river runs parallel to Ganga before joining it at Allahabad. The tail end of WYC joins the river Yamuna near Palla and EYC also joins at Wazirabad reservoir. The river water is generally used for irrigation, drinking and industries as well as for mass bathing, laundry, cattle bathing, etc.

On the basis of hydrological and ecological conditions Yamuna has been classified into five segments that are Himalayan Segment, Upper Segment, Delhi Segment, Eutrophicated Segment and Diluted Segment. The river is diverted at 5 barrages during its course i.e. at Dak Patthar (about 160 km from origin in Uttarakhand); at Hathnikund (172 km from origin, just at foothills in Haryana); at Wazirabad (in NCT Delhi, 396 km from origin); at Okhla (in NCT – Delhi, 418 km from origin); and at Mathura (near Gokul village in U.P. about 570 km from origin). These barrages are the major water abstraction locations on the river. The water is contributed into the Yamuna River, not only through its tributaries but also by the irrigations canals and drains carrying waste water from various urban locations.

2.2 Issues and Challenges

The Yamuna river faces extremes of dry as well as flood conditions during a year. Due to high population density of the catchment, the river remains almost in dry state during January to June in many parts of its stretch and under flooded conditions during July-September. During the non-monsoon period (October to June), the river flow reduces significantly and some river stretches become totally dry, whereas, during monsoon period (July-September), the rivers receives significant amount of water, which is beyond its conveyance capacity resulting in floods (CPCB, 2006).

The construction of diversion structures at regular intervals (Hathnikund, Wazirabad, Okhla, Gokul etc.) for irrigation, domestic and industrial water supply, has largely modified the flow regime of the river. During the lean season, a river is kept alive not so much by directed surface runoff but by the base flows. Over the last three decades, drilling of a large number of bore wells – with pumps run by electricity – has led to overexploitation of both shallow and deep aquifers in adjacent districts of Uttar Pradesh and Haryana. Lack of regulation in the groundwater abstraction has depleted the water table resulting in changes in surface

water dynamics during the lean season and dry river segments are commonly observed between Hathnikund and Wazirabad barrage in the non-monsoon period. Wastewater inflow in river Yamuna through various drains has aggravated the water quality problems and this has adversely affected biodiversity and aquatic ecosystem.

2.3 Need for Maintenance of E-flow

Yamuna, a major tributary of River Ganga, supports the livelihood of millions of people in its basin states. To fulfil the growing needs of drinking water, irrigation and industry, several structures have been built which store and divert large volumes of water from the river as it runs its course through the riparian states of Uttarakhand, Haryana, the National Capital Territory of Delhi and Uttar Pradesh. River Yamuna during lean season carries very less flow in its stretch from Hathnikund to Okhla barrage, which adversely affects the quantity and quality of river water. Large volumes of treated/untreated sewage and industrial effluent are discharged into the river from townships in Haryana and Uttar Pradesh and through several drains in Delhi segment. Encroachment and dumping of municipal and construction waste on the flood plains has impeded the flow and impaired its natural ability to rejuvenate itself. Overall, this not only affects the well-being of river, but also the health of citizens exposed to the hazards of polluted water in the river and possible seepages in groundwater.

Jain and Kumar (2013) have observed that there is a hierarchy of flows required for a river to perform its numerous natural functions. In the monsoon season, certain flows are required to transport sediments while in the non-monsoon season certain percentage of flow is needed to avoid algal choking, for which the requirements exceed those to meet other ecological elements.

Environmental flow is essential for Yamuna to regain the characteristics of a healthy living river system. Hon'ble NGT has given directions for the maintenance of requisite e-flow in River Yamuna downstream of the barrage at Hathnikund in Haryana and at Okhla in Delhi, so that there is enough fresh water flowing in the river till Agra for restoration of ecological functions of the river. Hon'ble Supreme Court has directed that a minimum flow of 10 cumec (353 cusec) must be allowed to flow through the river Yamuna. However, as per the report 'Action Plan of the Monitoring Committee for Rejuvenation of River Yamuna' (Chandra and Sajwan, 2018), the release of 10 cumecs of water in lean months is completely insufficient to sustain the flow in the river. This is because most of the 10 cumecs of water released from Hathnikund barrage evaporates or percolates into the ground as it flows downstream. As a result, most segments of Yamuna remain dry during lean season. The general BOD standard for discharge of effluent in inland surface water body is 30 mg/l. Here, it is assumed that there would be dilution with freshwater to achieve a desired BOD level of say 3 mg/l. With over 6140 Kg/h of total BOD load (refer Chapter 4) in the river in the Delhi segment, the Yamuna will require much more freshwater to achieve desired levels of BOD. It needs to be highlighted that the purpose of e-flow is not to improve the quality of river water by dilution.

2.4 Major Features of Study Reach Between Hathnikund and Okhla Barrage

Figure 2.1 shows the location of the entire Yamuna basin as a part of the Ganga basin. The study reach under investigation is the reach between Hathnikund and Okhla barrage.

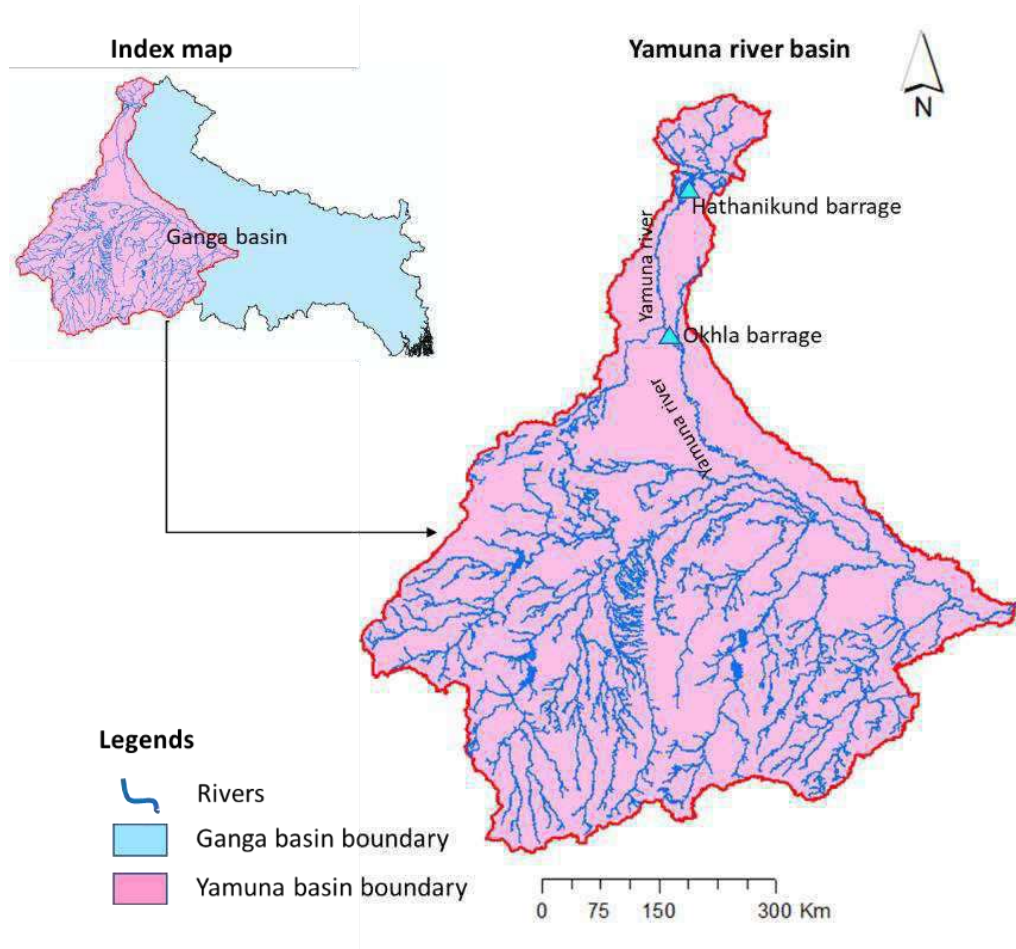


Fig. 2.1 Study area map showing the river stretch between Hathnikund and Okhla Barrage.

Figure 2.2 shows the annual rainfall in the reach under investigation. Between 1975 and 2016, the rainfall in the study reach varied greatly. In 1987, rainfall dropped to a low of 423 mm, however, the following year rainfall increased significantly to a peak of 1132 mm. During the period 1975-2016, highest rainfall of 1217 mm was recorded in the year 1978. During the decade 2007-2016, highest rainfall of 1083 mm was recorded in 2013, while lowest rainfall of 576 mm occurred in 2009. The average monthly rainfall and average monthly temperature are shown in Fig. 2.3.

Figure 2.4 shows the stream network of the Upper Yamuna basin upto Okhla barrage. It may be noted here that the basin of Sahibi river that merges with Najafgarh drain is not shown in the map (for water balance purposes, the inflow from Najafgarh drain would be utilized in the study). Figure 2.5 shows the Digital Elevation Model (DEM) of Upper Yamuna basin upto Okhla Barrage. The DEM is prepared based on SRTM 30 m data set. From the source, the Yamuna river basin covers a number of slope classes as depicted in Fig. 2.6. It is seen from Fig. 2.6 that upto Hathnikund barrage the variation in slope is changing abruptly and the shape of the basin is circular which causes quick runoff. The shape of the basin from

Hathnikund barrage to Okhla barrage is elongated and also exhibits less slope variation. Such morphology of the basin takes more time to produce runoff as compared to circular basin shape.

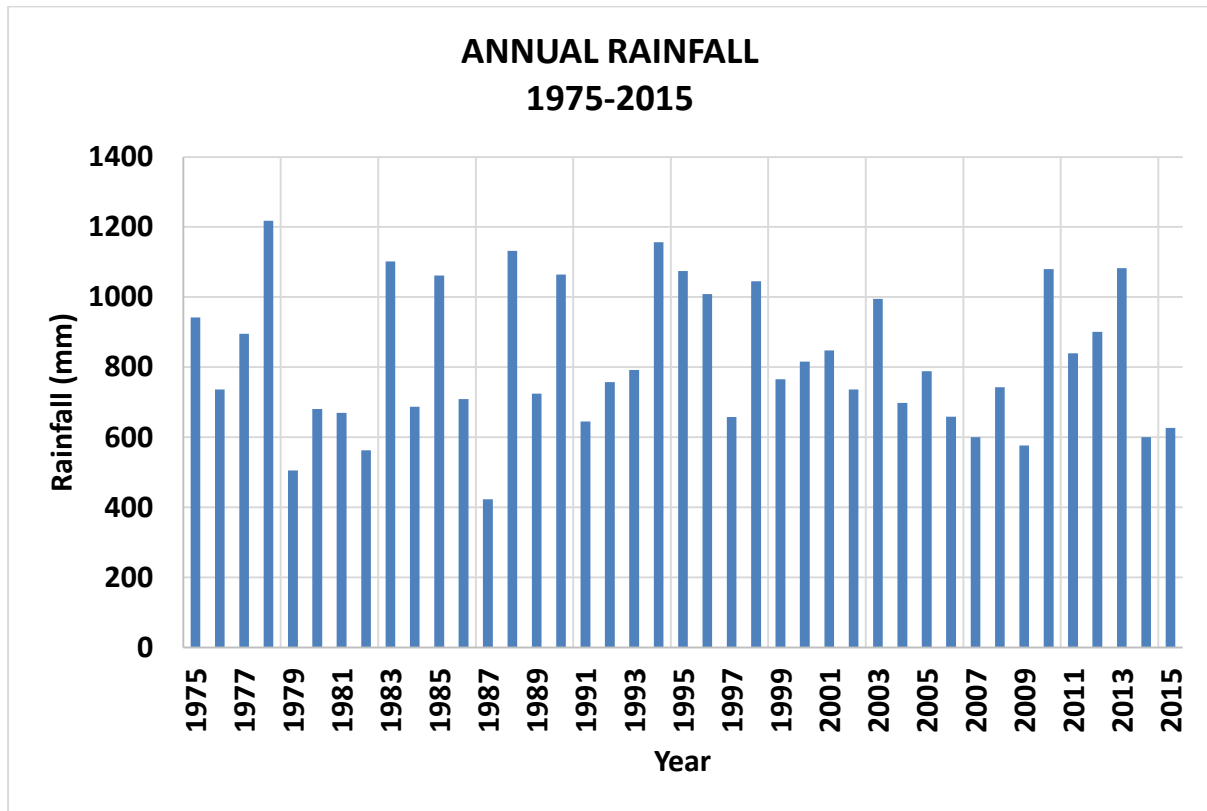


Fig. 2.2 Annual rainfall in study reach

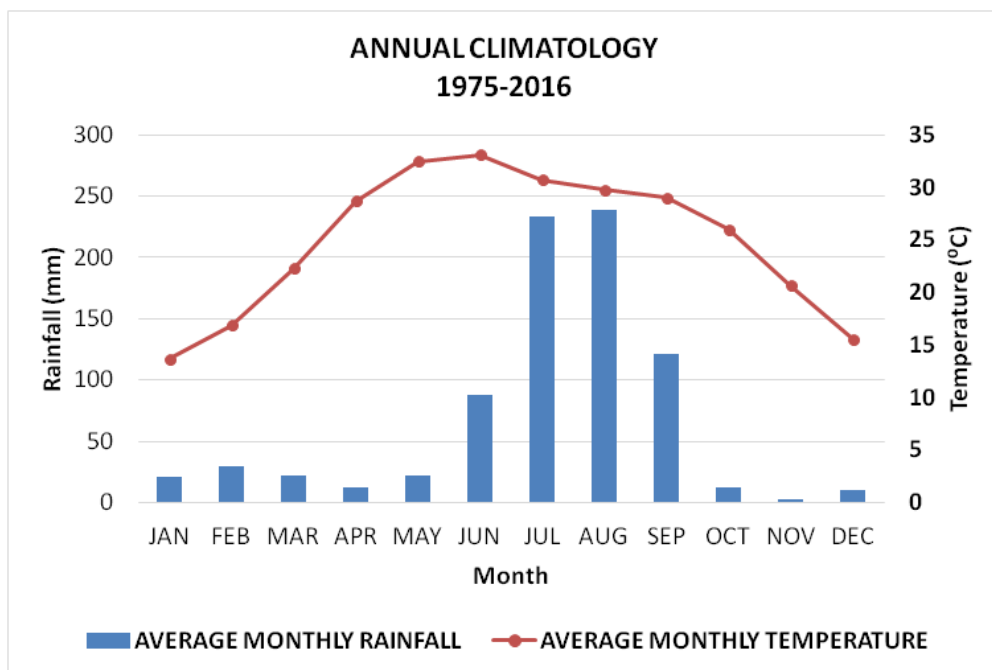


Fig. 2.3 Average monthly rainfall and average monthly temperature in study reach

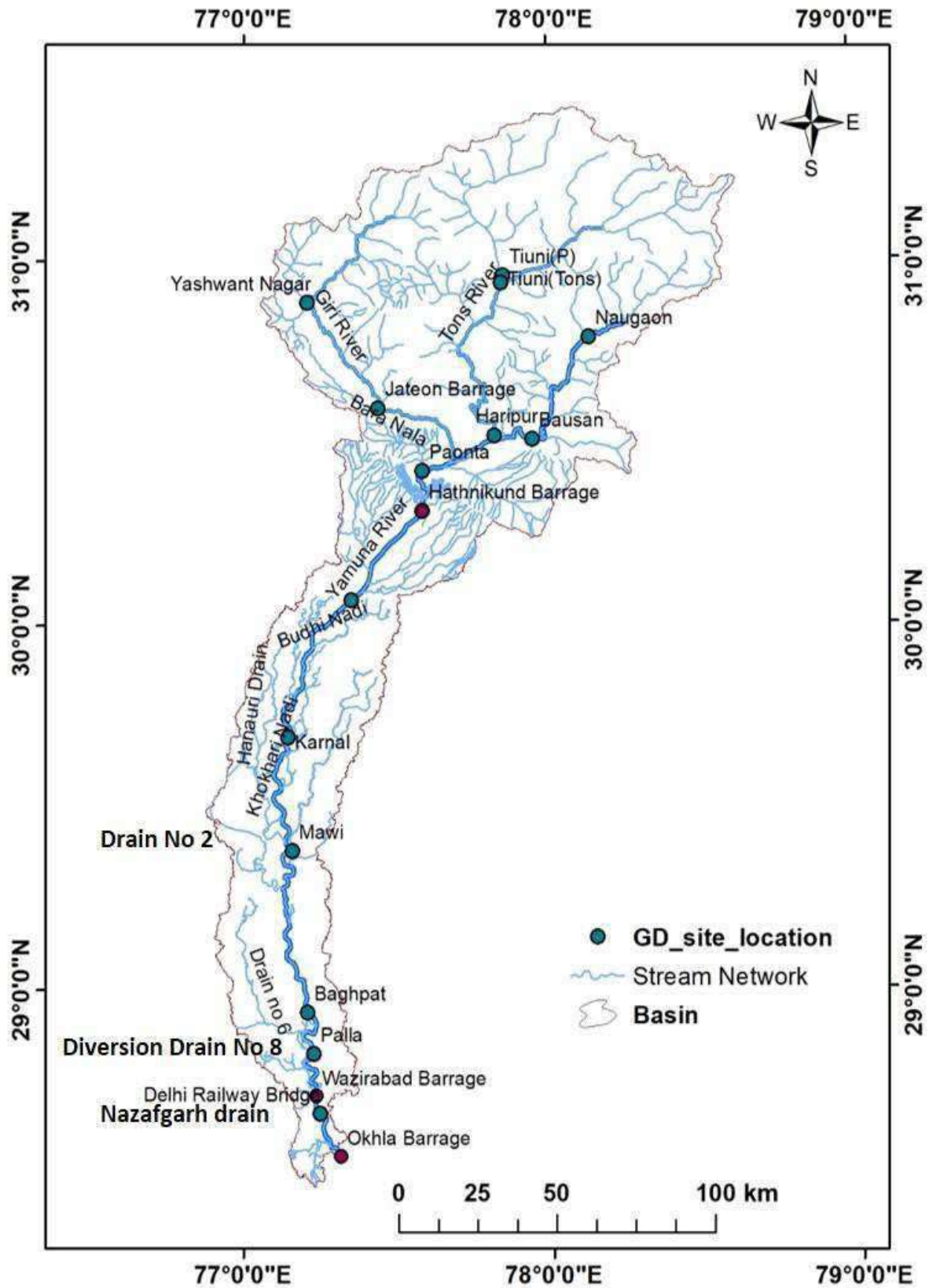


Fig. 2.4 Upper Yamuna stream network upto Okhla barrage

Hathnikund barrage was commissioned in 2002 to regulate the flow of Yamuna for irrigation in Haryana and Uttar Pradesh through two canals namely the Western Yamuna Canal and the Eastern Yamuna Canal, as well as the municipal water supply to Delhi. It replaced the Tajewala Barrage constructed in 1873 located about 3 km downstream of Hathnikund. In the Himalayan Segment of River Yamuna i.e. from Yamunotri Glacier to Hathnikund Barrage, the river water quality is good and it meets all the desired standards. To fulfill the water demand of the surrounding districts in the states of Haryana and Uttar Pradesh, little water (about 10 cumecs) of water is allowed to flow downstream of Hathnikund Barrage especially during summers and winters, on account of which the river remains dry in several stretches between Hathnikund and Delhi.

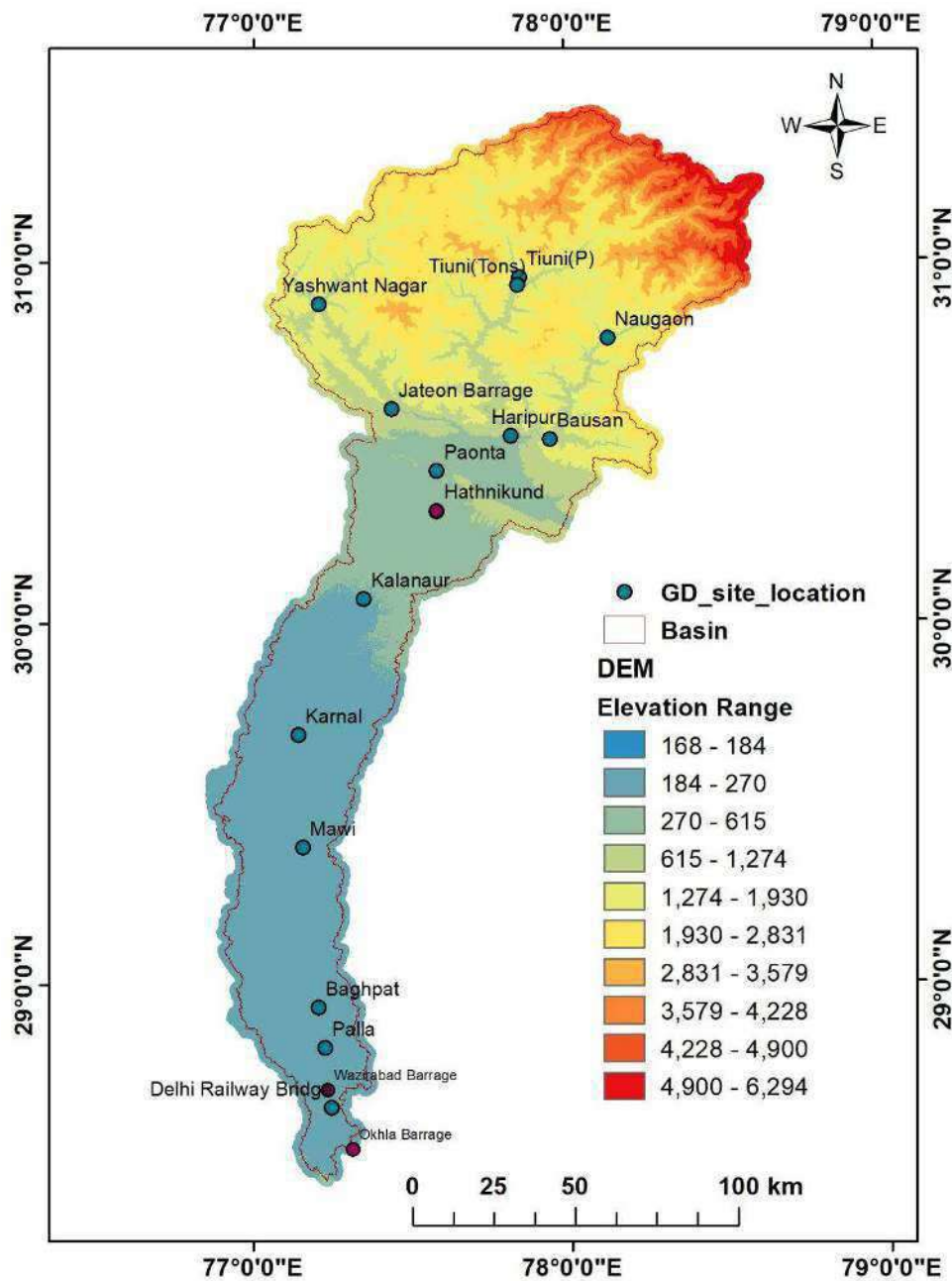


Fig. 2.5 Upper Yamuna Digital Elevation Model (DEM) upto Okhla barrage

In Delhi, the Yamuna water is again tapped by Wazirabad barrage for the domestic water supply to Delhi. Usually no water or extremely little water is allowed to flow downstream of this barrage during lean season. About 22 km downstream of Wazirabad barrage is the Okhla barrage. From this segment, Yamuna water is diverted into Agra canal for irrigation. River water is not allowed to flow downstream during summers; beyond the Okhla barrage, river water comprises the domestic and industrial wastewater generated from east Delhi, Noida and Sahibabad.

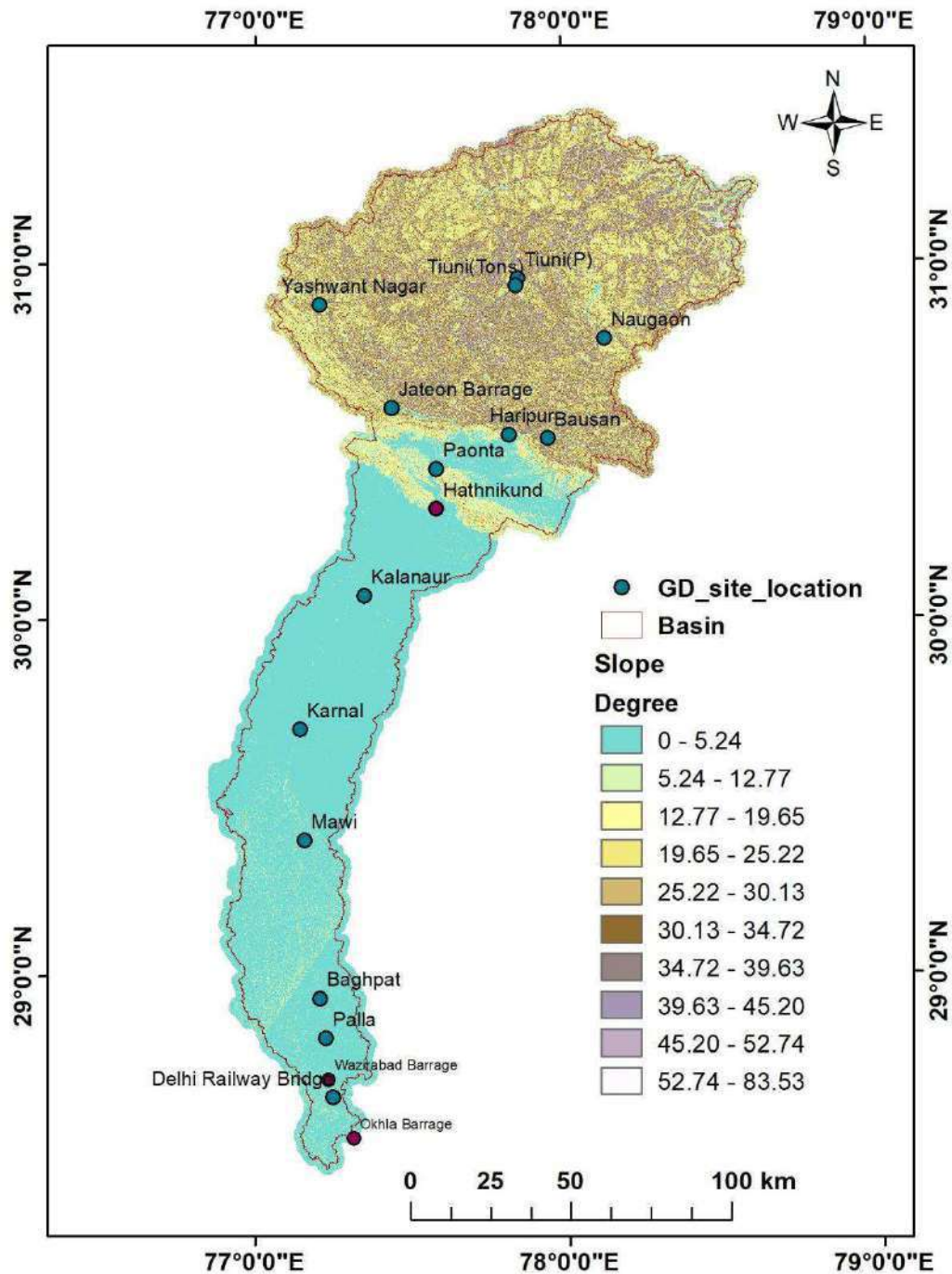


Fig. 2.6 Upper Yamuna Slope Map upto Okhla barrage

The river water is abstracted at different locations for varied uses. Substantial river water is abstracted at Hathnikund and Okhla. Figure 2.7 illustrates the points of major water abstractions and additions in Yamuna river in the study reach (CPCB, 2006). In the reach of river Yamuna between Hathnikund and Okhla barrage, discharge of river Yamuna is observed by CWC at Kalanaur, Karnal, Mawi, Baghpat, Palla and Delhi Railway Bridge G&D sites (refer Fig. 2.4). Delhi Railway Bridge is located between Wazirabad and Okhla barrage.

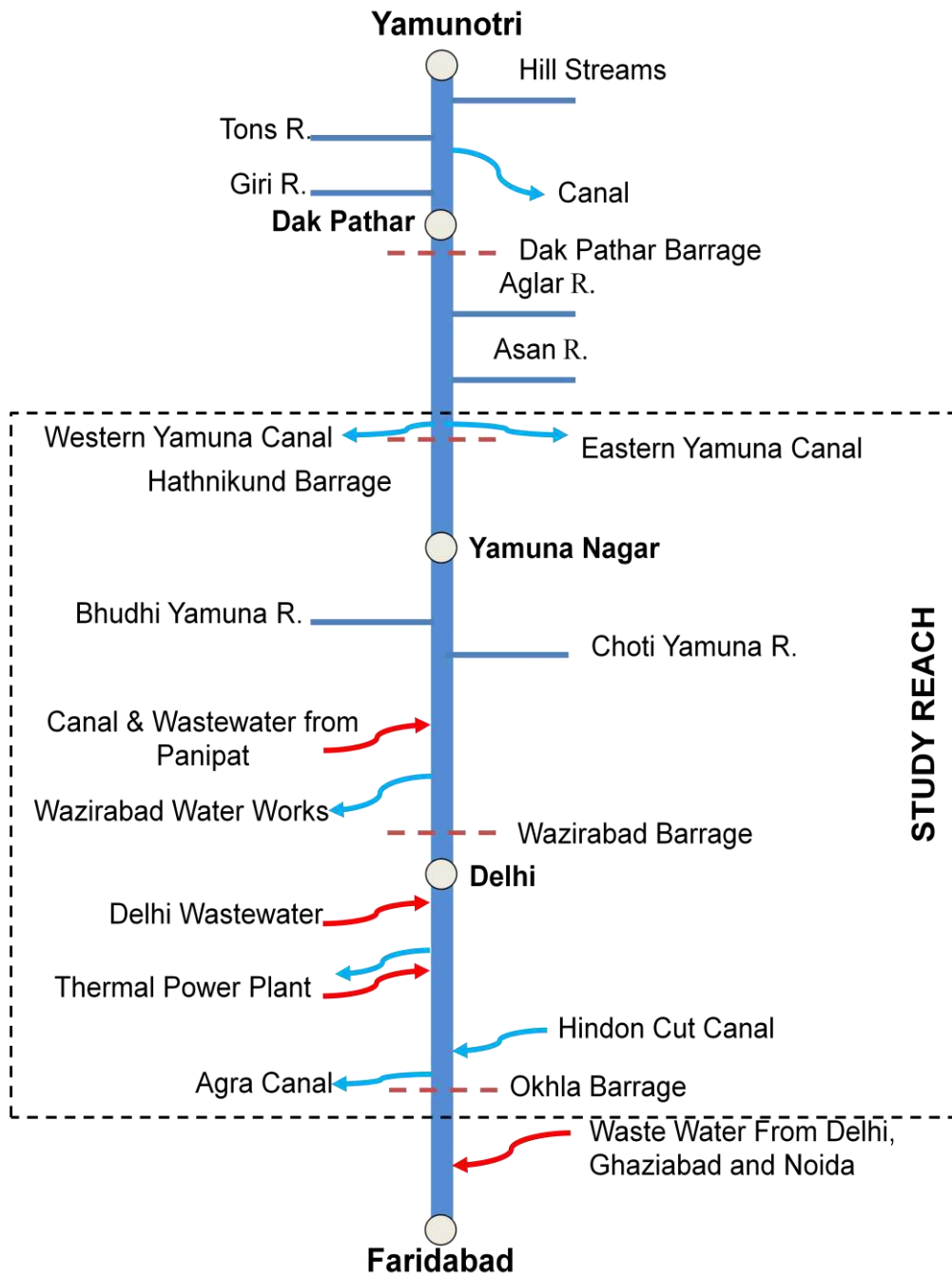


Fig. 2.7 Points of water abstraction and additions in Yamuna river (modified from CPCB, 2006).



Fig. 2.8 Nazafgarh drain joining Yamuna River near Signature Bridge, Delhi

Because of the low flows during lean season and huge quantity of waste it receives, the Yamuna river within the limits of Delhi has been given the dubious distinction of being one of the worst polluted rivers of the country by the Central Pollution Control Board (CPCB). For instance, at the location near Nazafgarh drain joining Yamuna River close to Signature Bridge in Delhi (Fig. 2.8) the DO value is not-detectable.

Chapter 3

METHODOLOGY FOR ASSESSMENT OF ENVIRONMENTAL FLOWS

3.1 General

Several methods/methodologies have been proposed in the literature for the assessment of e-flows. These methods/methodologies range from simplistic use of the hydrological record to establish minimum and flushing flows to sophisticated procedures linking changes in river discharge with hydraulic, geomorphological, ecological and socio-economic responses. Recent studies have combined a number of methods within a broader methodological framework designed to provide comprehensive recommendations on water allocations for ecosystem protection. The evolution and development of the science of e-flows and the methodology for estimation of e-flows adopted in the present study are discussed below.

3.2 Evolution of Science of E-Flows

The development of environmental flows assessment (EFA) methodologies began in USA in the late 1940s, mainly as a result of new environmental and freshwater legislation accompanying the peak of the dam-building era. Australia and South Africa are the other advanced countries that addressed the development and application of EFA methodologies (Tharme, 2003).

In several countries, the main objective of EFA has been to define a minimum acceptable flow based on predictions of instream habitat availability matched against the habitat preferences of one or a few species of fish (Jowett, 1997; Pusey, 1998). Since fish species such as trout and salmon are very sensitive to flow, it has been argued that if the flow is appropriate for these species, it will probably serve most other ecosystem needs. However, scientific literature reveals that this may not necessarily be so, and flow management is best addressed for the entire ecosystem. Recent EFA methodologies have increasingly taken a holistic approach (Brown and King, 2003; Instream Flow Council, 2002) due to existence of already over-allocated water resources projects in the absence of any e-flows regulations. EFA methodologies have been classified in several ways by different organizations as shown in Table 3.1.

Perspective and interactive approaches: Perspective EFAs recommend a single environmental flow. By using this perspective approach, however, insufficient information is supplied on the implications of not providing the recommended flow. Interactive EFAs focus on establishing the relationship between river flow and one or more attributes of the river system. This relationship may then be used to describe environmental/ecosystem implications (and resulting social/economic implication) of various flow scenarios. Interactive methodologies thus facilitate the exploration of trade-offs of several water allocation options.

Bottom-up and top-down approaches: The basis of most EFA methodologies is a bottom-up approach, which is the systematic construction of a modified flow regime from scratch on a month-by month (or more frequent) and element-by-element basis, where each element represents a well-defined feature of the flow regime intended to achieve specific objectives. In contrast, top-down approaches define the environmental flows requirement in terms of accepted departures from the natural (or other reference) flow regime. Thus, top-down approaches are less susceptible to omission of critical flow features than bottom-up approaches.

Methods and methodologies: Tharme (2003) distinguished the two levels of EFA as “methods” (procedures or techniques used to measure, describe or predict changes in important physical, chemical or biological variables of the stream environment) and “methodologies” (collection of several instream flow methods which are arranged into an organized iterative process which can be implemented to produce results). The critical review, development and evaluation of these assessment methodologies have been dealt in detail by several researchers (Tharme, 1996; Jowett, 1997; Dunbar et al., 1998; Tharme, 2003; Acreman and Dunbar, 2004; Jha et al., 2008, Arthington, 2012, Hatfield et al. 2013, Linnansaari et al., 2013).

Table 3.1 Overview of EFA methodologies

Organization	Category	Sub-category	Example
IUCN (Dyson et al. 2003)	Methods	Look-up Tables	Hydrological (e.g. Q95 index); Ecological (e.g. Tennant Method)
		Desktop Analysis	Hydrological (e.g. Richter Method); Hydraulic (e.g. Wetted Perimeter Method); Ecological
		Functional Analysis	Building Block Methodology (BBM); Expert Panel Assessment Method (EPAM); Benchmarking Methodology
		Habitat Modelling	Physical Habitat Simulation Modelling (PHABSIM)
	Approaches		Expert Team Approach; Stakeholder Approach (expert and non-expert)
	Frameworks		Instream Flow Incremental Methodology (IFIM); Downstream Response to Imposed Flow Transformation (DRIFT); Ecological Limits of Hydrological Alteration (ELOHA)
World Bank (Brown and King, 2003)	Perspective Approaches	Hydrological Index Methods	Tennant Method, Desktop method

		Hydraulic Rating Methods	Wetted Perimeter Method
		Expert Panels	Expert Panel Assessment Method (EPAM); Scientific Panel Assessment Method (SPAM)
		Holistic Approaches	Building Block Methodology (BBM)
	Interactive Approaches		Instream Flow Incremental Methodology (IFIM); Downstream Response to Imposed Flow Transformation (DRIFT); Ecological Limits of Hydrological Alteration (ELOHA)
IWMI (Tharme, 2003)	Hydrological Index Methods		Tennant Method, Desktop methods
	Hydraulic rating Method		Wetted Perimeter Method
	Habitat Simulation Methodologies		PHABSIM, MesoHabsim, Instream Flow Incremental Methodology (IFIM), System for Environmental Flow Assessment (SEFA)
	Holistic Methodologies		Holistic Approach; Instream Flow Incremental Methodology (IFIM); Downstream Response to Imposed Flow Transformation (DRIFT); Building Block Methodology (BBM); Expert Panel Assessment Method (EPAM); Scientific Panel Assessment Method (SPAM); Habitat Analysis Method; Ecological Limits of Hydrological Alteration (ELOHA)

3.3 Hydrological Methods

These are the simplest and most widespread EFA methods, also referred to as desk-top or look-up table methods. These methods rely primarily on historical flow records. Environmental flow is usually given as a percentage of average annual flow or as a percentile from the flow duration curve, on a seasonal or monthly basis.

Commonly, the Environmental Flow is represented as a proportion of flow (often termed the 'minimum flow', e.g. Q95 – the flow equalled or exceeded 95 percent of the time) intended to maintain river health. Most methods simply define the minimum flow requirement; however, in recognition of the 'Natural Flow Paradigm' more sophisticated methods have been developed that take several (up to 32) flow characteristics into account (such as low flow durations, rate of flood rise/fall etc).

Hydrological Index Methods provide a relatively rapid, non-resource intensive, but low resolution estimate of environmental flows. Therefore, the methods are most appropriate at the planning level of water resources development, or in low controversy situations where they may be used as preliminary estimates.

3.4 Hydraulic Rating Methods

As difficulties exist in relating changes in the flow regime directly to the response of species and communities; hence, approaches have been developed that use habitat for target species as an intermediate step. Within the total environmental niche required by an individual animal or plant living in a river, it is the physical aspects that are affected by changes in the flow regime.

The most obvious physical dimension that can be changed by altered flow regimes is the depth/wetted perimeter area of submerged river bed of the channel. Hydraulic rating methods provide simple indices of available habitat (e.g. depth/wetted perimeter) in a river at a given discharge. Graphs of discharge and wetted perimeter provide a basic tool for environmental flow evaluation. As a rule of thumb, shallow, wide rivers tend to show more sensitivity of their wetted perimeter to changes in flow than do narrow, deep rivers.

Gippel and Stewardson (1998) have highlighted the problems of trying to identify thresholds (critical discharges below which wetted perimeter declines rapidly) that can be used to define environmental flows.

Hydraulic rating methods are based on historical flow records (stage-discharge rating curve) and cross-section data. They model hydraulics as function of flow and assume links between hydraulics (wetted perimeter, depth, velocity) and habitat availability of target biota. In other words, they use hydraulics as a surrogate for the biota. Environmental flow is given either as a discharge that represents optimal minimum flow, below which habitat is rapidly lost, or as the flow producing a fixed percentage reduction in habitat availability. In recent years, hydraulic rating methods have been superseded by Habitat Simulation Methodologies or absorbed within Holistic Methodologies.

3.5 Habitat Simulation Methodologies

Habitat simulation methodologies are widely used and based on hydrological, hydraulic and biological response data. They model links between discharge, available habitat conditions (including hydraulics) and their suitability to target biota. Environmental flow is predicted from habitat-discharge curves or habitat time and exceedence series.

PHABSIM (Physical HABitat SIMulation model) (Bovee, 1986) is the most commonly applied habitat simulation methodology. Habitat simulation methodologies also make use of hydraulic habitat-discharge relationships, but provide more detailed, modelled analyses of both the quantity and suitability of the physical river habitat for the target biota. Thus, environmental flow recommendations are based on the integration of hydrological, hydraulic and biological response data. Flow-related changes in physical microhabitat are modelled in various hydraulic programs, typically using data on depth, velocity, substratum composition and cover; and more recently, complex hydraulic indices (e.g. benthic shear stress), collected at multiple cross-sections within each representative river reach. Simulated information on available habitat is linked with seasonal information on the range of habitat conditions used by target fish or invertebrate species, commonly using habitat suitability index curves (Groshens and Orth, 1994). The resultant outputs, in the form of

habitat-discharge curves for specific biota, or extended as habitat time and exceedence series, are used to derive optimum environmental flows. The habitat simulation-modelling package PHABSIM (Bovee, 1982; Bovee et al., 1998; Milhous *et al.* 1989; Stalnaker *et al.* 1994), housed within the Instream Flow Incremental Methodology (IFIM), is the pre-eminent modeling platform of this type. The relative strengths and limitations of such methodologies are described in King and Tharme (1994); Tharme (1996); Arthington and Zalucki (1998); Pusey (1998) and they are compared with other types of approaches in Tharme (2003).

As PHABSIM method is primarily meant for microhabitats, a number of efforts were made thereafter to develop methods for mesohabitats and macrohabitats. Parasiewicz (2001, 2007, 2008) came out with a mesohabitat scale (i.e. Channel units, like run, riffle, pool etc.) MesoHABSIM model. This model combined the system-scale assessment of ecological integrity with physical habitat distribution to simulate habitat changes at catchment scale. The same types of meso-scale models were later developed by Harby et al. (2007), Halleraker et al. (2007) and Paul and Locke (2009). Some other models in this category are River Hydraulic and HABitat Simulation Model (RHYHABSIM) developed by Jowett (1989) and Riverine HABitat SIMulation (RHABSIM) model (an extensive version of PHABSIM) by the U.S. Fish and Wildlife Service in association with Payne (1994). Recently, the developers of most of these models have together come up with the new model, System for Environmental Flow Analysis (SEFA).

3.6 Holistic Methodologies

Holistic Methodologies are actually frameworks that incorporate hydrological, hydraulic and habitat simulation models. They are the only EFA methodologies that explicitly adopt a holistic, ecosystem based approach to environmental flow determination. A wide range of holistic methodologies has been developed and applied, in Australia, South Africa and United Kingdom. Ecosystem components that are commonly considered in holistic assessments include geomorphology, hydraulic habitat, water quality, riparian and aquatic vegetation, macroinvertebrates, fish and other vertebrates with some dependency upon the river/riparian ecosystem (i.e. amphibians, reptiles, birds, mammals). Each of these components can be evaluated using a range of field and desktop techniques (Tharme, 1996; Arthington and Zalucki, 1998; Tharme, 2003) and their flow requirements are then incorporated into EFA recommendations, using various systematic approaches.

3.7 Proposed Methodology for E-Flows Assessment

A detailed literature review has revealed that the most sophisticated methodologies for e-flow assessment are the holistic methodologies which use all the elements of water availability and demand i.e. hydrology, hydraulics, ecology, socio-economics etc. Jain and Kumar (2014) have provided an account of various e-flow assessments carried out in Indian rivers.

Recently, the Hon'ble NGT formed a committee for assessment of environmental flows for Ganga river from Haridwar to Unnao and the committee recommended e-flows on

the basis of hydraulic habitat requirement of indicator species using the HEC-RAS model (MOWR, 2018).

For the assessment of e-flows for Yamuna river from Hathnikund Barrage to Okhla barrage, the proposed methodology is formulated based on the following factors: data availability, time assigned for the study, and the previous such e-flow assessment for the Ganga basin (refer Fig. 3.1).

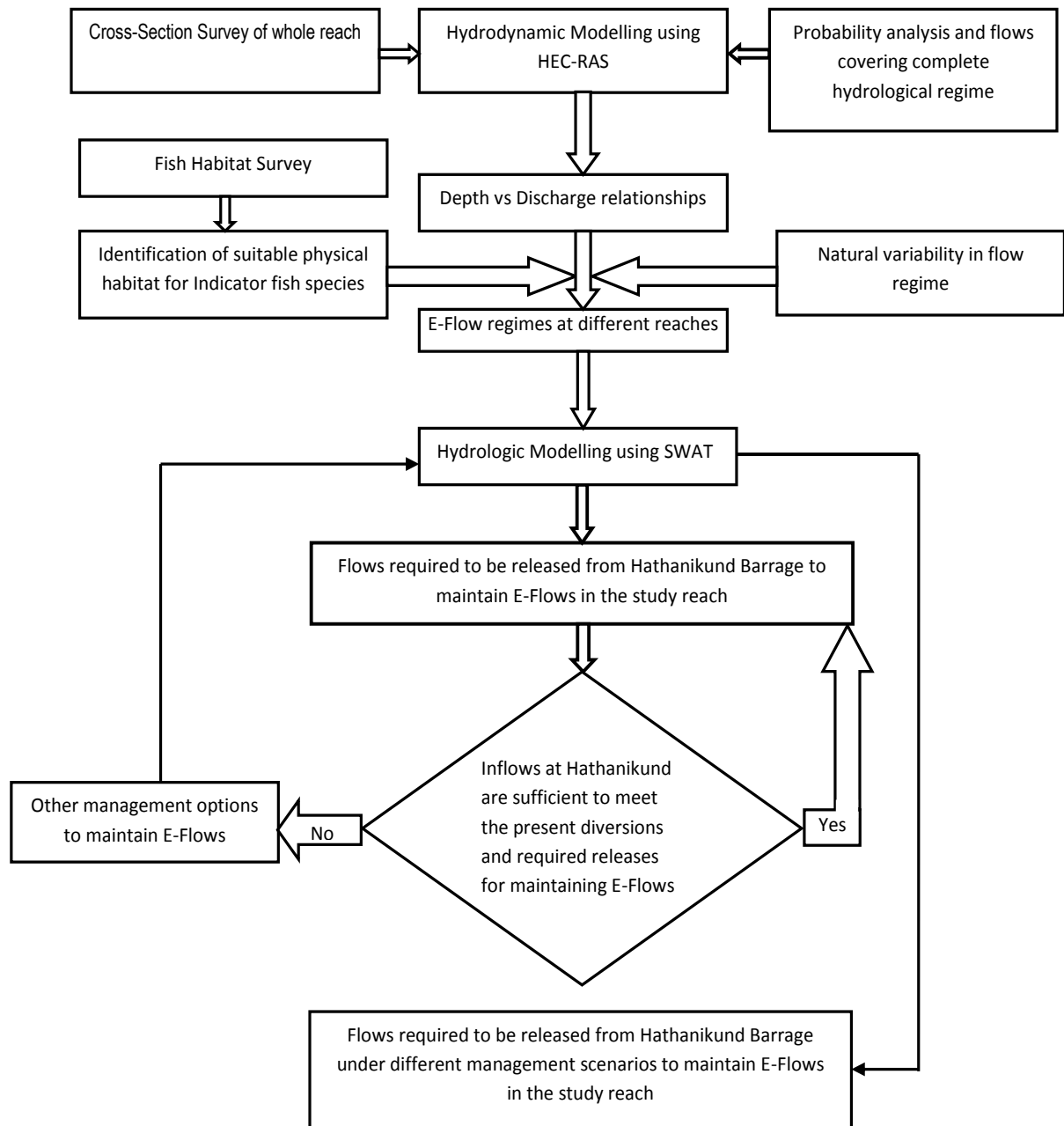


Fig. 3.1 Flowchart depicting the proposed methodology for e-flow assessment

In this proposed methodology, the physical habitat requirement of the indicator fish species will be converted into flow values using hydrodynamic modeling through HEC-RAS model as depicted in Fig. 3.2. Further, these flow values will be converted into flow regimes using the natural variability in river flow.

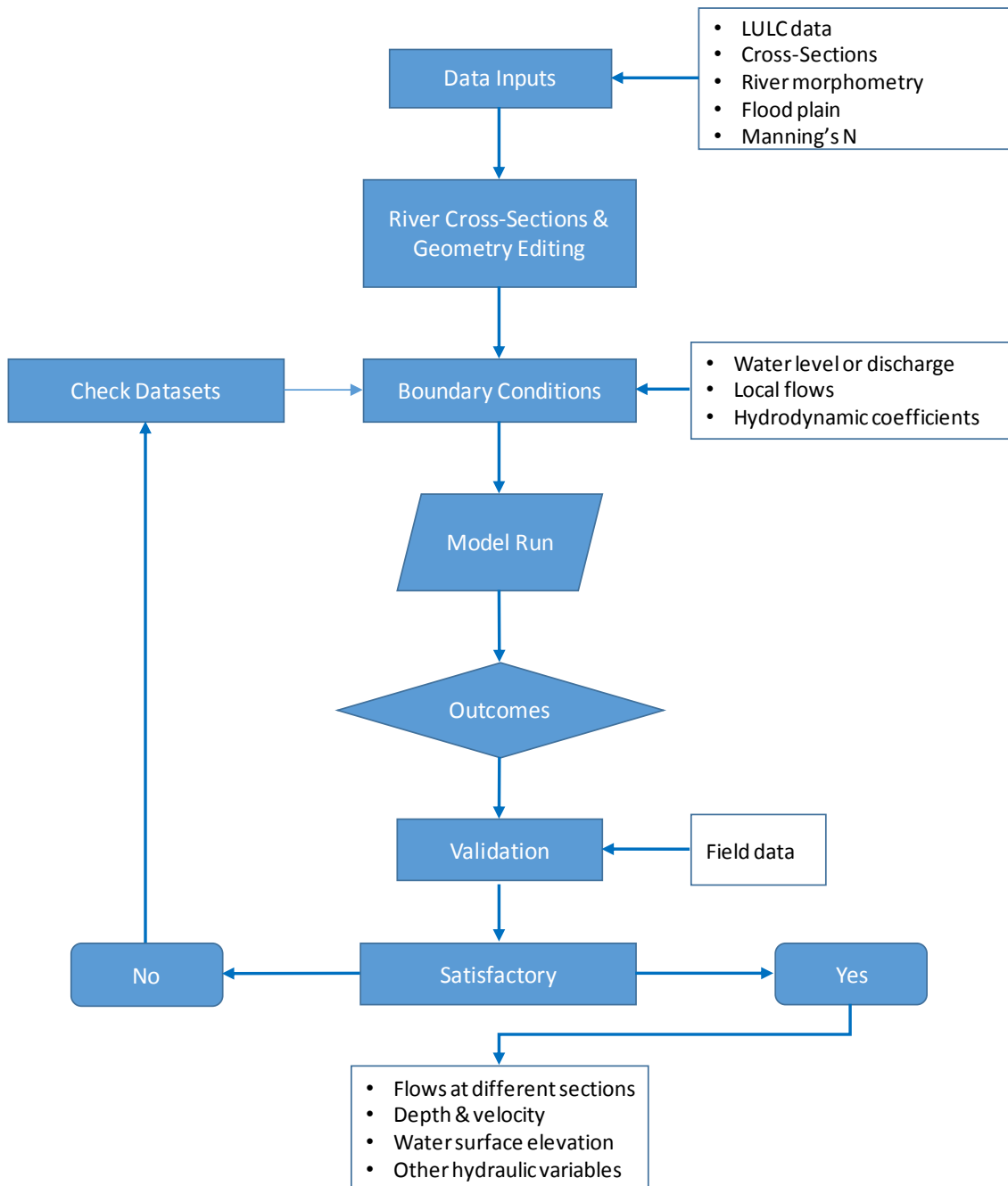


Fig. 3.2 Hydrodynamic Modeling using HEC-RAS 1D

To simulate the flow regime prior to and after the commencement of Hathnikund barrage, hydrological modeling using SWAT model has been proposed as shown in Fig. 3.3. The hydrological simulations will not only help to establish the virgin flow regime but also facilitate conversion of the flow values required to be maintained at various

locations downstream of Hathnikund barrage to the flows required to be released from Hathnikund barrage. Moreover, the model simulations will also help in assessing the efficacy of the management options for maintaining the necessary flows.

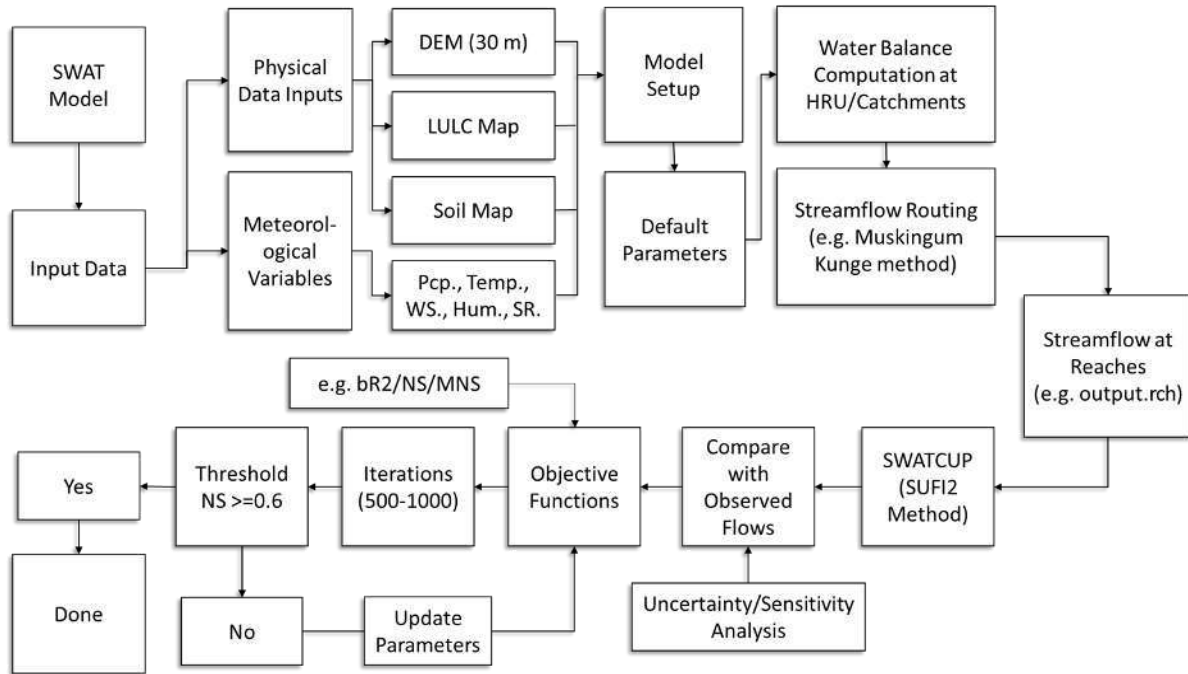


Fig. 3.3 Hydrologic Modeling using SWAT

To achieve the objectives, the whole methodology is segregated into three phases based on the availability of data/information as follows:

PHASE I (2 months)

- **Data collection and processing**
- **Hydrodynamic modeling using available coarse resolution dataset**
 - Setup HEC-RAS 1D hydraulic model with SRTM DEM (30 m) and default parameters.
 - Generation of discharge, water velocity and flood depth along the Yamuna river stretch from Hathnikund to Okhla barrage.

PHASE II (6 months)

- **Field surveys**
 - Generation of high resolution river cross-sections through field survey
 - Field survey for habitat requirement of indicator fish species
 - Collection of water quality samples to ensure the status of water quality of River Yamuna in present scenario. Parameters will be utilized in hydrological and hydrodynamic models for the assessment of the minimum requirement of environmental flows.

- **Hydrological and Hydrodynamic modeling**
 - Water balance analysis using SWAT (Soil and Water Assessment Tool) to generate local flows and outflows utilizing available dataset (e.g. SRTM 30 m DEM, LULC and SOIL map)
 - Generation of stage discharge relationships using HEC-RAS

PHASE III (4 months)

- **Integrated framework for Environmental Flows Assessment**
 - Development of SWAT model to simulate the flows both for present and virgin (before commissioning of Hathnikund/Tajewala barrage) flow conditions using DEM, LULC and soil data.
 - Generation of discharge, river depth, top width, velocity, flood area and water level along Yamuna river stretch from Hathnikund to Okhla barrage utilizing high resolution datasets
 - Determine the minimum required environmental flows for sustaining aquatic life, based on the results of hydrologic and hydrodynamic modelling and the secondary data on the habitat requirement of aquatic species
 - Estimation of releases from Hathnikund barrage to maintain the minimum required environmental flows at downstream reaches.
- **Qualitative Assessment of Yamuna river**
 - Pollutant load estimation at various locations in the concerned river reach using the primary and secondary water quality data of drains and canals joining Yamuna in the concerned river reach.
- **Management Options for Maintaining Recommended E-Flows**
 - Possibility of considering various future scenarios in terms of increasing irrigation efficiency, treatment of effluent coming through various drains meeting river Yamuna, creating storage in the upstream reaches etc. as management options for maintaining the recommended e-flows.

To achieve the study objectives, necessary data were collected from various agencies and processed. Details of the database generated are provided in Chapter 4.

Chapter 4

DATABASE FOR THE STUDY REACH AND DATA PROCESSING

4.1 Data Used in the Study

The key data requirements for environmental flow study are river flows, river geometry and habitat parameters. The present study deals with the assessment of environmental flows by using hydrodynamic and hydrological modelling approach, therefore, variety of datasets are required as input to the models as well as to validate the model outputs. The river inflow and outflow at different locations of the river at daily time interval, river cross sections, meteorological data like observed rainfall and temperature at daily time interval, recent land use land cover maps, soil maps with detailed information of soil parameters are utilized in the study. The analysis of variation in groundwater levels in the study reach between the years 1975 and 2018 have also been attempted. In addition, field surveys have been carried out for the following:

- (i) ascertain the indicator fish species and their habitat requirement, and
- (ii) river cross-section surveys at close spaced intervals

Table 4.1 lists the data collected from various agencies to achieve the study objectives.

Table 4.1 Data collected from various agencies for the study

SN	Data collected	Agency	Data Length	Remark
1	Daily gauge and discharge data at CWC gauging sites in study reach	YBO, CWC, New Delhi; UP Irrigation Dept. (Okhla)	1976-2018	Data breaks during 1991-1995
2	Daily Inflow, outflow, diversions at Hathnikund barrage	UP Irrigation Dept., Saharanpur	1976-2000	-
3	Releases from Wazirabad and Okhla barrage	UP Irrigation Dept. (Okhla); Delhi Jal Board	1995-2018	-
4	Daily discharge data of drains joining Yamuna from Haryana	Water Data Collection Division, Karnal, Haryana	1995 - 2018	Diversion drain No. 8 monthly data
5	Flow from Hindon Cut Canal	UP Irrigation Dept. (Okhla)	2005-2018	-
6	Groundwater level data in riparian states/ Delhi	CGWB, New Delhi	1971-2019	Pre-Post monsoon
7	River water quality data at G&D sites and Delhi segment	YBO, CWC, New Delhi	1995-2018	Monthly
8	River water quality & water quality of drains in Delhi Segment	CPCB, New Delhi	2014-2016	-

9	Flow drains joining Yamuna from Haryana	SPCB Haryana; Irrigation & Water Resources Dept. Haryana	1995-2018	Drain 2 daily data (1995-2018) Drain 8 Monthly data (2010-2018)
10	Groundwater level data and EC/TDS data for WYC	Irrigation & Water Resources Dept. Haryana	June 2019	Block wise
11	Cropping pattern, Land classification, Crop and Irrigation data	Irrigation & Water Resources Dept. Haryana	2015-2019	Block wise
12	Fish habitat suitability data through field visits to River Yamuna	NIH Roorkee and WII Deharadun	October 2019 & Feb 2020	-
13	River cross-section survey data at gauging sites at 10 km interval	YBO, CWC, New Delhi	2017	-
14	River cross-section survey undertaken by NIH at 306 locations	Geoscience Consultancy Services, Roorkee	-	309 locations

4.2 Analysis of Flow Data

4.2.1 Analysis of inflow and releases at Hathnikund barrage

Hathnikund barrage regulates the flow of Yamuna for irrigation in Haryana and Uttar Pradesh through the Western Yamuna Canal and the Eastern Yamuna Canal, as well as the municipal water supply to Delhi. A plot of eighteen years (2001-2018) average monthly inflows and releases from Hathnikund is shown in Fig. 4.1, while Fig. 4.2 shows the plot of average monthly inflows and releases from Hathnikund over the years 2001-2018.

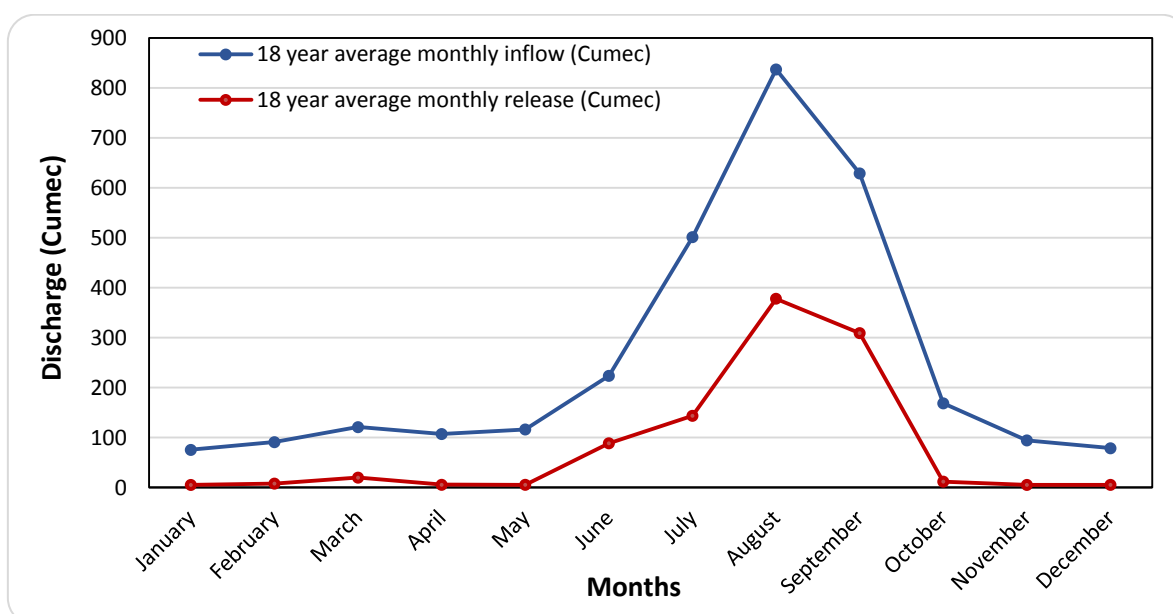


Fig. 4.1 Plot of eighteen years (2001-2018) average monthly inflows and releases from Hathnikund.

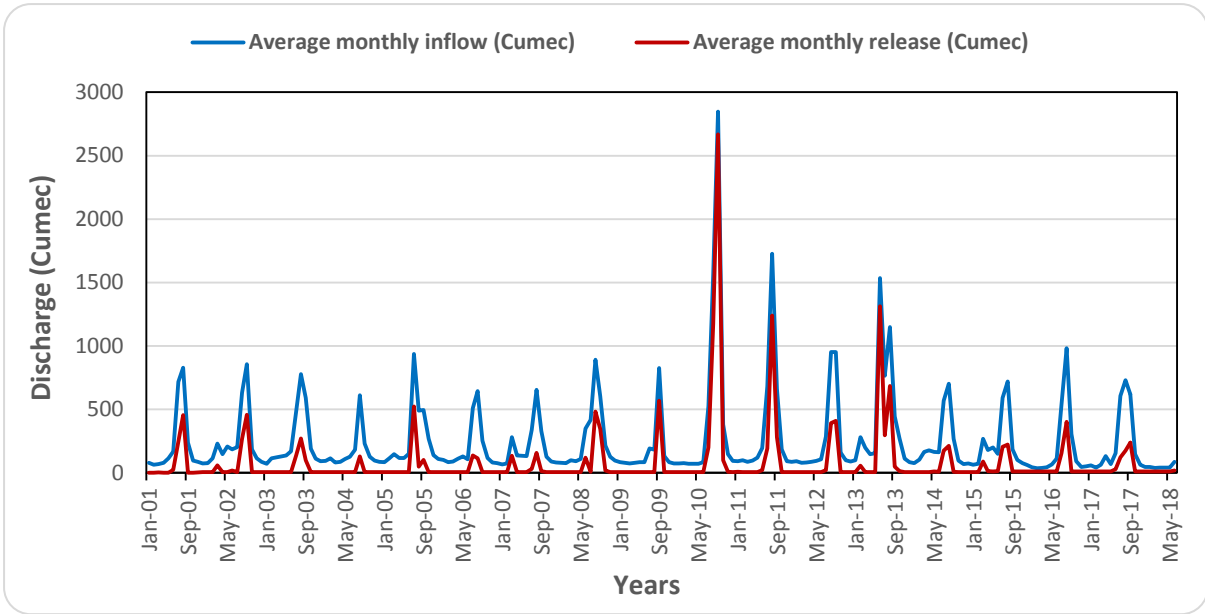


Fig. 4.2 Plot of average monthly inflows and releases from Hathnikund for the years 2001-2018.

4.2.2 Analysis of Monthly Releases from Hathnikund Barrage and Flows at Kalanaur, Karnal, Mawi, Baghpat, and Delhi Railway Bridge

Figure 4.3a illustrates the discharge observed at Kalanaur and downstream GD site Karnal for the years 1976-81. Figure 4.3b shows the discharge observed at Karnal and downstream GD site Mawi, Fig. 4.3c shows the discharge observed at Mawi and downstream GD site Baghpat, while Fig. 4.3d shows the discharge observed at Baghpat and downstream GD site Delhi Railway Bridge (DRB) for the years 1976-81.

Similarly, Fig. 4.4a illustrates the discharge observed at Kalanaur and downstream GD site Karnal for the years 2013-18. Fig. 4.4b shows the discharge observed at Karnal and downstream GD site Mawi, Fig. 4.4c shows the discharge observed at Mawi and downstream GD site Baghpat, while Fig. 4.4d shows the discharge observed at Baghpat and downstream GD site DRB for the years 2013-18.

In general, for most segments in the study reach during both time periods, the discharge observed at downstream site is more than the discharge at upstream site barring a few months, which reveals that certain amount of flow is getting added into the river from intermediate catchment, from drains, and irrigation return flow etc. However, for the Baghpat-DRB segment, the site at DRB is located downstream of Wazirabad barrage and the flow at this gauging site is largely influenced by the controlled releases from Wazirabad barrage and water contributed by various drains joining Yamuna between the barrage and DRB. The effect is largely visible for the period 2013-18.

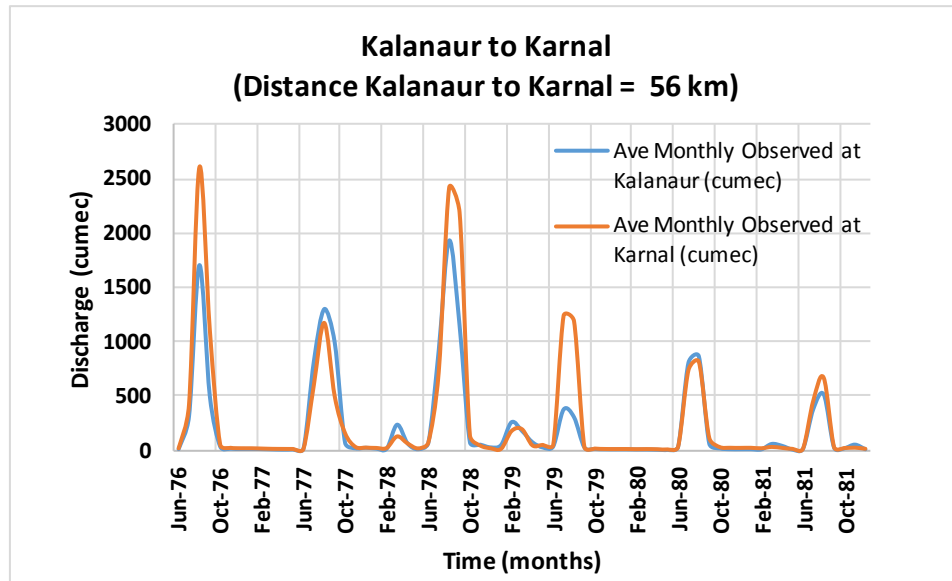


Fig. 4.3a Flow observed at Kalanaur and Karnal (1976-81)

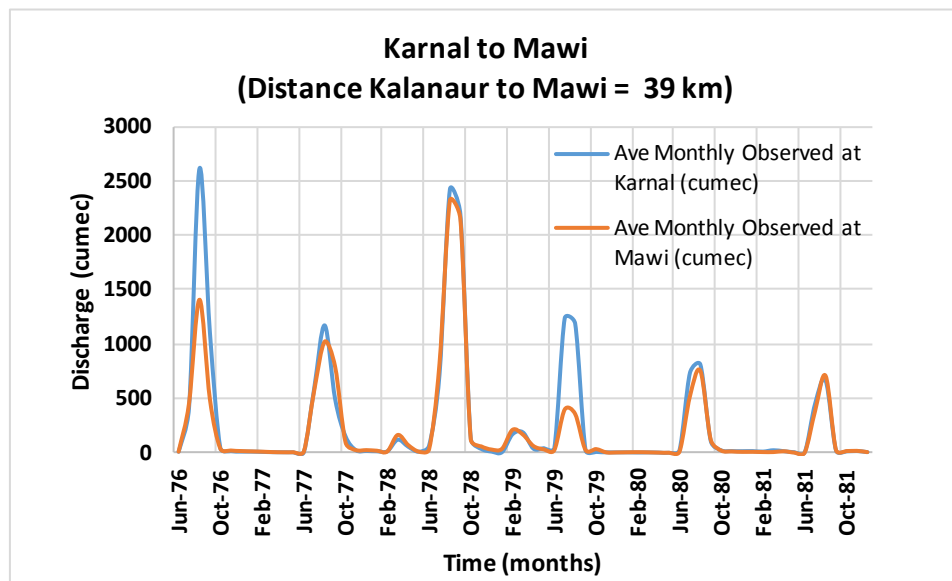


Fig. 4.3b Flow observed at Karnal and Mawi (1976-81)

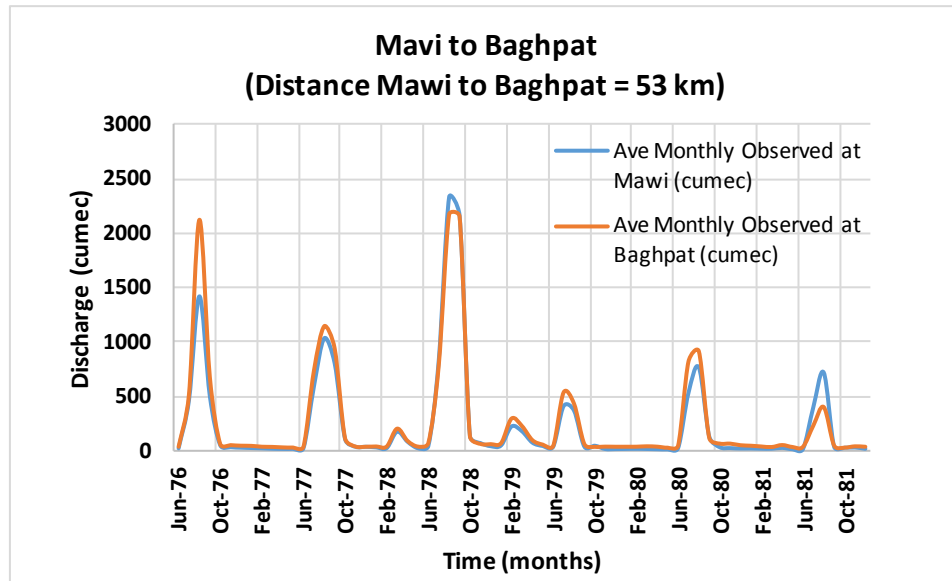


Fig. 4.3c Flow observed at Mawi and Baghpat (1976-81)

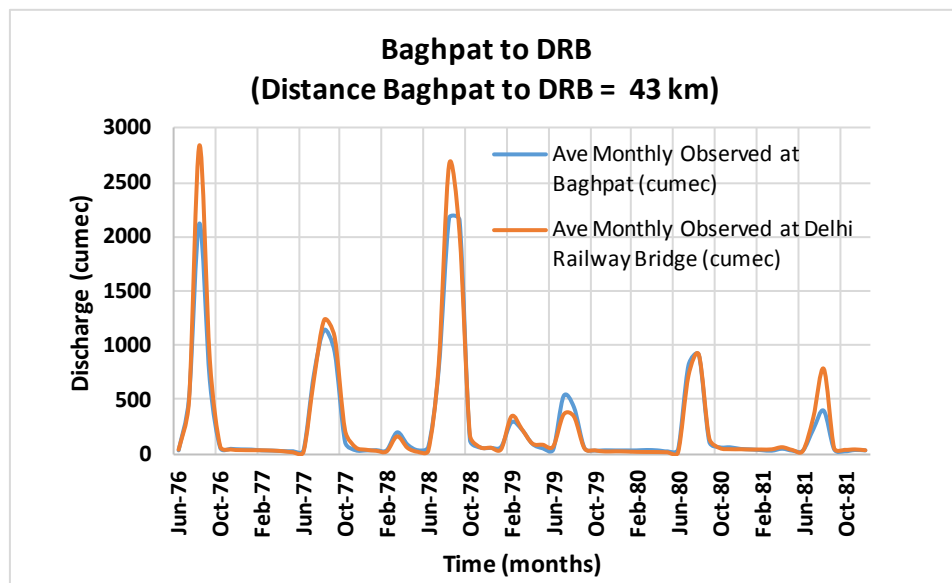


Fig. 4.3d Flow observed at Baghpat and Delhi Railway Bridge (1976-81)

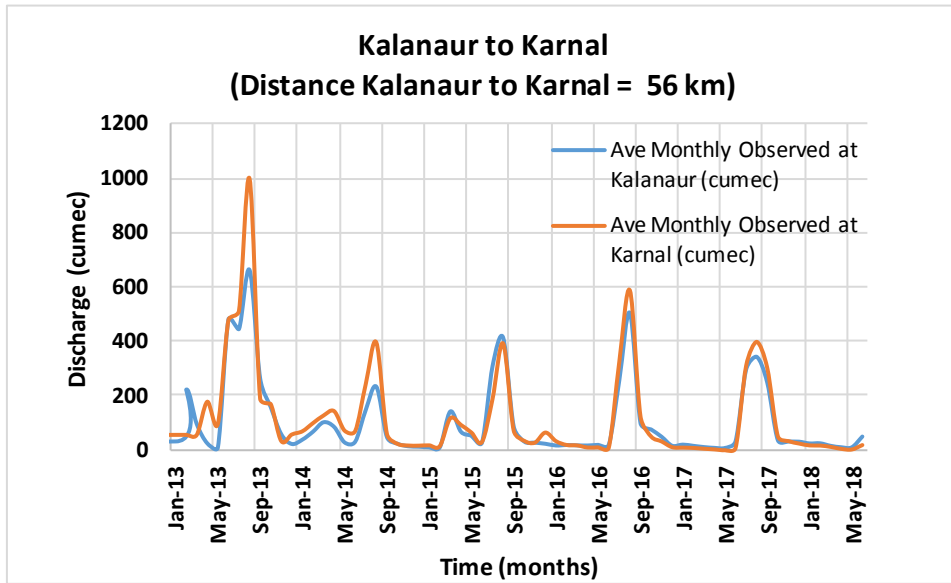


Fig. 4.4a Flow observed at Kalanaur and Karnal (2013-18)

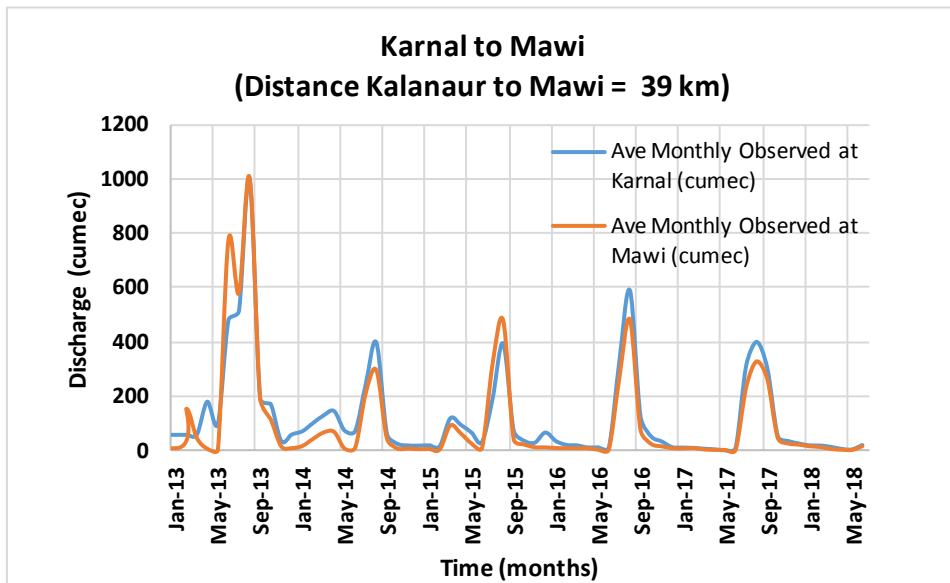


Fig. 4.4b Flow observed at Karnal and Mawi (2013-18)

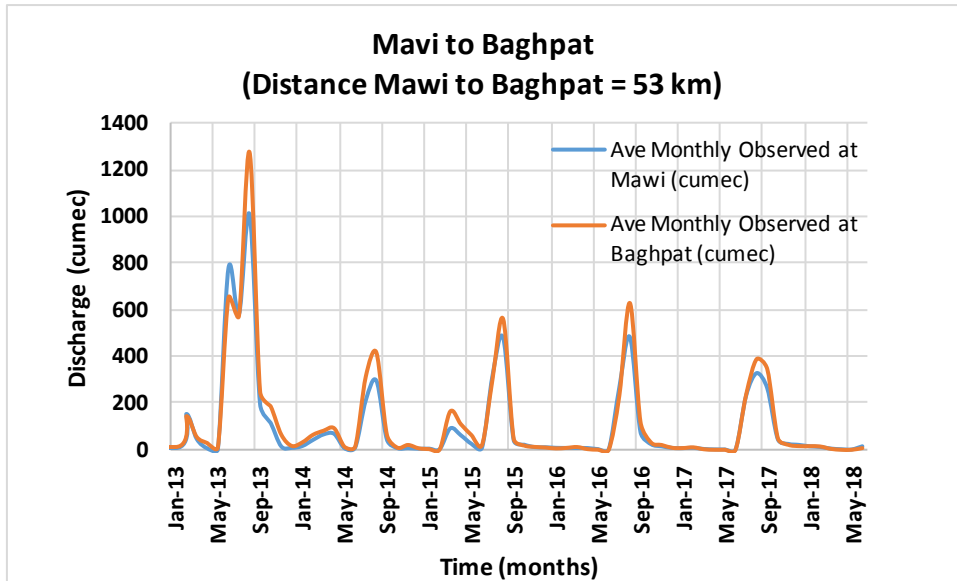


Fig. 4.4c Flow observed at Mawi and Baghpat (2013-18)

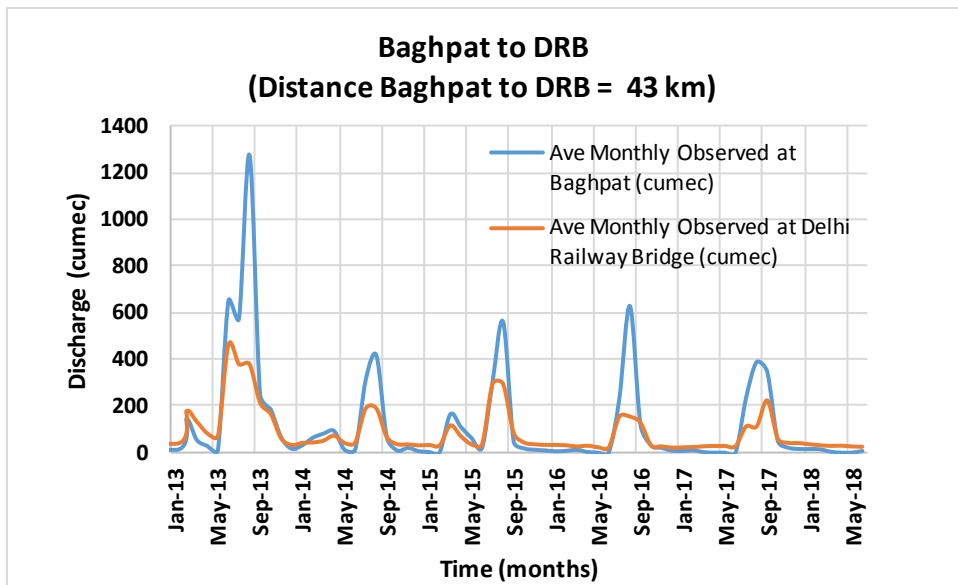


Fig. 4.4d Flow observed at Baghpat and Delhi Railway Bridge (2013-18)

4.3 Groundwater Depletion

In view of large withdrawals of groundwater in the riparian states of Haryana and Uttar Pradesh, groundwater levels have receded all along the river stretch from downstream of Kalanaur to Baghpat, which in turn has affected the baseflow contribution to the flows in Yamuna in this stretch during the non-monsoon period. The advent of diesel pumps and pumps run by electricity spurred the drilling of a large number of tube wells over the period of last three decades. To assess the deepening groundwater levels, since the period when groundwater overexploitation was not common, the depth to groundwater levels (DTWL) for pre-monsoon and post-monsoon are plotted for the years 1975 and 2018 in Figs. 4.5(a)-

(d) for the locations available from CGWB. The plots clearly exhibit large depletion in groundwater levels over the period of four decades. Between Hathnikund and Okhla barrage, maximum depletion ranging from 10 to 20 m is recorded in the Mawi-Baghpat reach.

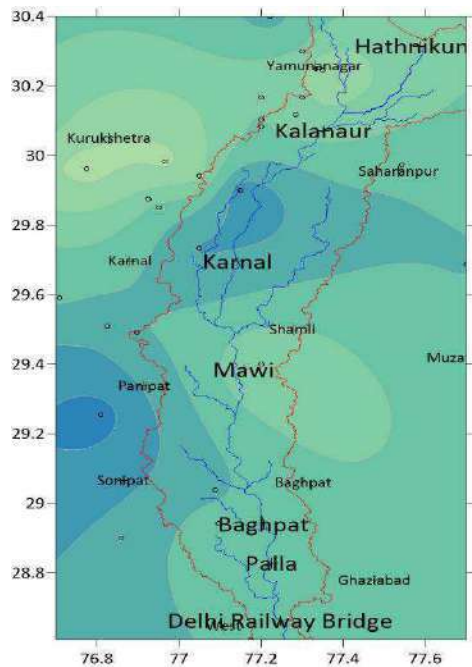


Fig. 4.5a DTWL (m) pre-monsoon 1975

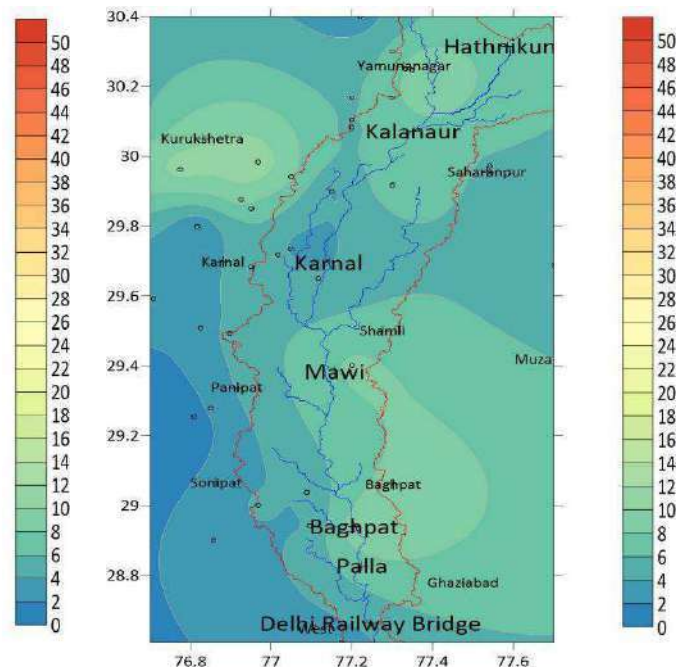


Fig. 4.5b DTWL (m) post-monsoon 1975

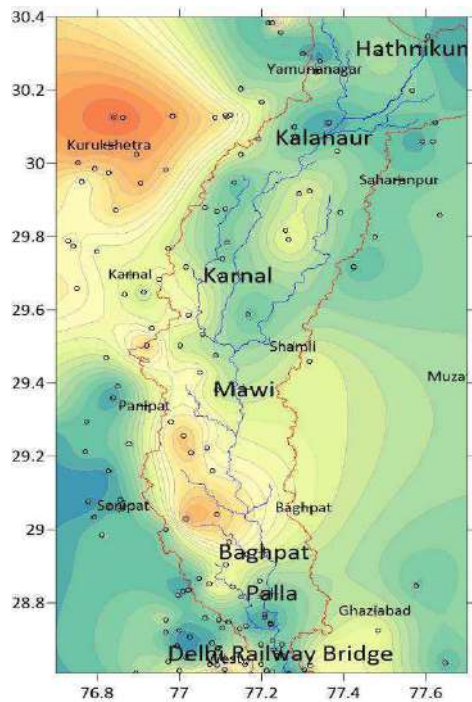


Fig. 4.5c DTWL (m) pre-monsoon 2018

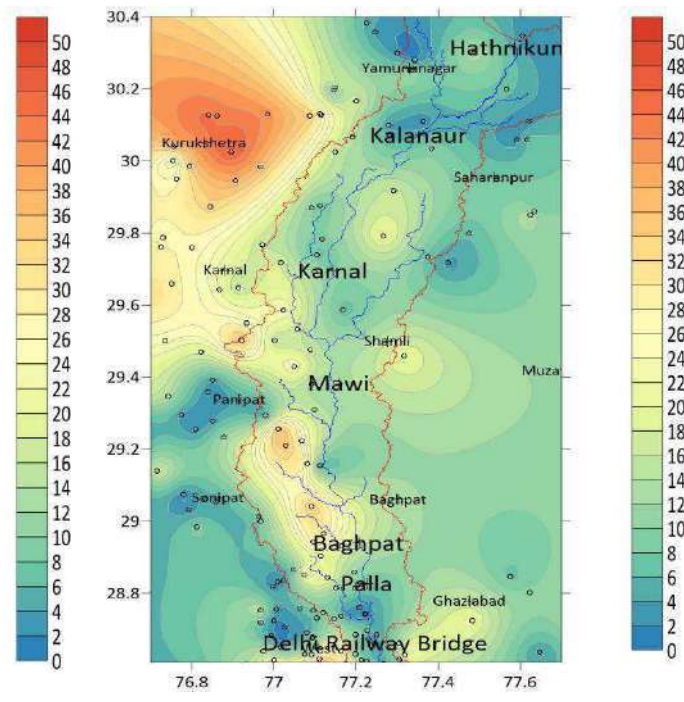


Fig. 4.5d DTWL (m) post-monsoon 2018

4.4 Field Survey for River Cross-Sections in Study Reach

For achieving accuracy in flow simulations using hydrodynamic modeling, the river cross-sections are needed at close intervals (this aspect is discussed in detail in Chapter 5). Since cross-sections at close intervals were not available, field surveys were carried out to determine the cross-sections along Yamuna river at 306 lines. The river cross-sections are taken every 1 km throughout the river from Hathnikund barrage to Okhla barrage, except for small stretches near locations marked in Fig. 4.6, where the cross-sections are taken at every 250 m. At each such location, 05 cross-sections were surveyed located 250 m apart within a reach of 1 km. Total locations where spacing interval was 250 m within a distance of 1 km are 14 in number, with the 14th location falling at Okhla barrage (refer Table 4.1a). Plots of a few surveyed river cross-sections are provided in Annexure 1.

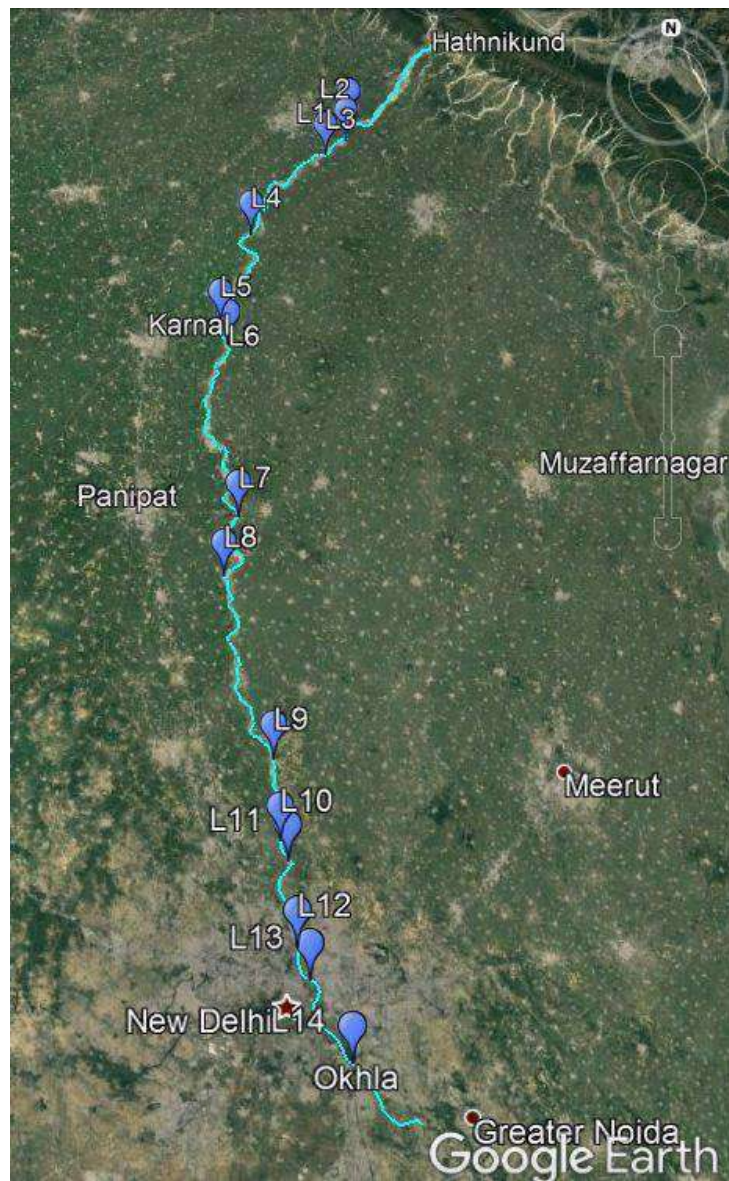


Fig. 4.6 The 14 identified locations on Yamuna river (where river cross-sections were surveyed 250 m apart inside a reach of 1 km; total 306 lines were surveyed at 1 km interval)

Table 4.1a Details of 14 locations where river cross-sections were surveyed at an interval of 250 m within a reach of 1 km. Such locations were identified either at gauging sites or at confluence of canal/ drains/ natural streams and main river.

Label	Latitude	Longitude	Type of Site (G&D site or confluence of streams/ drains with main river)	Distance from Hathnikund barrage (km)	Description of locations
Location 1	30° 8'27.10"N	77°24'16.60"E	Confluence site	31	Canal near Kanalsi
Location 2	30° 6'2.16"N	77°23'44.85"E	Confluence site	36	Drain near Birtapu
Location 3	30° 4'15.69"N	77°21'40.52"E	Confluence and G&D site	41	Gauging site near Kalanaur
Location 4	29°54'7.69"N	77°11'48.95"E	Confluence site	71	Drain near Ranipurbarasi must
Location 5	29°43'38.33"N	77° 7'52.35"E	Confluence site	97	Drain near Mohayuddinpur
Location 6	29°41'25"N	77° 8'44"E	G&D site	103	Gauging site near Karnal
Location 7	29°23'10.04"N	77° 9'29.39"E	G&D site	146	Gauging site near Mawi
Location 8	29°16'45.03"N	77° 7'26.85"E	Confluence site	163	Drain near Khojkipur
Location 9	28°59'14"N	77°12'7"E	G&D site	203	Gauging site near Bhagpat
Location 10	28°51'42.71"N	77°12'28.32"E	Confluence site	219	Drain near Palla
Location 11	28°50'2"N	77°13'13"E	G&D site	222	Gauging site near Palla
Location 12	28°42'27.40"N	77°13'49.33"E	Confluence site	243	Drain near Wazirabad
Location 13	28°39'42"N	77°14'57"E	G&D site	248	Gauging site near DRB
Location 14	28°32'54.58"N	77°18'49.13"E	G&D site	263	Okhla barrage

4.5 Field Survey for Habitat Requirement of Indicator Fish Species

To determine e-flows for maintaining ecological integrity and sustaining fisheries resources of river Yamuna, a rapid field survey was conducted in river Yamuna for identification of indicator fish species. A field team comprising of NIH members and river ecology expert from Wildlife Institute of India carried out field sampling between Hathnikund barrage and Panipat during the month of October 2019 and February 2020.

Fish and river habitat variables (flow and depth measurements) were carried out at various locations viz., Hathnikund, Yamuna Nagar and Panipat and above Delhi segment. Details of the field survey and findings are presented in Chapter 6.

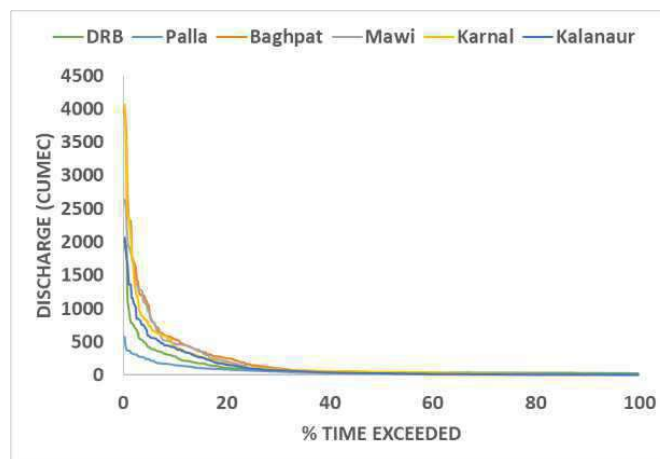
4.6 Flow Duration Curve

Flow Duration Curves (FDC) corresponding to different dependability years help understand the response of the basin in different hydrologic scenarios. FDC is constructed using long-term observed data (10 year return period) of a river at the desired locations. It is the graphical representation of discharge versus the exceedance probability.

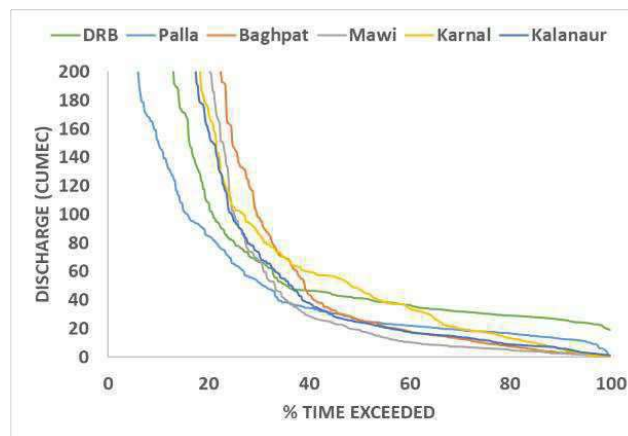
With the probability of exceedance corresponding to Q95, the FDC corresponding to 7-day mean discharge for the 10-year return period (7Q10) is defined as the appropriate e-flow during drought years/low-flow periods (Jain & Kumar, 2014). The 7Q10 flow for regulation purposes may useful for

- Water quality protection from waste water discharge.
- Habitat protection during drought condition.
- Chronic criteria for aquatic life.
- A local extinction flow.

The flow duration curves were constructed for Yamuna river at different gauging sites (Figs. 4.7a-b).



(a)



(b)

Fig. 4.7 Combined Flow Duration Curve for gauging sites at DRB, Baghpat, Mawi, Karnal and Kalanaur

The 7-day mean flows were obtained for a return period of 10 years (2009 – 2018) and the graphs (Figs. 4.7 and Fig. 4.8) has been plotted between percentile and discharge in cumec for different gauging sites at Delhi Railway Bridge (DRB), Baghpat, Mawi, Karnal and Kalanaur. The curve obtained in the graph represents the 7Q10 flow curve. In flow duration

curve analysis, the high zone is centred at the 5th percentile and the low zone is centred at the 95th percentile. In the low zone flow is due to base flow or snow melt but in the high zone peak flow is due to the rain.

Flow duration curve analysis identifies intervals which can be used as a general indicator of hydrologic conditions (from wet to dry conditions) but it does not retain the temporal sequences of flows and so do not define the timing or duration of e-flows. Q90 and Q95 indicate 90% and 95% probability that such discharge will be available in the river, respectively. Table 4.2 shows the values of Q90 and Q95 as low flow indices for different gauging sites.

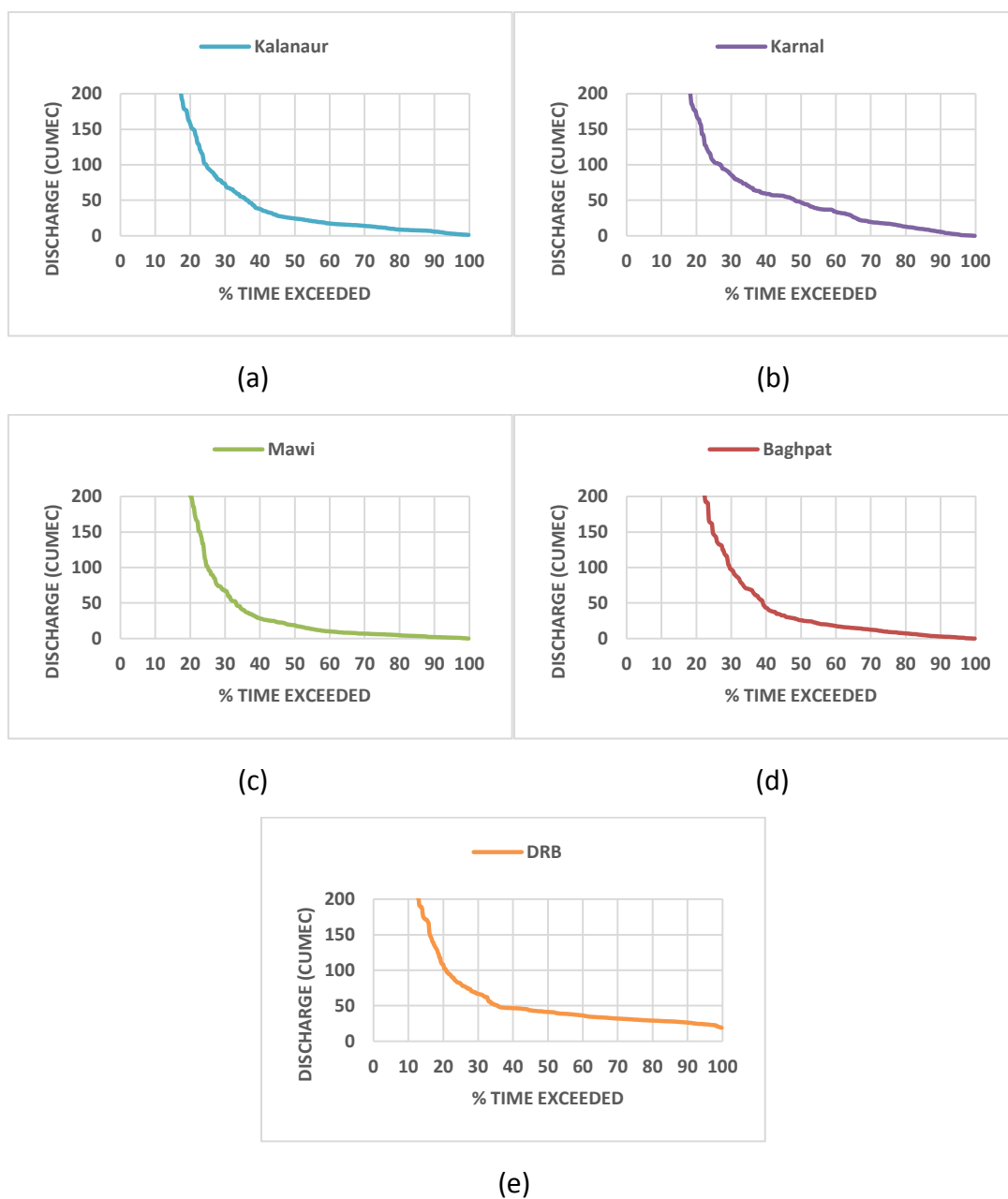


Fig. 4.8 Flow duration curve for gauging sites at (a) Kalanaur (b) Karnal (c) Mawi (d) Baghpat (e) DRB

Table 4.2 Percent of time exceeded 7-day average discharge of 10 year return period (7Q10) value corresponding to gauging sites

% Time exceeded	Gauging site				
	DRB	Baghpat	Mawi	Karnal	Kalanaur
Q90 of 7Q10	26.22	2.88	2.16	5.75	5.82
Q95 of 7Q10	23.74	1.44	1.38	2.19	2.82

However, the values of Q90 and Q95 in Table 4.2 do not meet the habitat requirement of the indicator fish species (refer Chapter 6) in the study reach and only indicate that such discharge will be available in the river at the different gauging sites.

4.7 Water Quality Status in Study Reach

The river water quality data monitored by CPCB (2015-2019) and CWC (2013-2018) was used to understand the spatial and temporal variation in the quality of the Yamuna River water. Few essential parameters like pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Nitrogen (TN), and Total Phosphorous (TP) were studied. The pollutant load entering the river through various drains, monitored by CPCB during 2015-2019, was also analyzed to work out the mitigation measures to improvise the water quality for the healthy ecosystem.

pH: The mean pH of Yamuna river in the stretch under study varied in the range of 6.4 - 8.9 from 2015-2019. The pH exceeded the criteria of 8.5 prescribed for propagation of wild life and fisheries on few occasions (Figs. 4.9-4.14). However, the pH was mostly in the alkaline range. The observed pH at Paonta Sahib, Hathnikund, Yamunanagar, Sonipat, Wazirabad, Nizamuddin, and Okhla was 7.90 ± 0.05 , 7.52 ± 0.05 , 7.58 ± 0.05 , 7.65 ± 0.05 , 7.81 ± 0.06 , 7.50 ± 0.04 , and 7.48 ± 0.03 respectively. It is observed that the pH of the river reduces from 7.90 ± 0.05 to 7.52 ± 0.05 as the river flows from Paonta Sahib to Hathnikund, however gradual increase in pH is observed till Sonipat and swift increase in pH is observed at Wazirabad (Figs. 4.15-4.16). The gradual increase in pH, in the stretch Hathnikund to Sonipat, may be due to groundwater and wastewater influx in the river. The sudden increase in pH at Wazirabad is due to the presence of phytoplankton in the river which consumes the CO_2 resulting in increased pH. Below Wazirabad barrage, the quick reduction in pH is due to influx of sewage and reducing condition of river. The reducing condition and excess carbon influx in the river results in generation of H_2S and CO_2 , which on dissolution in water get converted to acids.

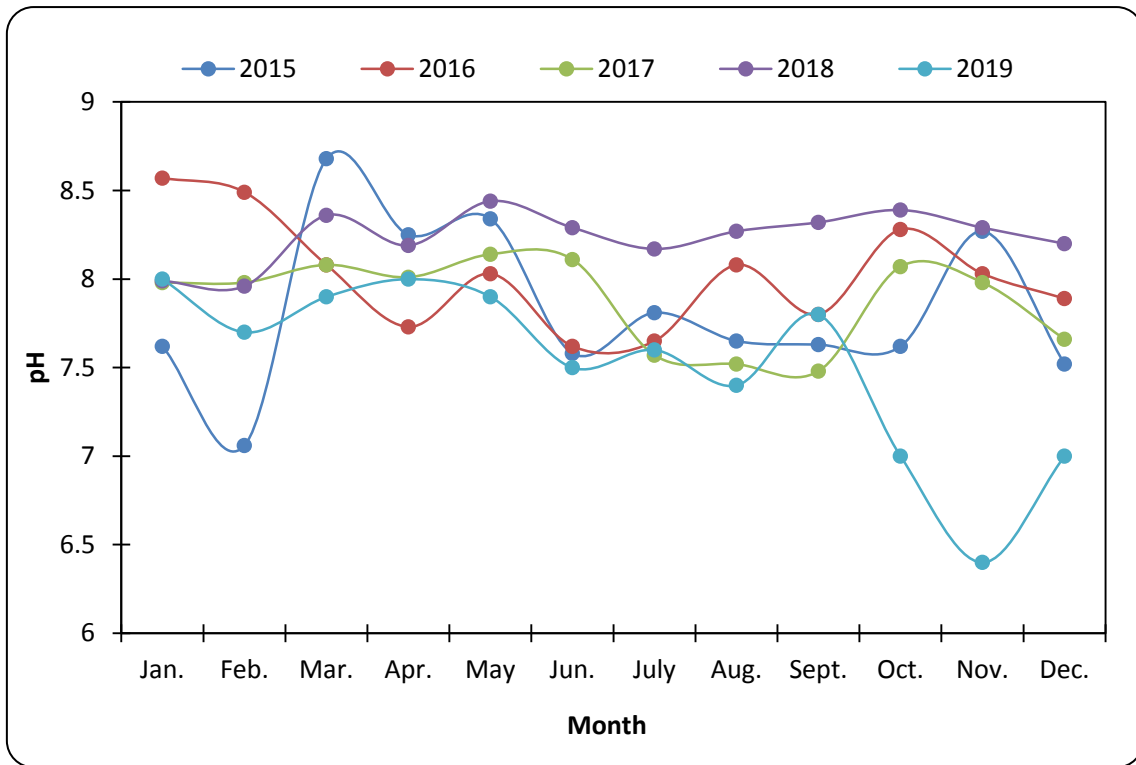


Fig. 4.9 pH variation at Paonta Sahib

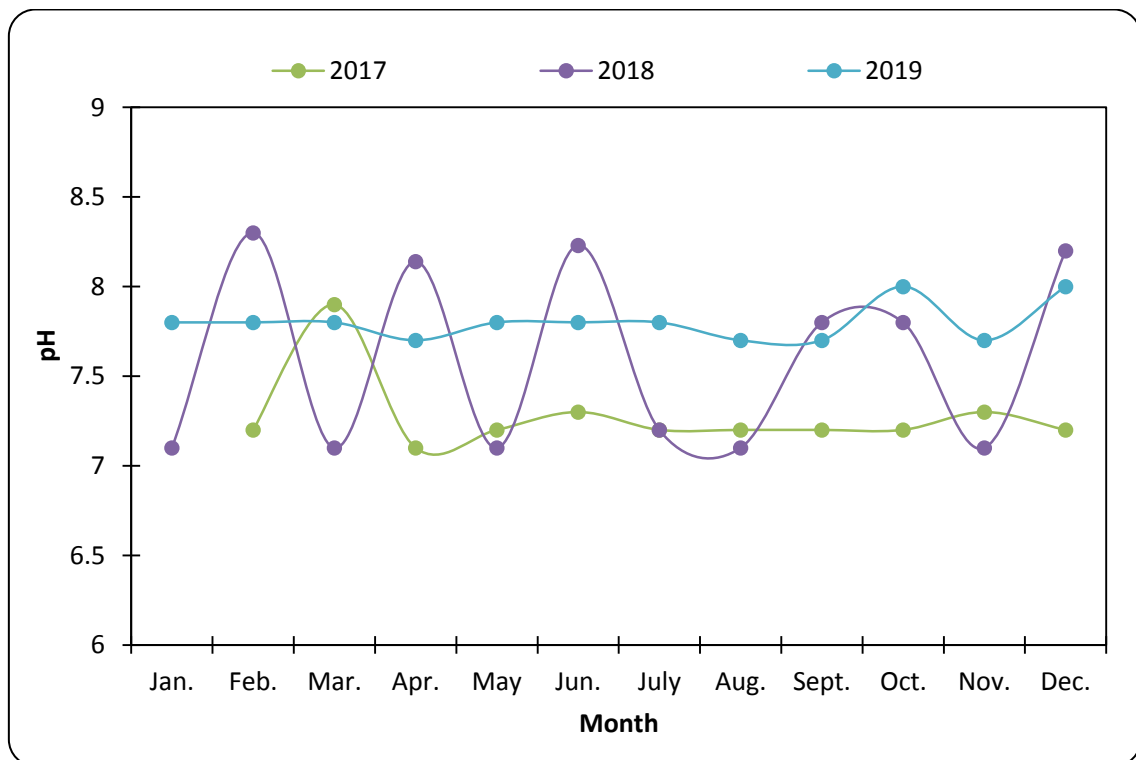


Fig. 4.10 pH variation at Hathinikund

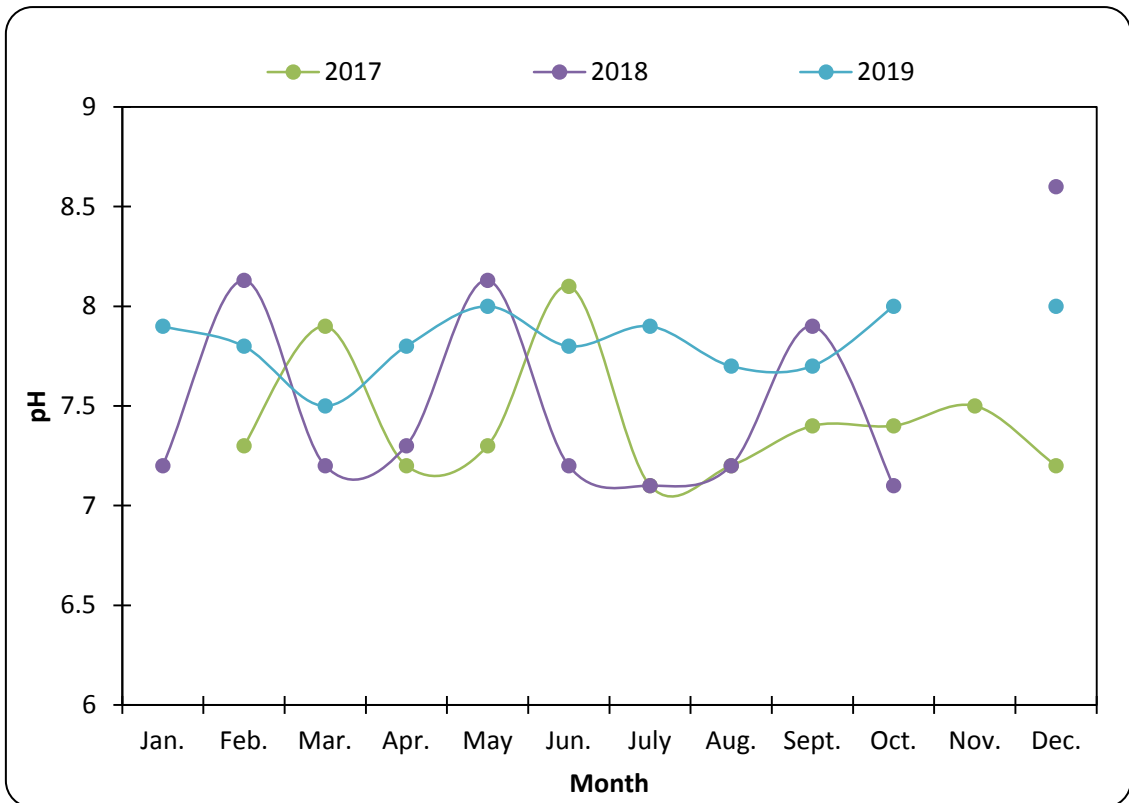


Fig. 4.11 pH variation at Yamunanagar/ Kalanaur

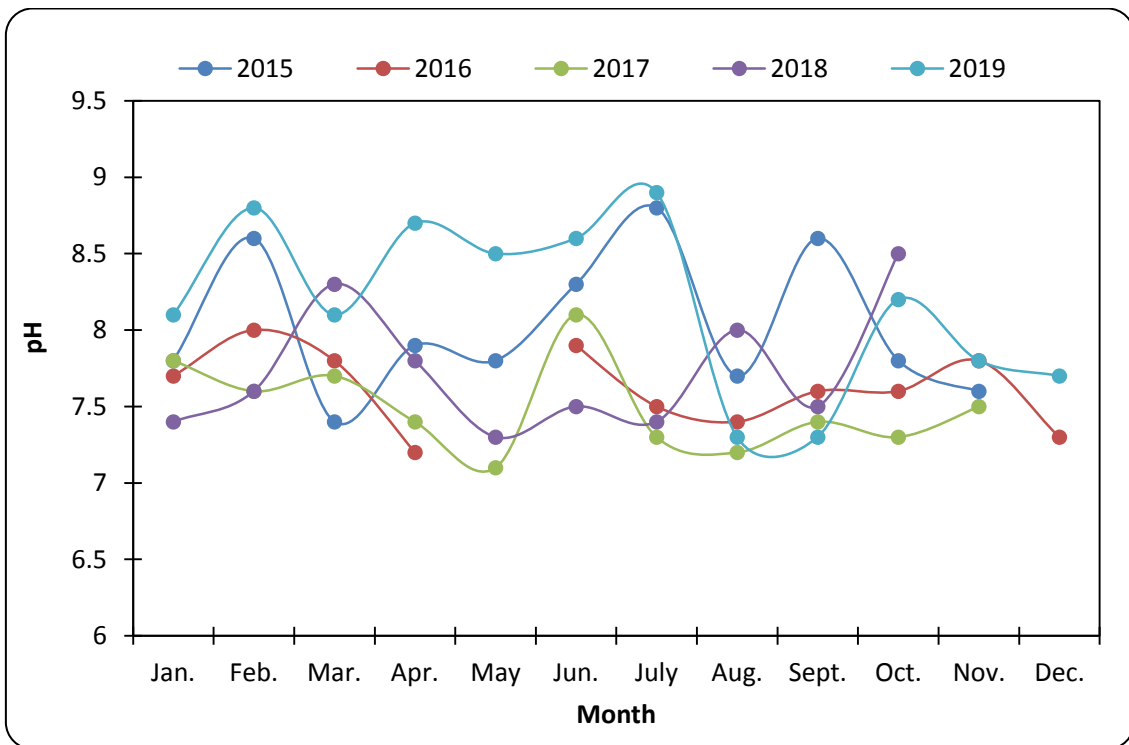


Fig. 4.12 pH variation at Wazirabad

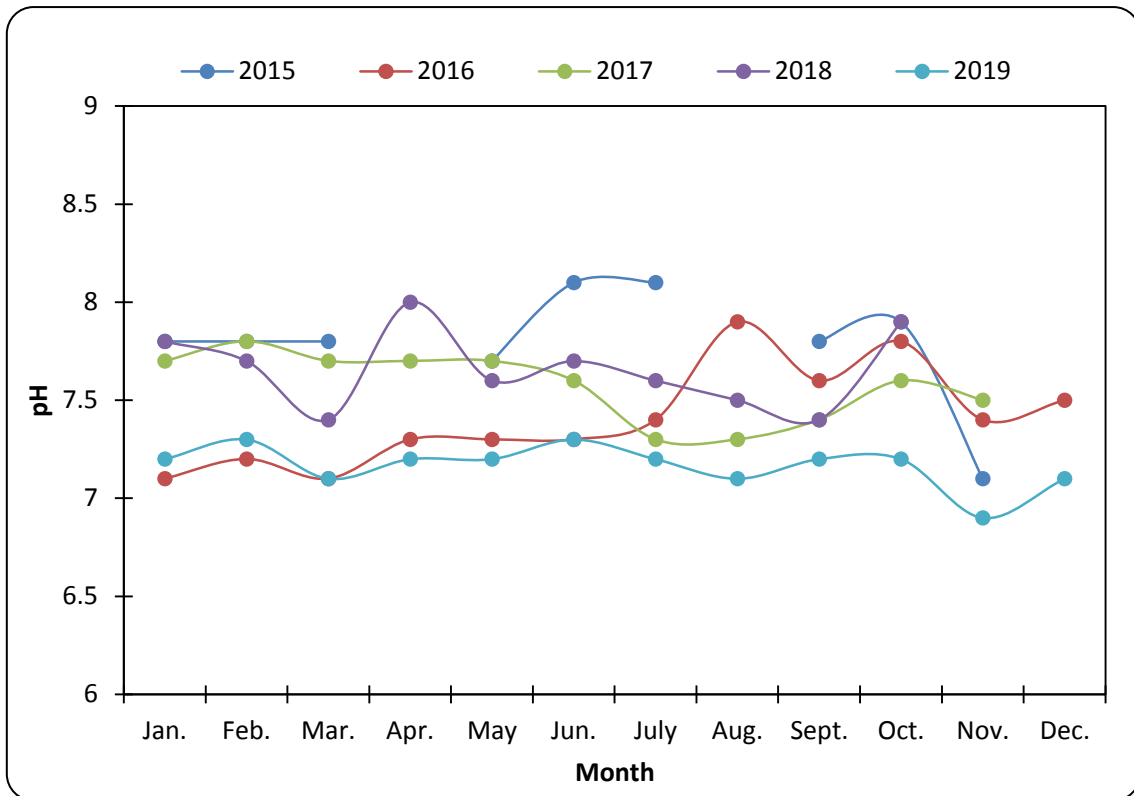


Fig. 4.13 pH variation at Delhi Railway Bridge

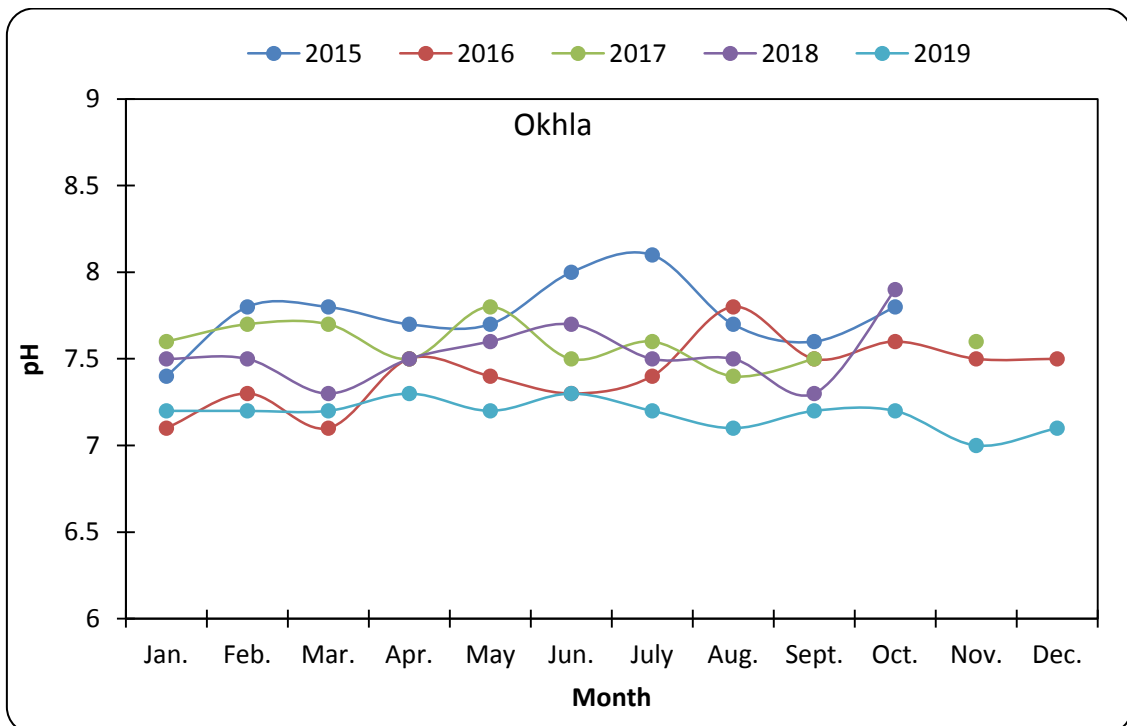


Fig. 4.14 pH variation at Okhla

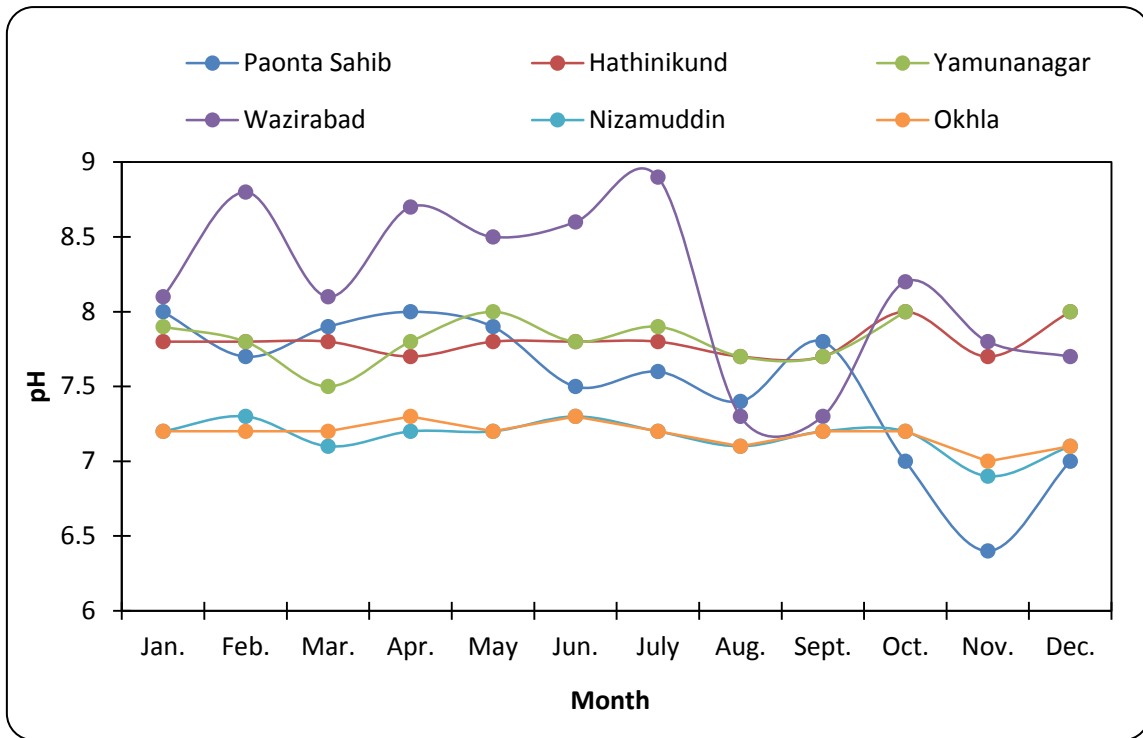


Fig. 4.15 pH variation at different locations during 2019

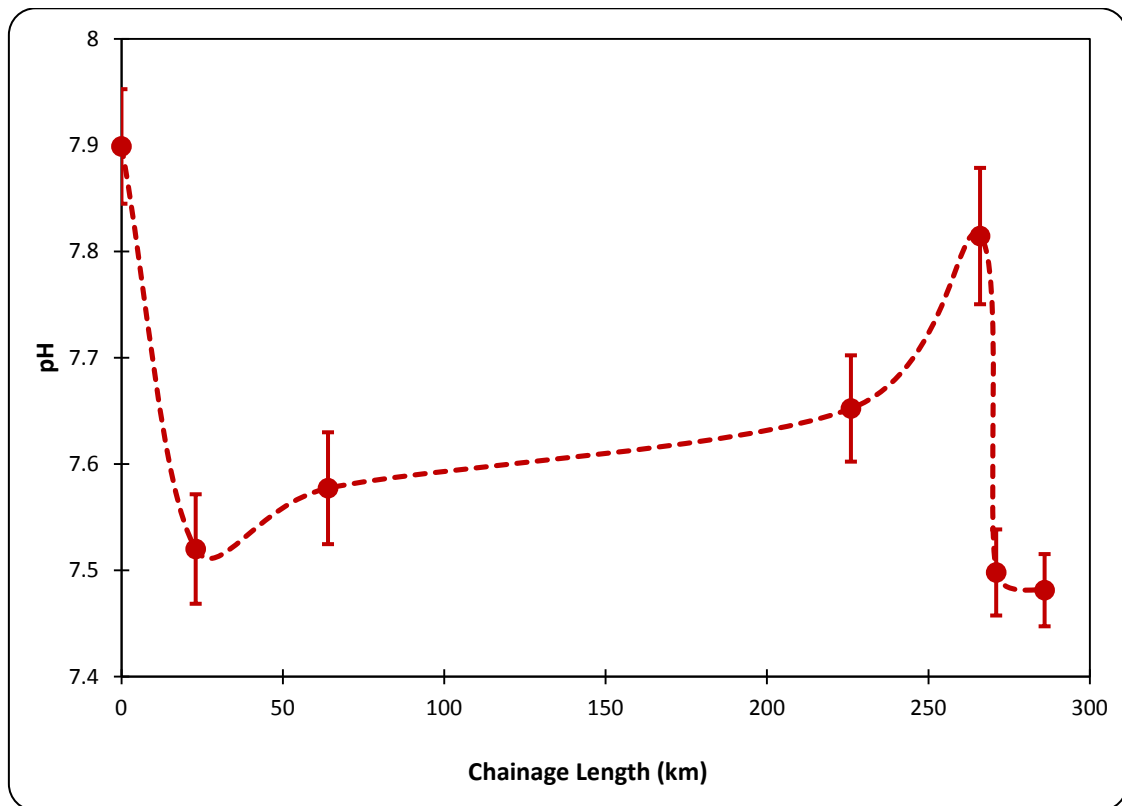


Fig. 4.16 Average annual pH variation at different locations – Paonta Sahib (0 km), Hathinikund (23 km), Yamunanagar (64 km), Sonipat (226 km), Wazirabad (266 km), Nizamuddin (271 km), Okhla (286 km) (2015-2019)

Electrical Conductivity: The EC values indirectly denotes the dissolved solids in the water and indicates the change in the water quality. The EC value of Yamuna River was in the range of 128-3860 $\mu\text{S}/\text{cm}$ in the stretch from Paonta Sahib to Okhla during 2015-2019. The EC values were higher in the post monsoon stretch for all the location, however, a sudden change in conductivity to the tune of 2 times and 4 times is observed at Sonipat and Nizamuddin respectively (Figs. 4.17 -4.24).

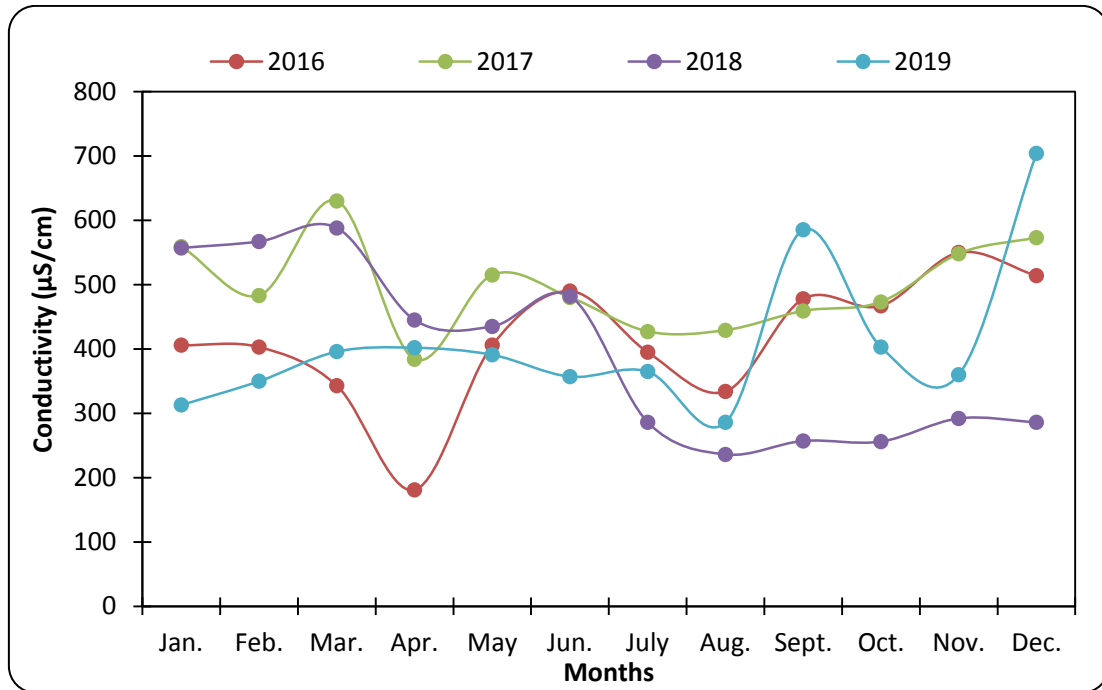


Fig. 4.17 EC variation at Paonta Sahib

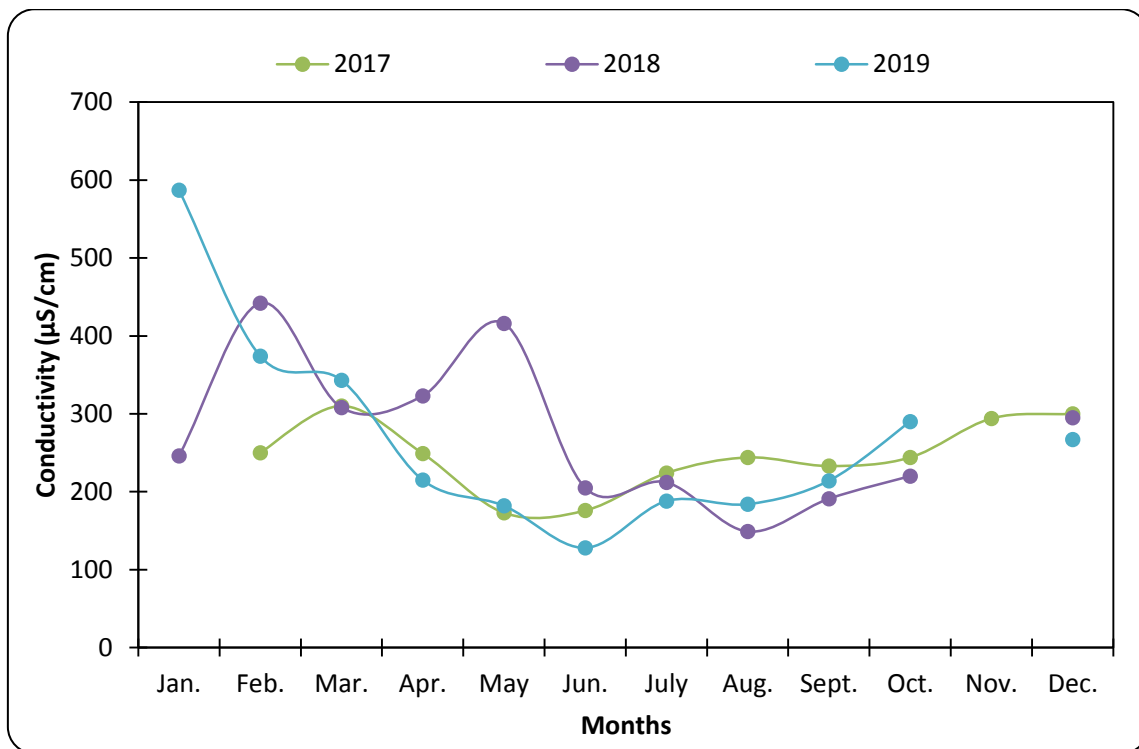


Fig. 4.18 EC variations at Hathinikund

The observed conductivity at Paonta Sahib, Hathinikund, Yamunanagar, Sonipat, Wazirabad, Nizamuddin, and Okhla was $413.5 \pm 16.78 \mu\text{S/cm}$, $263.5 \pm 13.78 \mu\text{S/cm}$, $311.5 \pm 17.66 \mu\text{S/cm}$, $599.7 \pm 50.75 \mu\text{S/cm}$, $620.7 \pm 78.02 \mu\text{S/cm}$, $1370.5 \pm 76.04 \mu\text{S/cm}$, and $1043.5 \pm 47.24 \mu\text{S/cm}$ respectively. The drastic increase in conductivity at Sonipat and Nizamuddin indicates influx of high TDS effluent in the river.

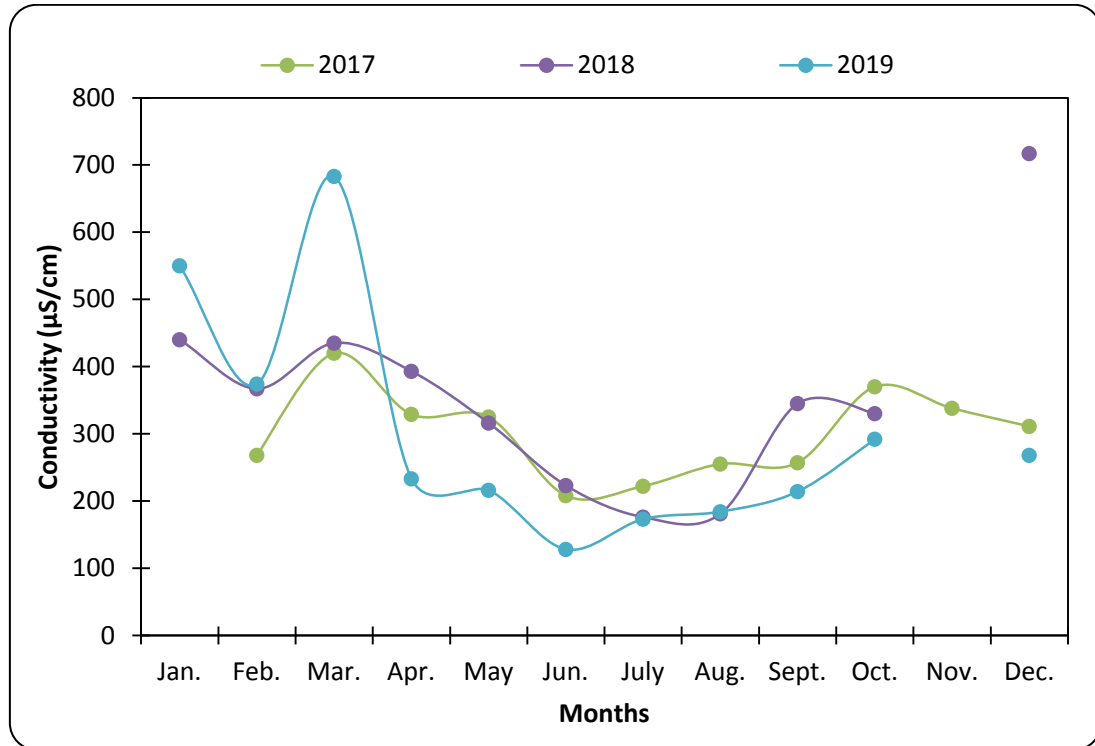


Fig. 4.19 EC variation at Yamunanagar/ Kalanaur

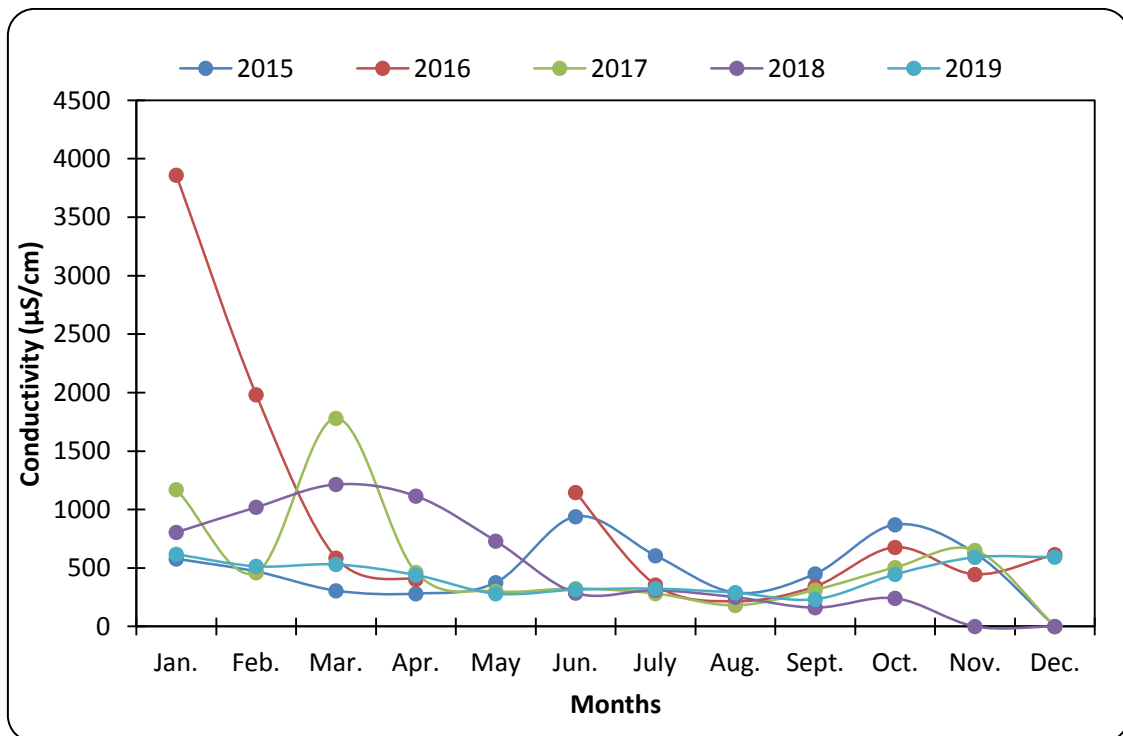


Fig. 4.20 EC variation at Wazirabad

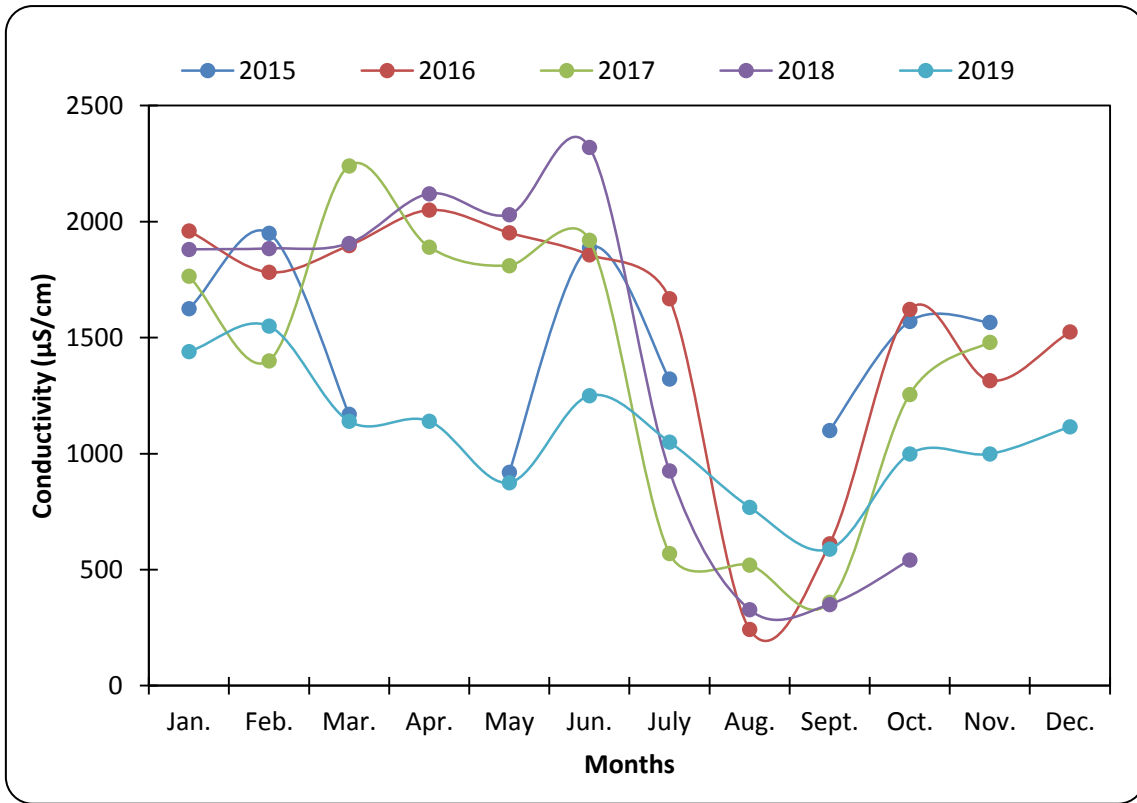


Fig. 4.21 EC variation at Delhi Railway Bridge

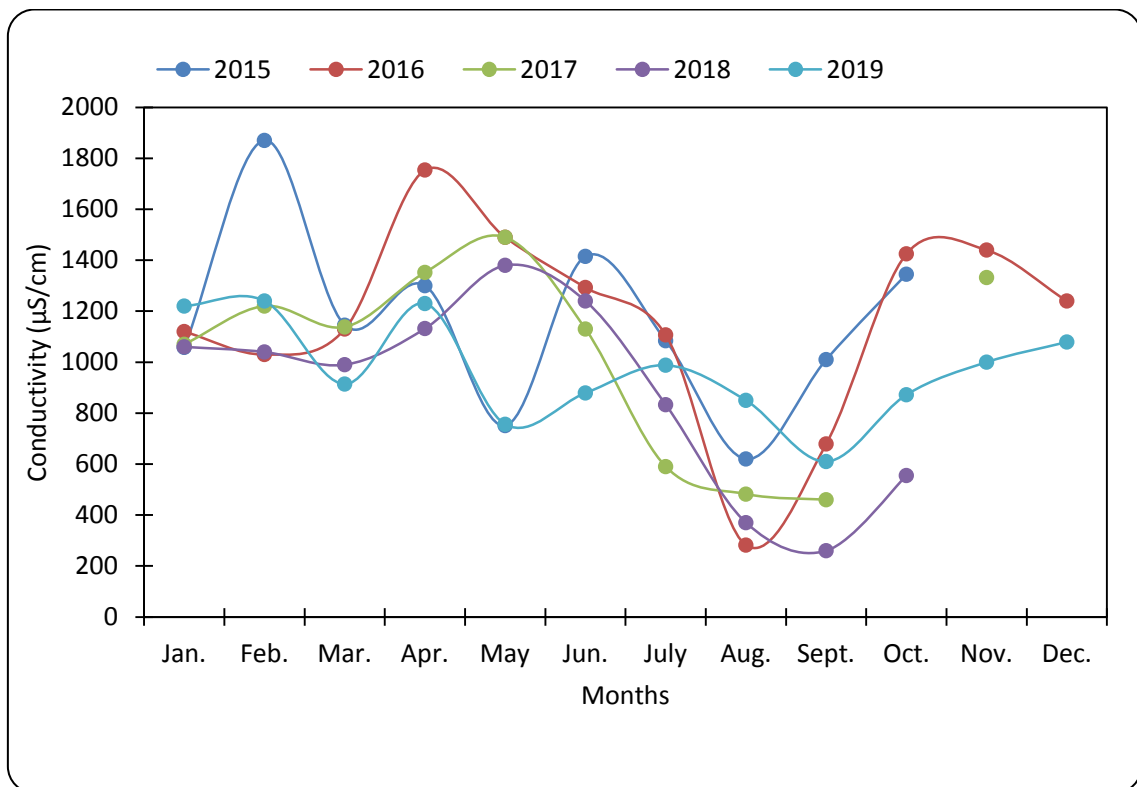


Fig. 4.22 EC variation at Okhla

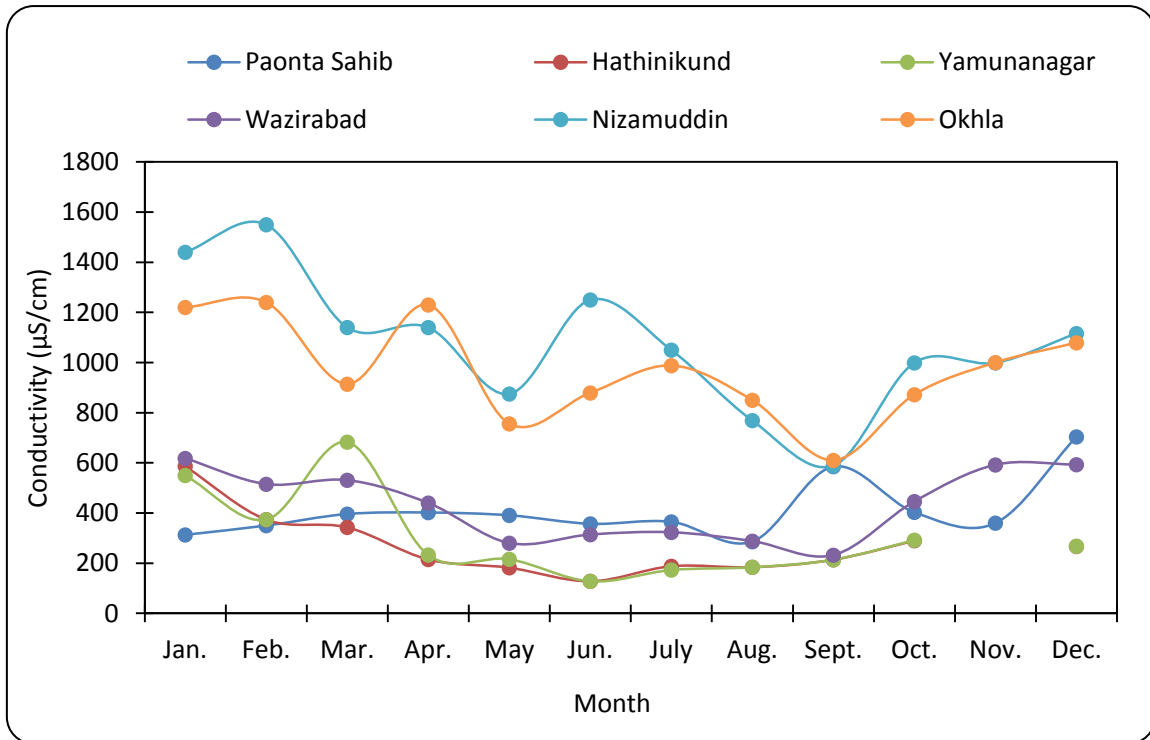


Fig. 4.23 EC variation at different locations during 2019

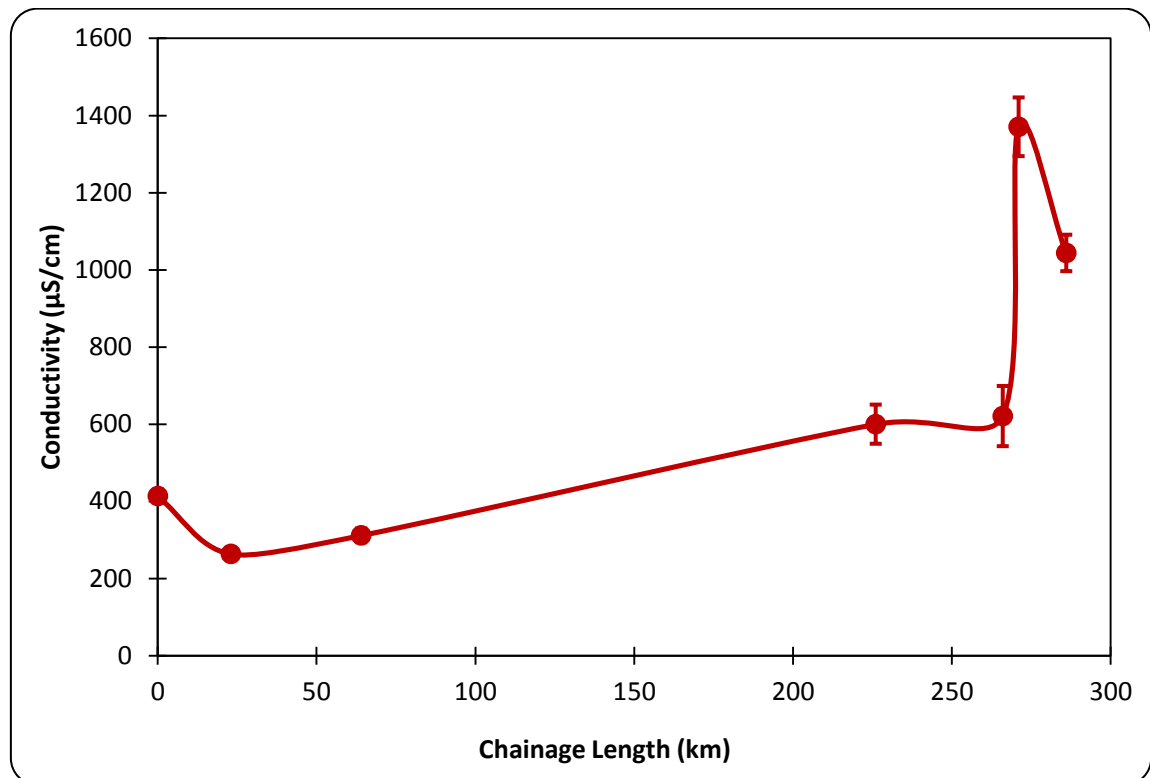


Fig. 4.24 Average annual EC variation at different locations – Paonta Sahib (0 km), Hathinikund (23 km), Yamunanagar (64 km), Sonipat (226 km), Wazirabad (266 km), Nizamuddin (271 km), Okhla (286 km) (2015-2019)

Dissolved Oxygen: DO concentration in the Yamuna River varied in the range of non-detectable (ND) - 15.5 mg/l in the stretch from Paonta Sahib to Delhi (**Fig. 4.25-4.32**). The required DO value for propagation of wildlife and fisheries is more than 4 mg/l, however, some fish species can survive at DO concentration as low as 1.4 mg/l.

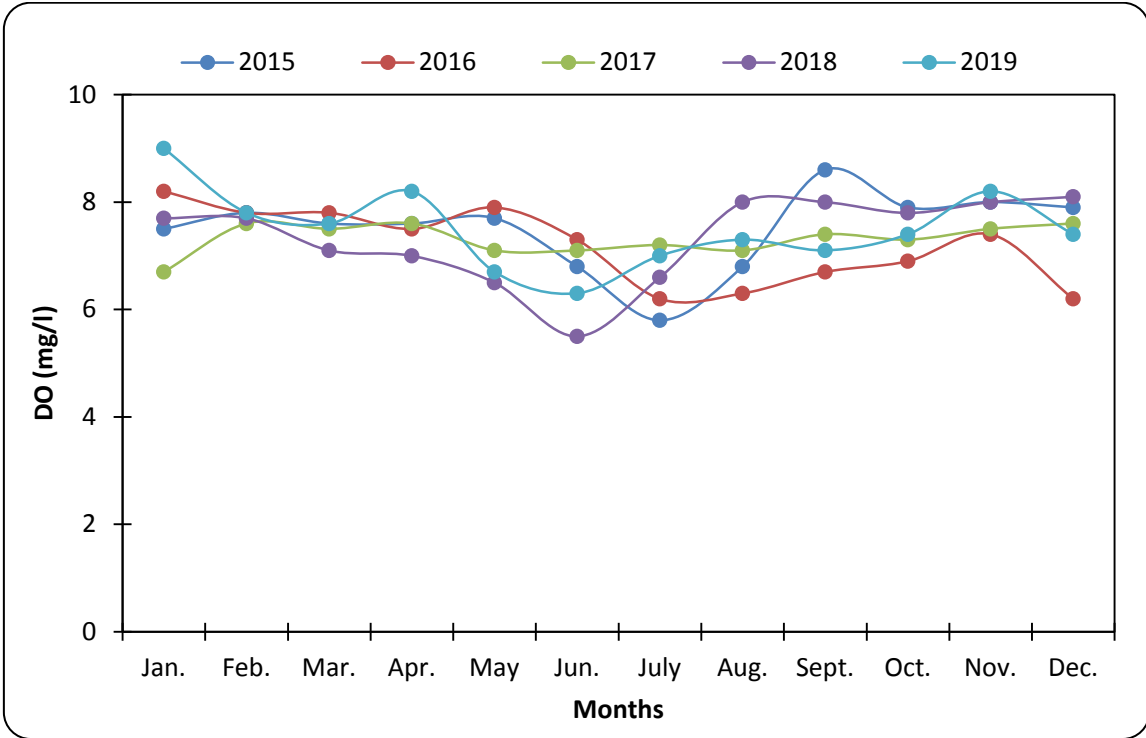


Fig. 4.25 DO variations at Paonta Sahib

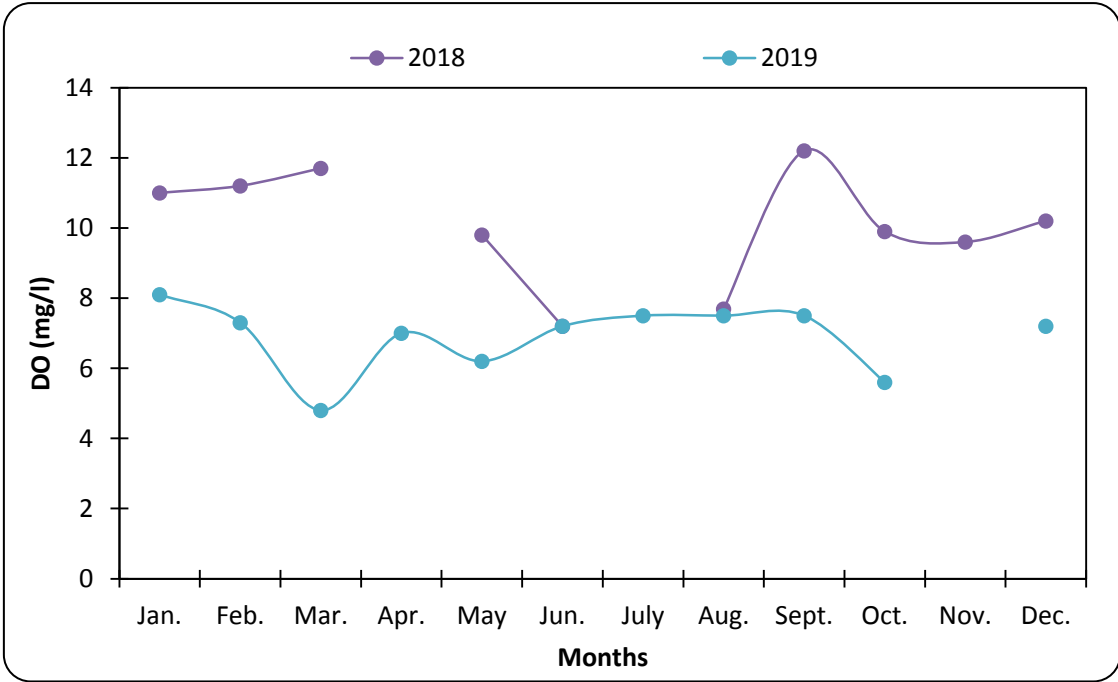


Fig. 4.26 DO variations at Hathinikund

The DO levels were satisfactory in the stretch between Paonta Sahib and Sonipat. The DO levels in Yamuna River at Wazirabad exceeded the saturation level at several occasions during October to March, may be due to presence of phytoplankton and macrophytes in the water. The DO level in Yamuna River at Nizamuddin and Okhla has remained below 2 mg/l during most part of the year and cannot sustain fishery. This dip in DO levels is due to dumping of untreated effluents in the river and the situation can be improved by proper treatment of wastewater entering the river.

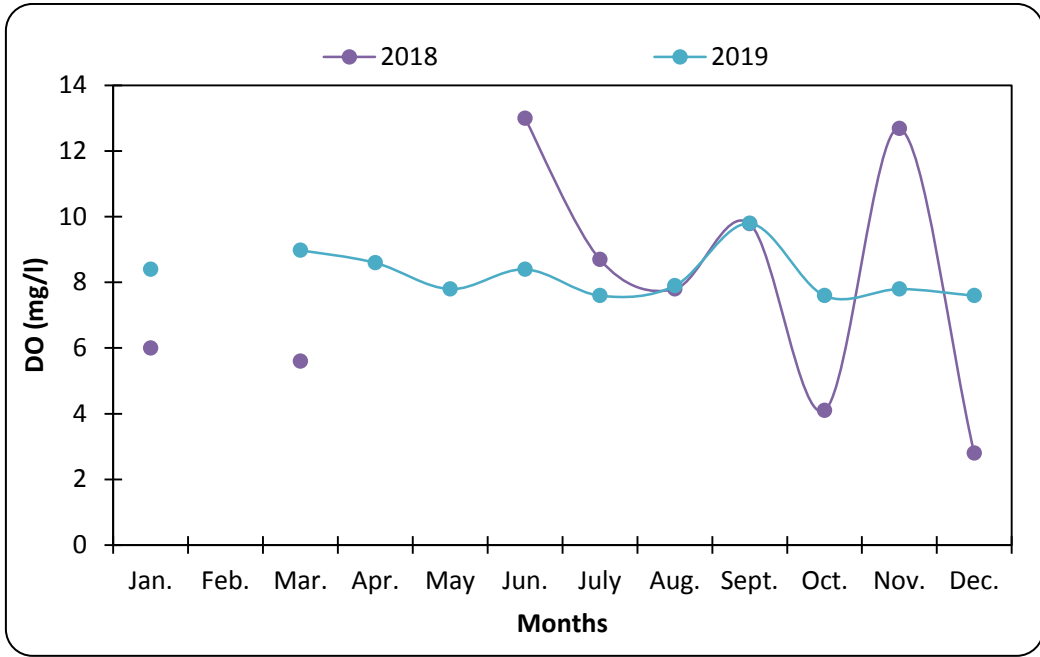


Fig. 4.27 DO variation at Yamunanagar/ Kalanaur

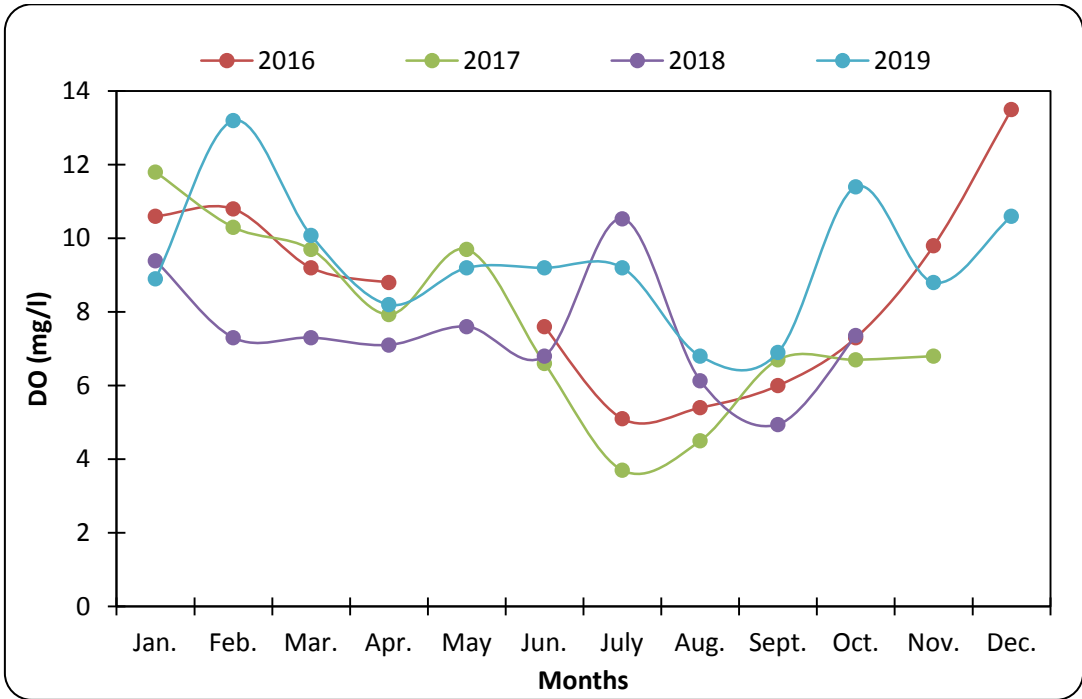


Fig. 4.28 DO variation at Wazirabad

The average annual DO at Paonta Sahib, Hathnikund, Yamunanagar, Sonipat, Wazirabad, Nizamuddin, and Okhla was 7.4 ± 0.09 mg/l, 8.6 ± 0.36 mg/l, 7.8 ± 0.40 mg/l, 7.8 ± 0.40 mg/l, 8.5 ± 0.36 mg/l, 1.4 ± 0.19 mg/l, and 1.4 ± 0.16 mg/l respectively. Sudden dip in DO levels at Nizamuddin indicates influx of high load of carbon in the river surpassing its natural carrying capacity.

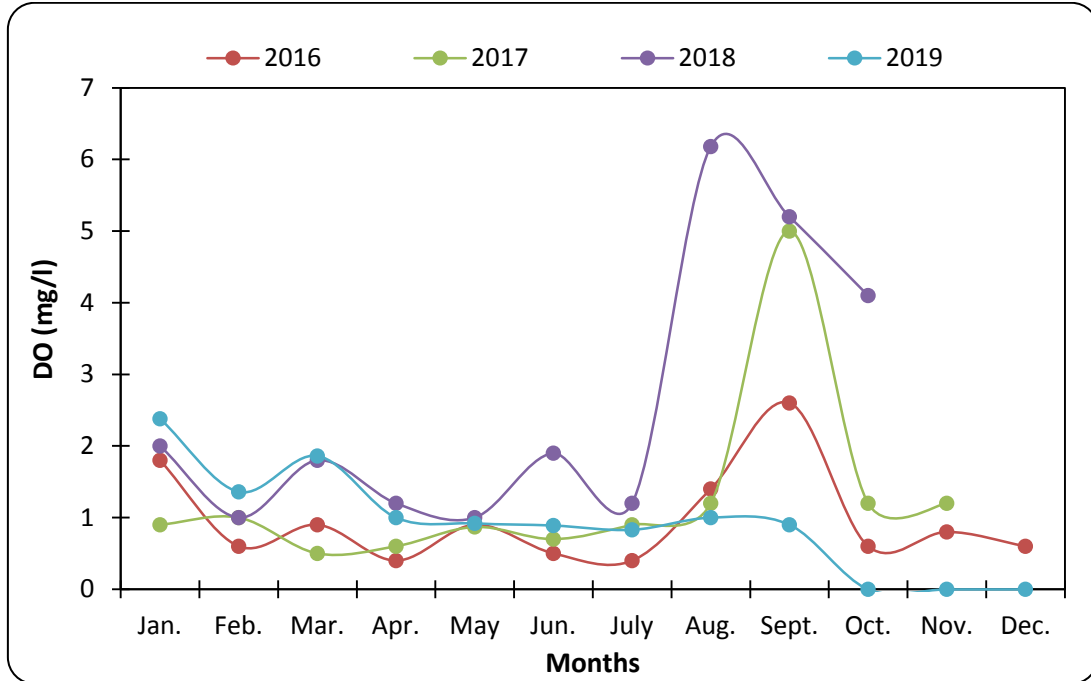


Fig. 4.29 DO variation at Delhi Railway Bridge

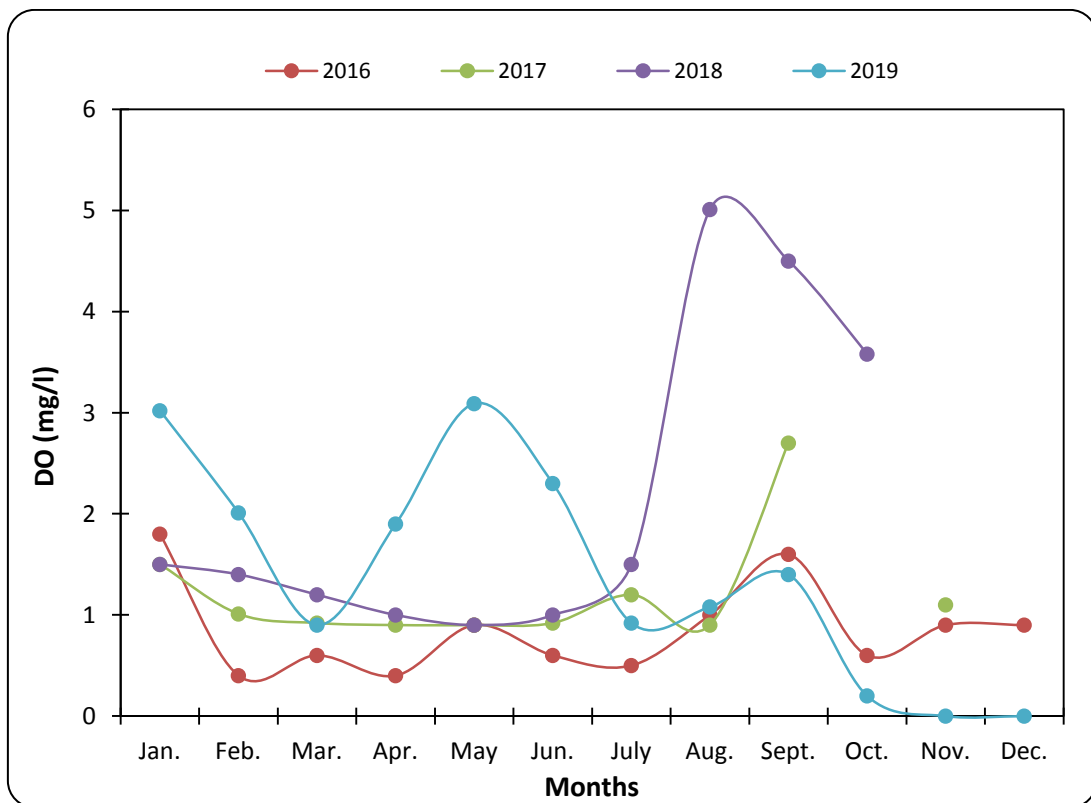


Fig. 4.30 DO variation at Okhla

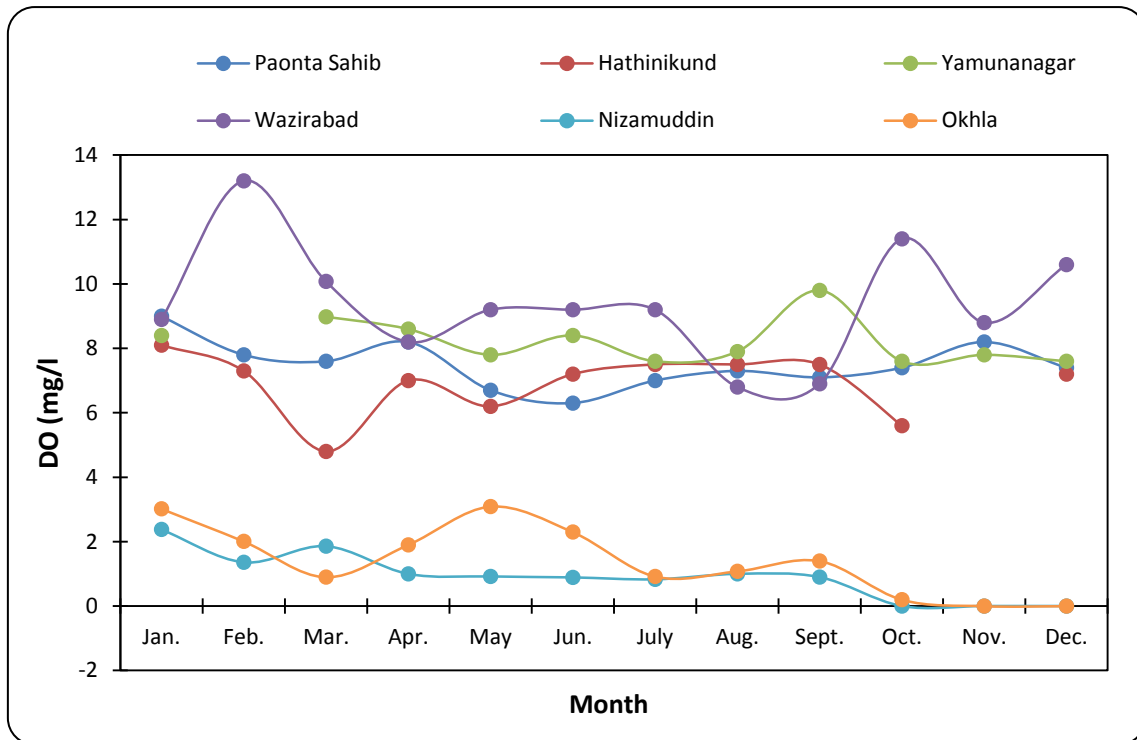


Fig. 4.31 DO variation at different locations during 2019

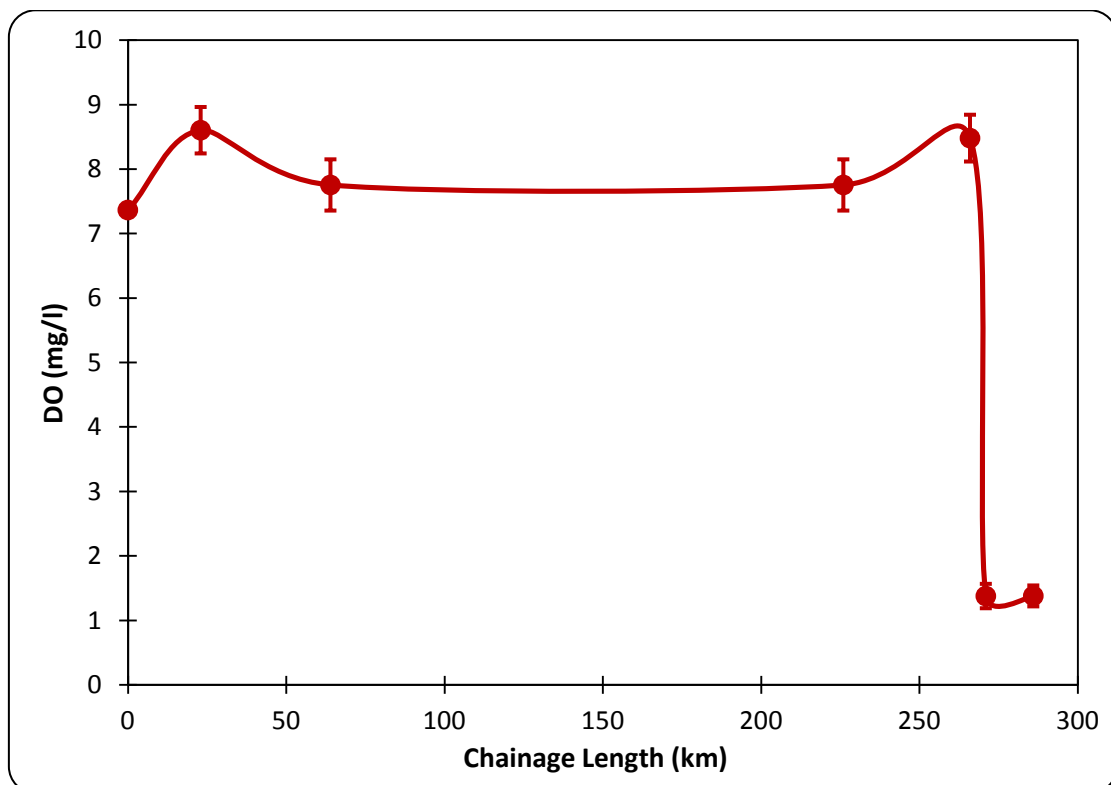


Fig. 4.32 Average annual DO variation at different locations – Paonta Sahib (0 km), Hathinikund (23 km), Yamunanagar (64 km), Sonipat (226 km), Wazirabad (266 km), Nizamuddin (271 km), Okhla (286 km) (2015-2019)

The DO values were measured during the field survey conducted during June 07-08, 2019 (Table 4.3). The DO in the river at Daheara village and Sonia Vihar Sports Club was observed to be 10.3 mg/l at around 18:00 HR and 11.0 mg/l at around 13:00 HR respectively. Few people were catching fish in Sonia Vihar and the size of fish were around 10 cm indicating the environment conduciveness for few species of fish. The team also interacted with fishermen catching fish from the river near Daheara village and was informed that the river contains fish of size 15-20 cm; however, during monsoon the fishermen can get catch of bigger size. It was also informed that the discharge in the drain/canal meeting Yamuna River is contaminated during certain periods of the year.

Table 4.3 DO values of Yamuna River & incoming drains (June 07-08, 2019)

S N	Location	Latitude	Longitude	On site DO value (mg/l)
Yamuna River				
1	Near Daheara Village	28.863° N	77.207° E	10.3
2	Sonia Vihar Water Sports Club, Wazirabad road, Delhi	28.713° N	77.236° E	11.0
3	Yudhister Setu	28.671° N	77.236° E	ND
4	Okhla head Park	28.568° N	77.296° E	ND
5	Okhla Barrage	28.545° N	77.311° E	ND
Drains				
6	Drain Near Dhobi Ghat, Batla house, Okhla	28.572° N	77.290° E	ND
7	Drain near Shakti Enclave, friends colony, New Delhi	28.574° N	77.273° E	ND
8	Drain near Power Grid, Maharani Bagh, Ganga Bihar, Sarai Kale Khan	28.568° N	77.274° E	ND
9	Drain near Railway road bridge, Pragati Maidan, New Delhi	28.611° N	77.251° E	1.2
10	Nazafgarh drain Joining to Yamuna River Near Signature Bridge	28.709° N	77.228° E	ND
11	Wazirabad road, Usmanpur, Shahadra, Delhi, Near Signature Bridge	28.708° N	77.235° E	ND
12	Western Yamuna Canal near Daheara	28.864° N	77.192° E	12.68

The DO concentration in the river water in the upstream of Wazirabad barrage upto Daheara was higher than the saturation value due to presence of algae and the photosynthesis taking place, but this condition is also of concern as the DO values may reduce to lower levels during night time as a result of respiration. In fact, the fishermen informed that during few occasion in the recent past they observed fish kill. The diurnal variation in DO values will reflect the condition of river in the upstream of barrage for the propagation of fish. The DO values were non-detectable in the river stretch below Wazirabad barrage upto Okhla barrage.

Biochemical Oxygen Demand: The BOD of pristine rivers is generally below 1 mg/L, for moderately polluted rivers 2 – 8 mg/l, and for severely polluted rivers more than 8 mg/L (WWAP, 2016). The BOD value in the river stretch from Paonta Sahib to Delhi were in the range of ND to 45 mg/l during 2015-2019 (Fig. 4.33-4.40). BOD values were minimum at Yamunanagar (ND) and highest at Okhla (45 mg/L). Based on the BOD vales, the stretch of Yamuna river upto Yamunanagar can be considered as moderately polluted. The stretch between Yamunanagar to Wazirabad is in the category of moderately polluted for most part of the year except few occasions, when the BOD exceeds 8 mg/l.

Yamuna River in Delhi from Wazirabad to Okhla is severely polluted. The average annual DO at Paonta Sahib, Hathinikund, Yamunanagar, Sonipat, Wazirabad, Nizamuddin, and Okhla was 0.84 ± 0.07 mg/l, 1.55 ± 0.13 mg/l, 1.65 ± 0.016 mg/l, 5.19 ± 0.66 mg/l, 3.28 ± 0.29 mg/l, 21.8 ± 1.55 mg/l, and 16.92 ± 1.19 mg/l respectively (Fig. 4.39-4.40). The appreciable increase in BOD at Sonipat is due to pollutant input through Drain 8 in the upstream of sampling station. Reduction in BOD was observed at Wazirabad due to self-cleansing capacity of the river, however, the chainage length between Sonipat and Wazirabad (5 km) and extent of reaeration is not sufficient enough to bring down the BOD to less than 2 mg/l. In the downstream of Wazirabad, sudden increase in BOD of river water is due to reduction in the freshwater flow from Wazirabad barrage and influx of excessive amount of almost untreated sewage, at several locations, into the river.

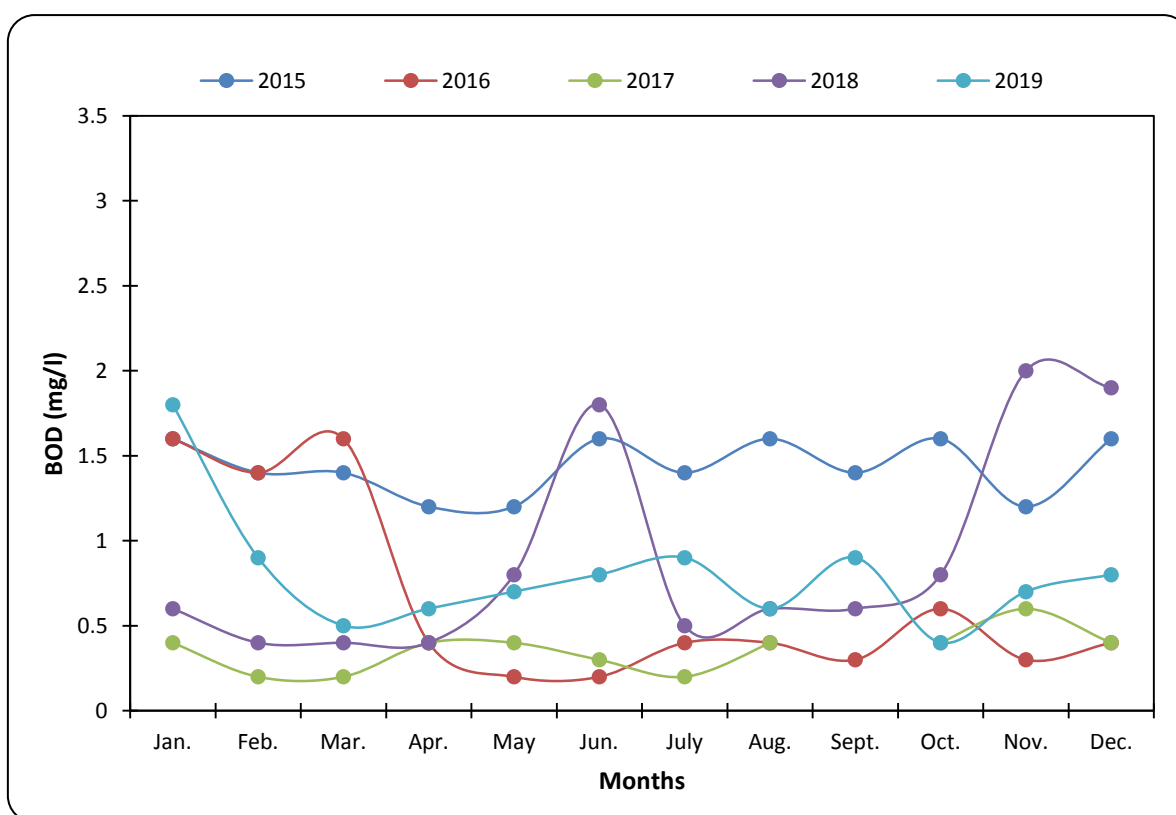


Fig. 4.33 BOD variations at Paonta Sahib

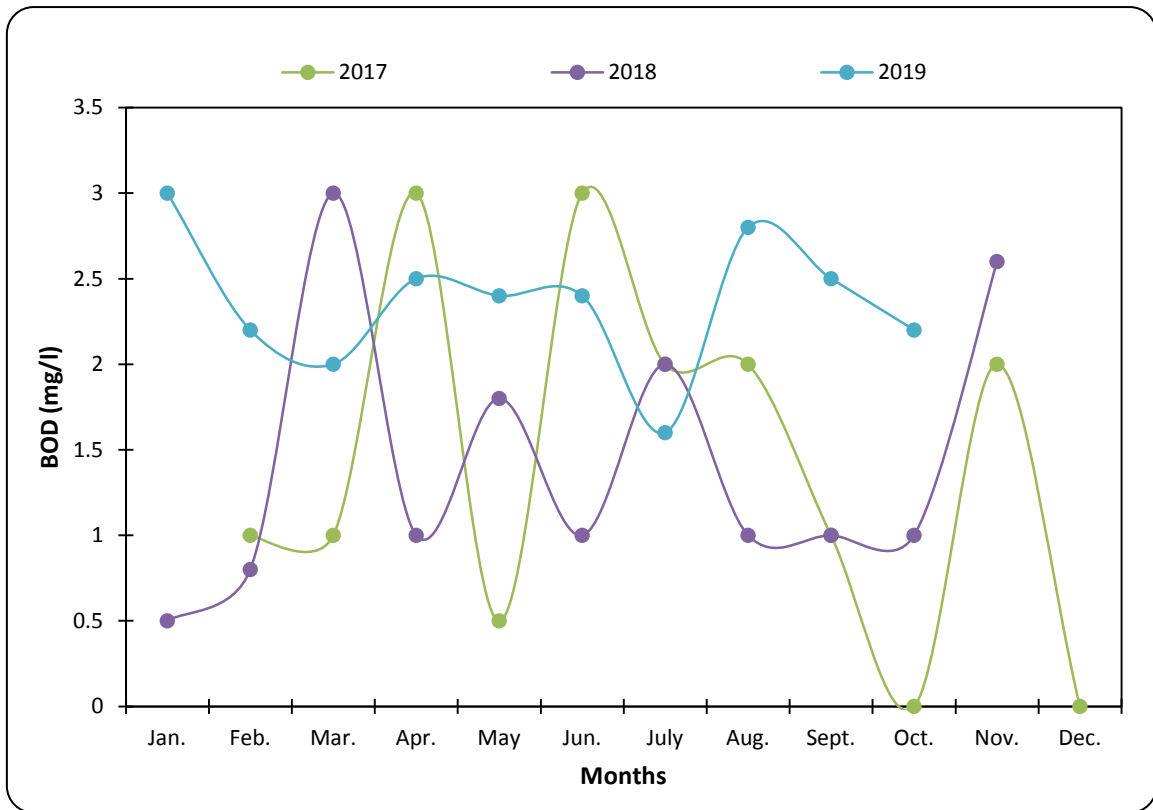


Fig. 4.34 BOD variations at Hathinikund

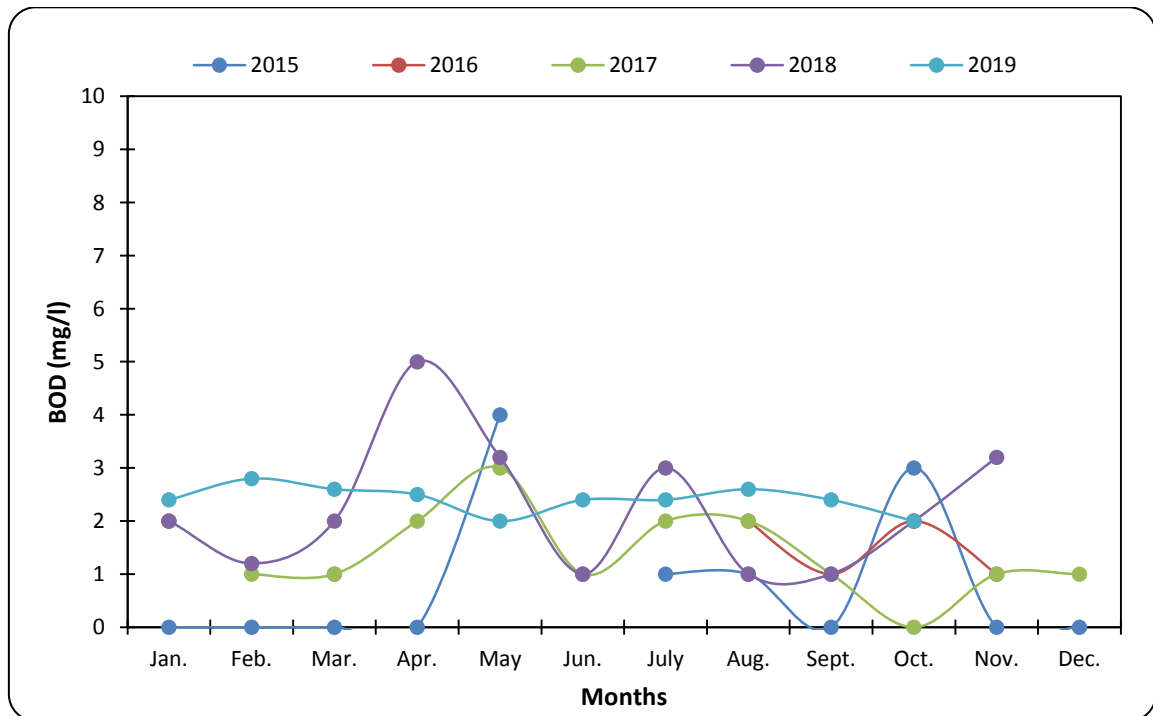


Fig. 4.35 BOD variation at Yamunanagar/ Kalanaur

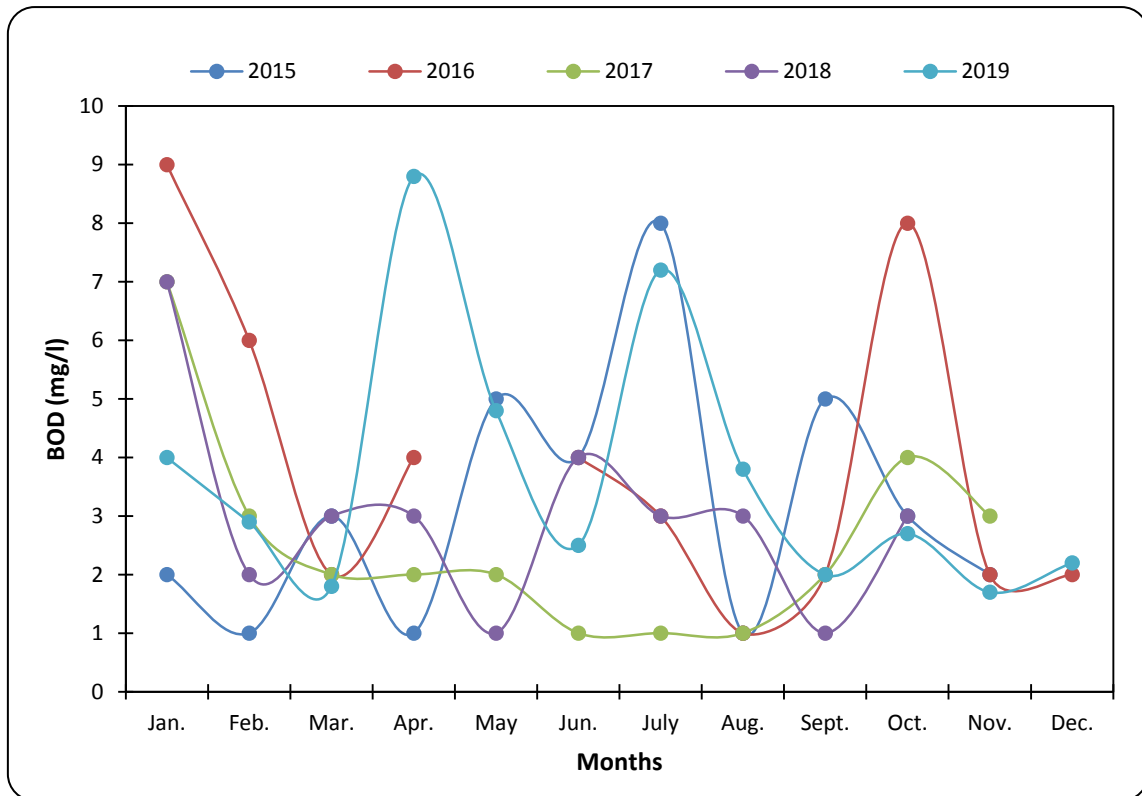


Fig. 4.36 BOD variation at Wazirabad

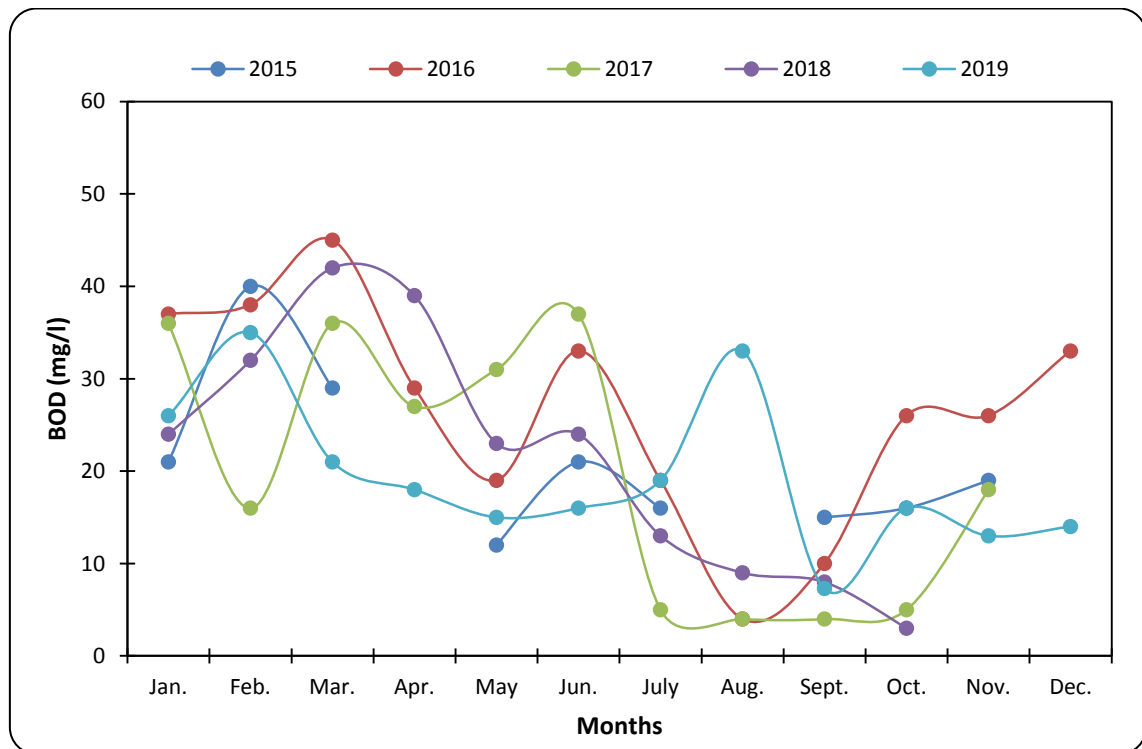


Fig. 4.37 BOD variation at Delhi Railway Bridge

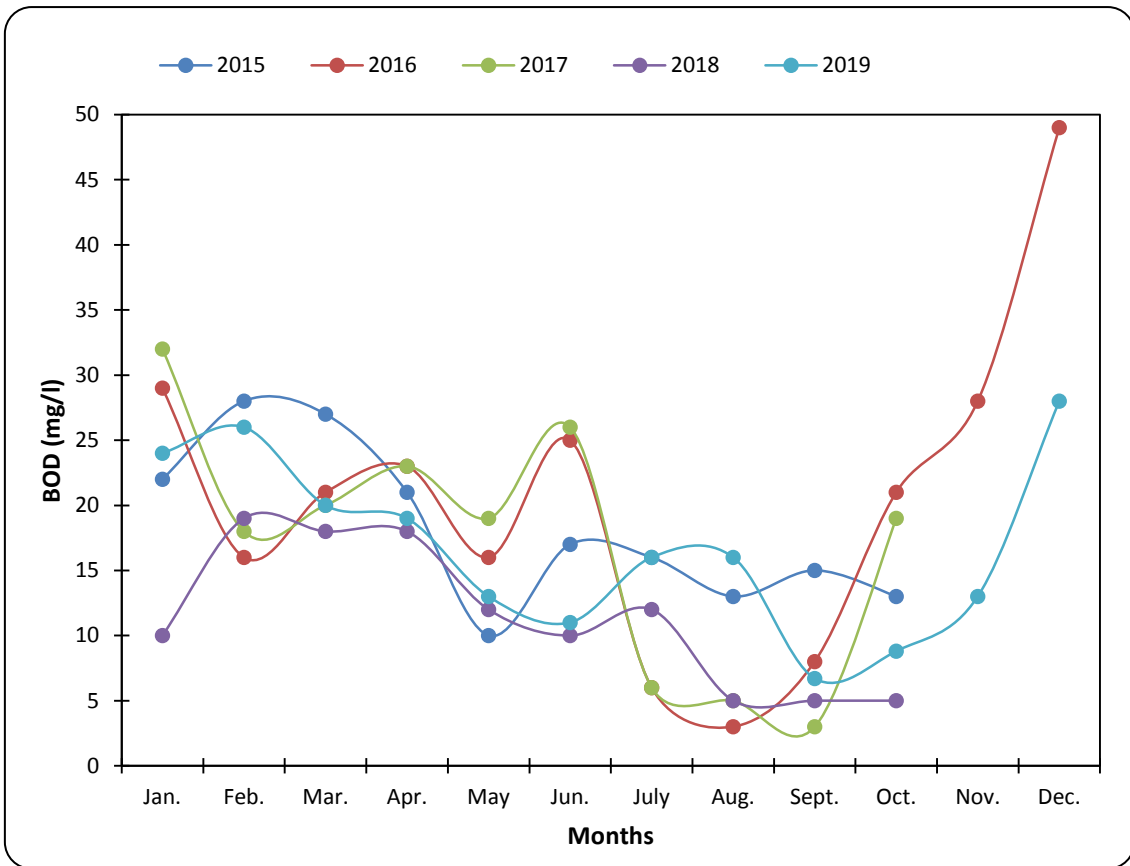


Fig. 4.38 BOD variation at Okhla

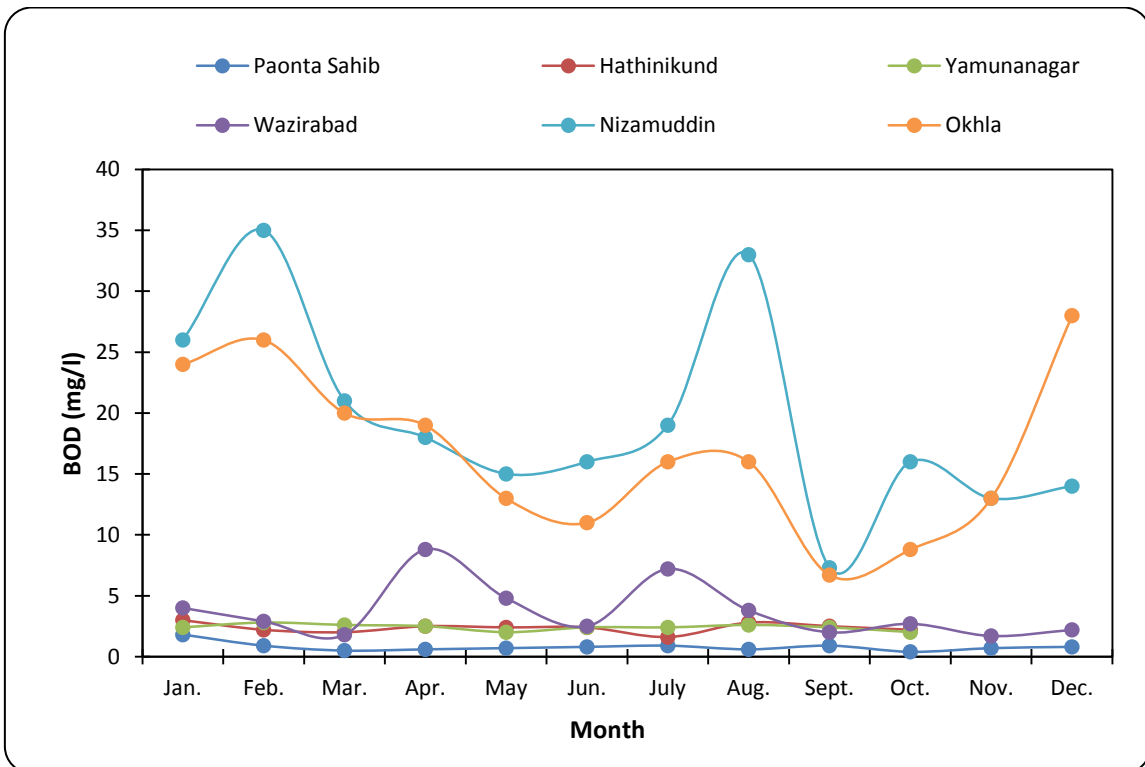


Fig. 4.39 BOD variation at different locations during 2019

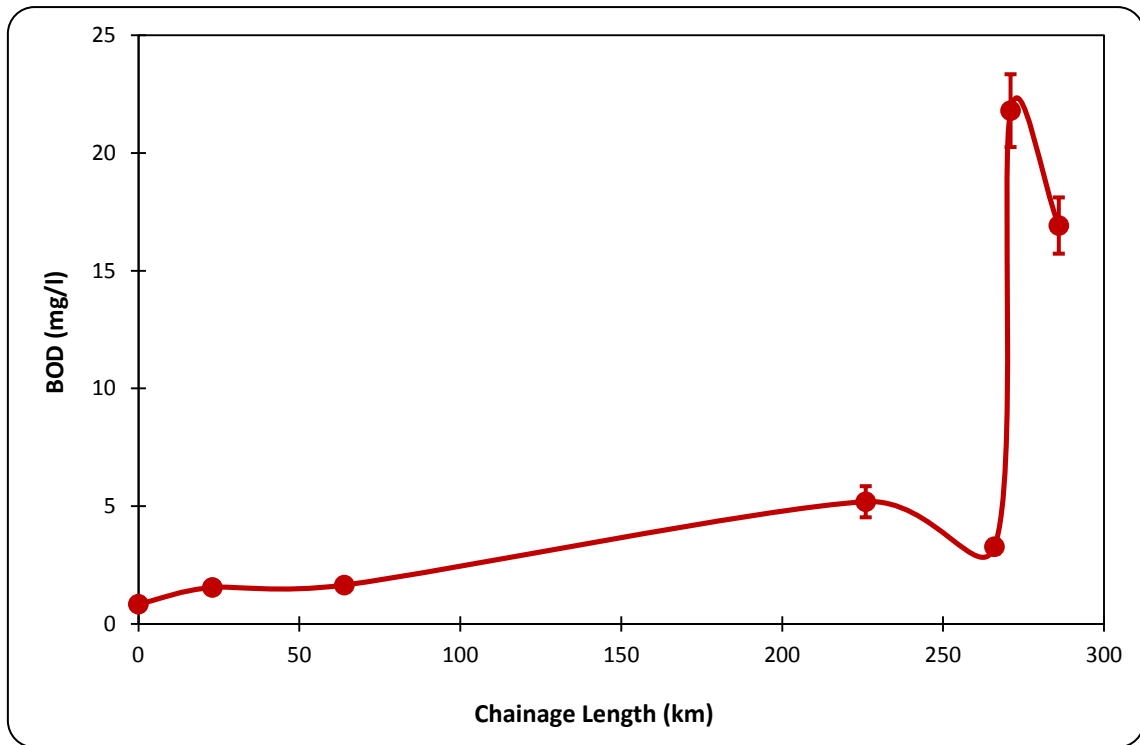


Fig. 4.40 Average annual BOD variation at different locations – Paonta Sahib (0 km), Hathinikund (23 km), Yamunanagar (64 km), Sonipat (226 km), Wazirabad (266 km), Nizamuddin (271 km), Okhla (286 km) (2015-2019)

Total Nitrogen: Excess nitrate is not toxic to aquatic life, but increased nitrogen may result in overgrowth of algae, which can decrease the dissolved oxygen content of the water, thereby harming or killing fish and other aquatic species. Total nitrogen concentration of less than 0.7 mg/l denotes good water quality, 0.7-1.5 denotes fair water quality, and greater than that represents poor water quality and eutrophic state. Total Nitrogen values in the Yamuna River was in the range of 0.001 – 119 mg/L (Fig. 4.41-4.45). The nitrogen concentration in the river water is on the higher side i.e. more than 1.5 mg/l from Paonta Sahib itself and in Delhi the concentration is almost 20 times higher during most of the time.

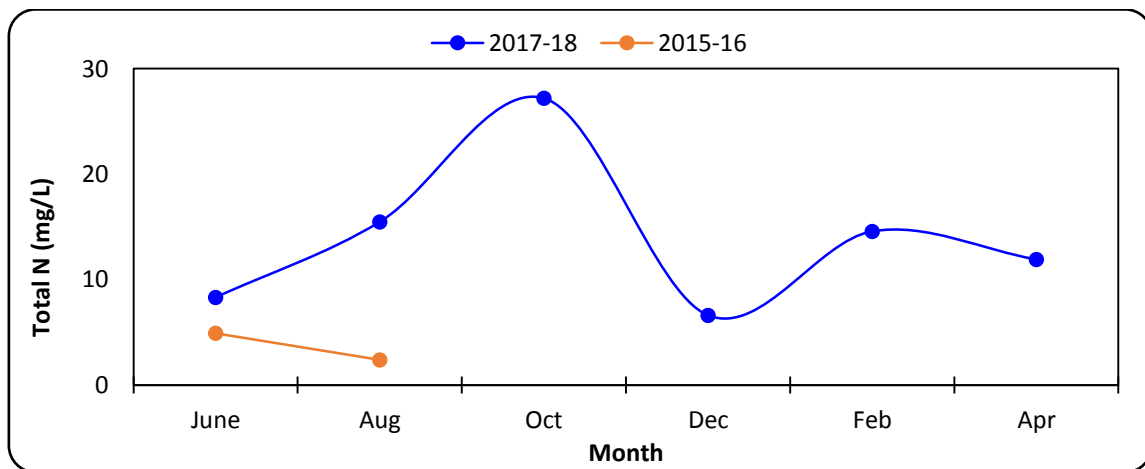


Fig. 4.41 TN variations at Paonta Sahib

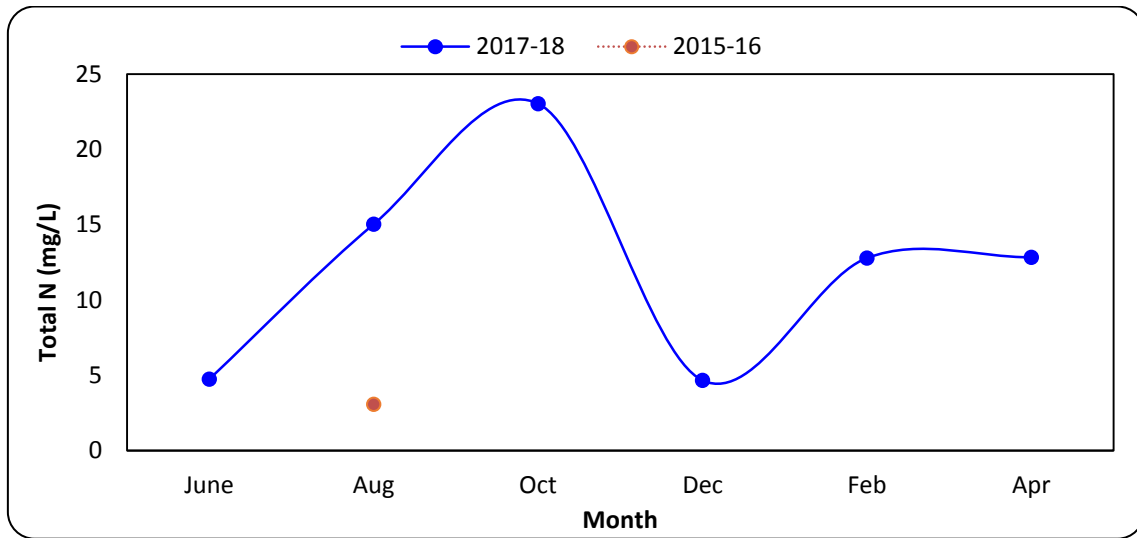


Fig. 4.42 TN variations at Yamunanagar/ Kalanaur

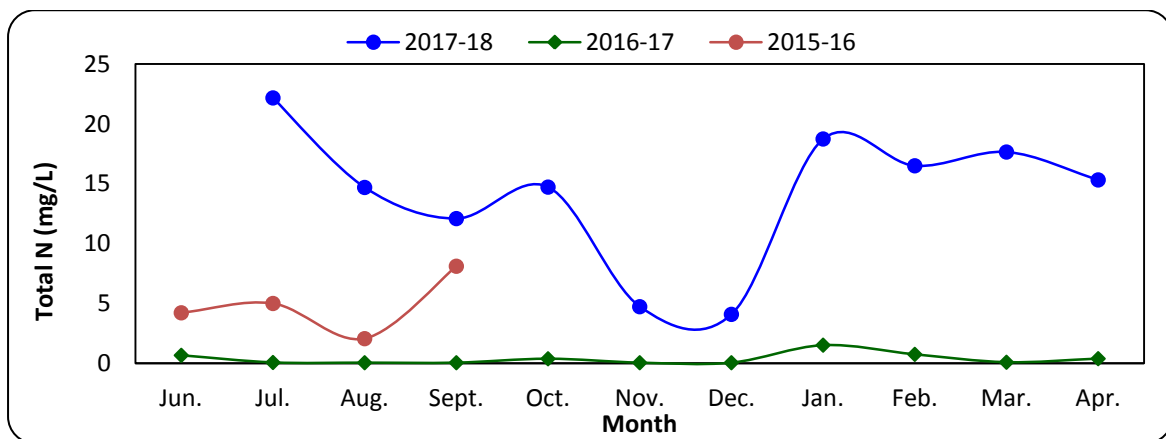


Fig. 4.43 TN variations at Panipat / Mawi

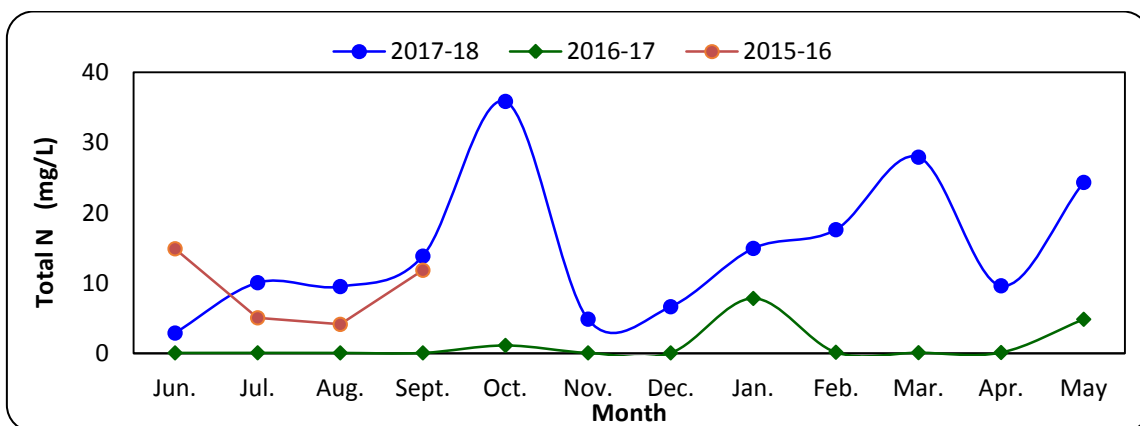


Fig. 4.44 TN variations at Sonipat / Palla

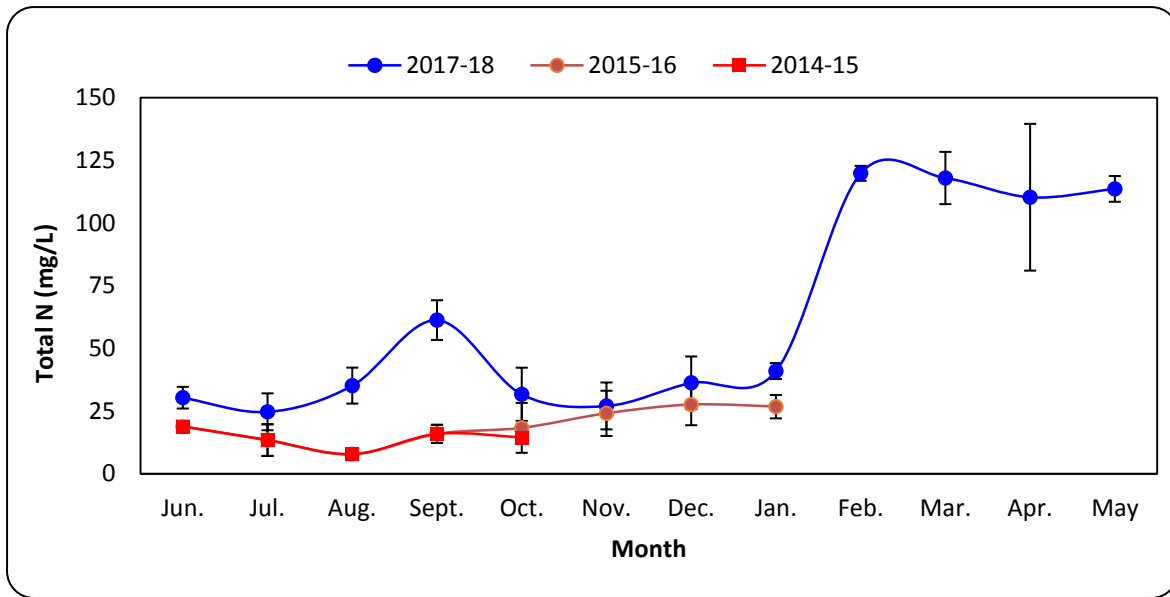


Fig. 4.45 TN variations at Delhi Railway Bridge

Total Phosphorus: TP is an essential nutrient for all life forms, but at high concentrations the most biologically active form of phosphorus (orthophosphate) can cause water quality problems by overstimulating the growth of algae. TP concentration of less than 0.025 mg/l denotes good water quality, 0.025-0.075 mg/l denotes fair water quality, and greater than 0.075 mg/l represents poor water quality and eutrophic state. The TP concentration in the river varied from 0.001 mg/l to 13.4 mg/l. Maximum concentration was observed at Delhi (Fig. 4.46-4.50).

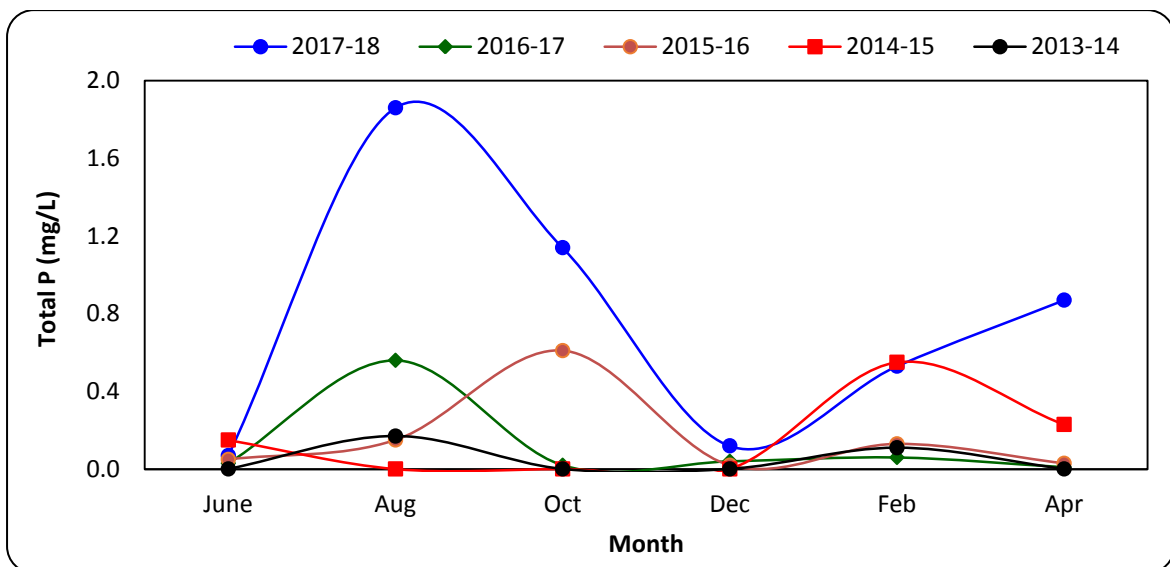


Fig. 4.46 TP variations at Paonta Sahib

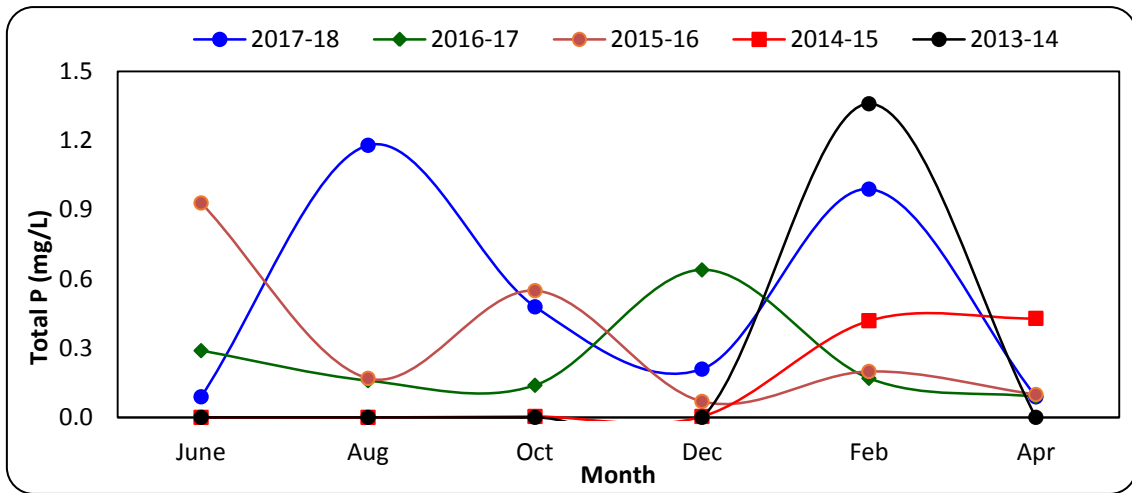


Fig. 4.47 TP variations at Yamunanagar/ Kalanaur

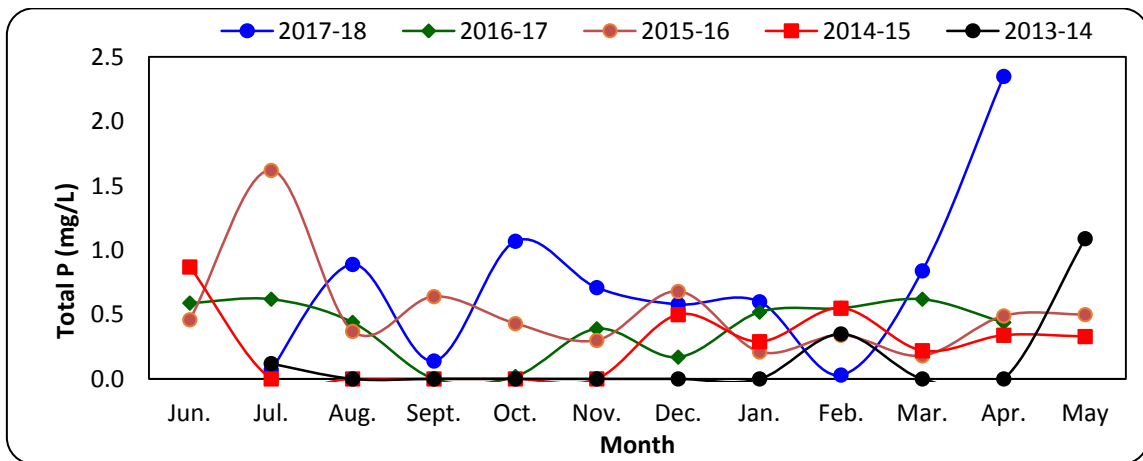


Fig. 4.48 TP variations at Panipat / Mawi

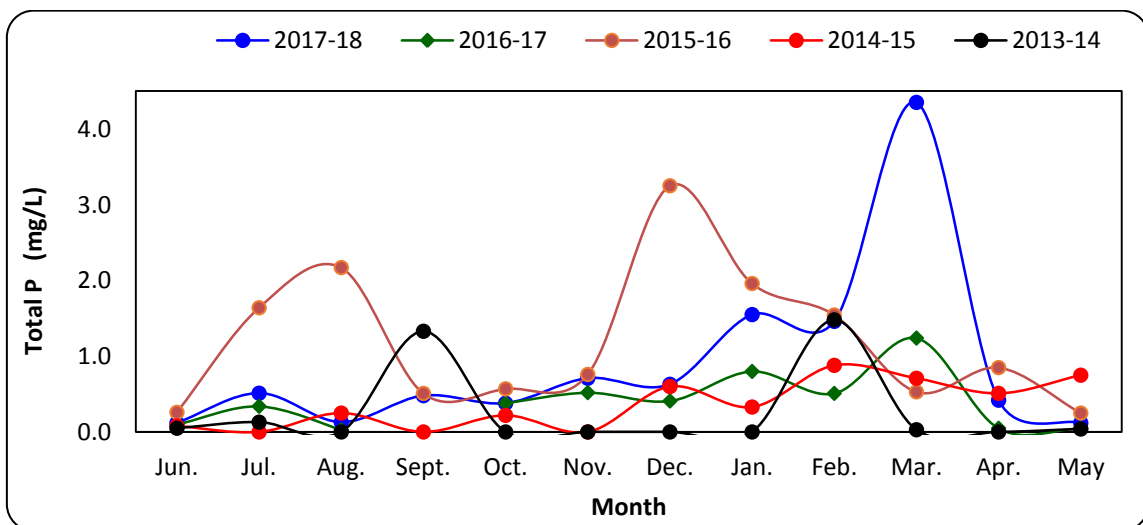


Fig. 4.49 TP variations at Sonipat / Palla

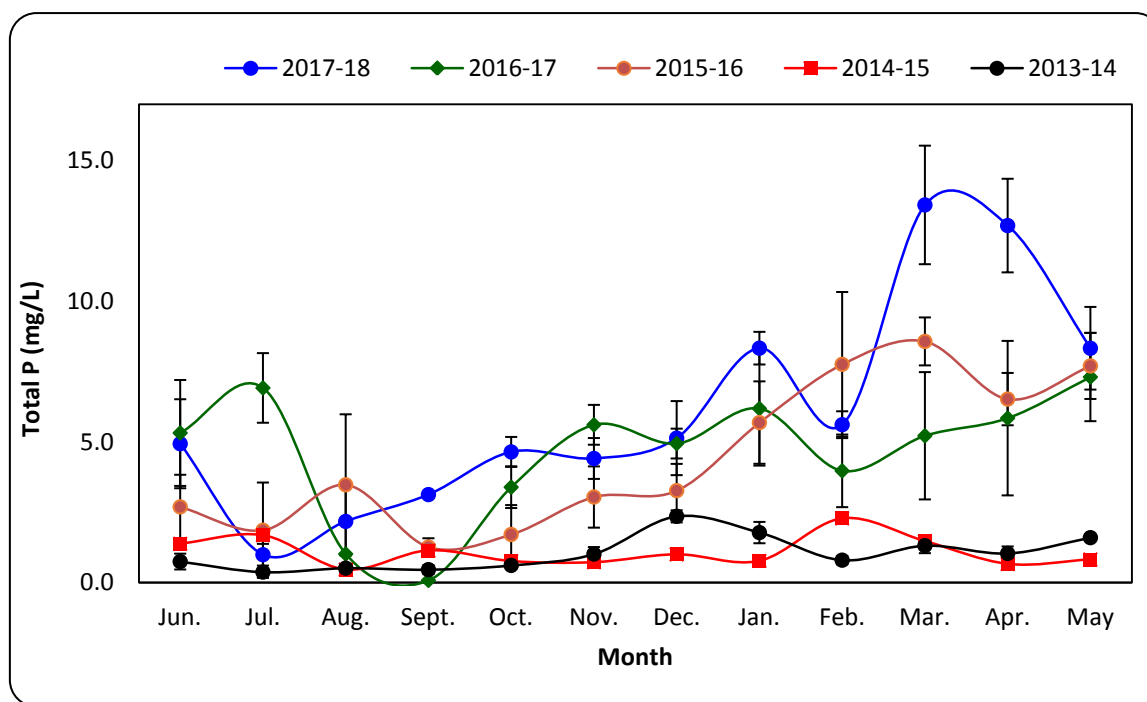


Fig. 4.50 TP variations at Delhi Railway Bridge

4.7.1 Pollutant load influx and river water quality

As discussed in the preceding sections, the water quality of Yamuna river starts deteriorating downstream of Yamunanagar / Kalanaur. Accordingly, flow and BOD concentrations of drains meeting River Yamuna were collected from CPCB, New Delhi, and Water Data Collection Division, Karnal, Haryana. The drain flow and BOD data were analysed for the pollutant load influx and impact on the river water quality. The average BOD load and flow for the non-monsoon season is provided in Fig. 4.51.

The average non-monsoonal BOD concentration in river water upto Kalanaur is less than 4 mg/l which is desired and indicates the healthy state of the river. In addition, the DO values were more than 6 mg/l indicating the conducive environment for the fishes to proliferate. It also indicates the high assimilative capacity of the river in this stretch. However, the influence of Drain 2 and Diversion drain 8 dumping significant amount of organic load in the river is clearly visible with the increase in BOD level and decrease in DO levels. For healthy fish environment, the DO levels in the river should not reduce below 50% of saturation value for significant periods. DO values less than 30% of saturation value are lethal to the coarse fish and results in fish deaths. Although, the BOD value of the river water increased, the DO levels in the river water were sufficient enough for the sustenance of aquatic life.

Below Wazirabad barrage upto Okhla barrage, the river receives approx. 6140 kg/hr BOD load out of which around 70% load is contributed through Nazafgarh drain. The average non-monsoonal DO value in the river stretch is 1.1 ± 0.14 mg/l as O_2 . However, during the field survey by NIH team, the DO value in this stretch was non-detectable indicating the BOD load to the river higher than the assimilative capacity of the river.

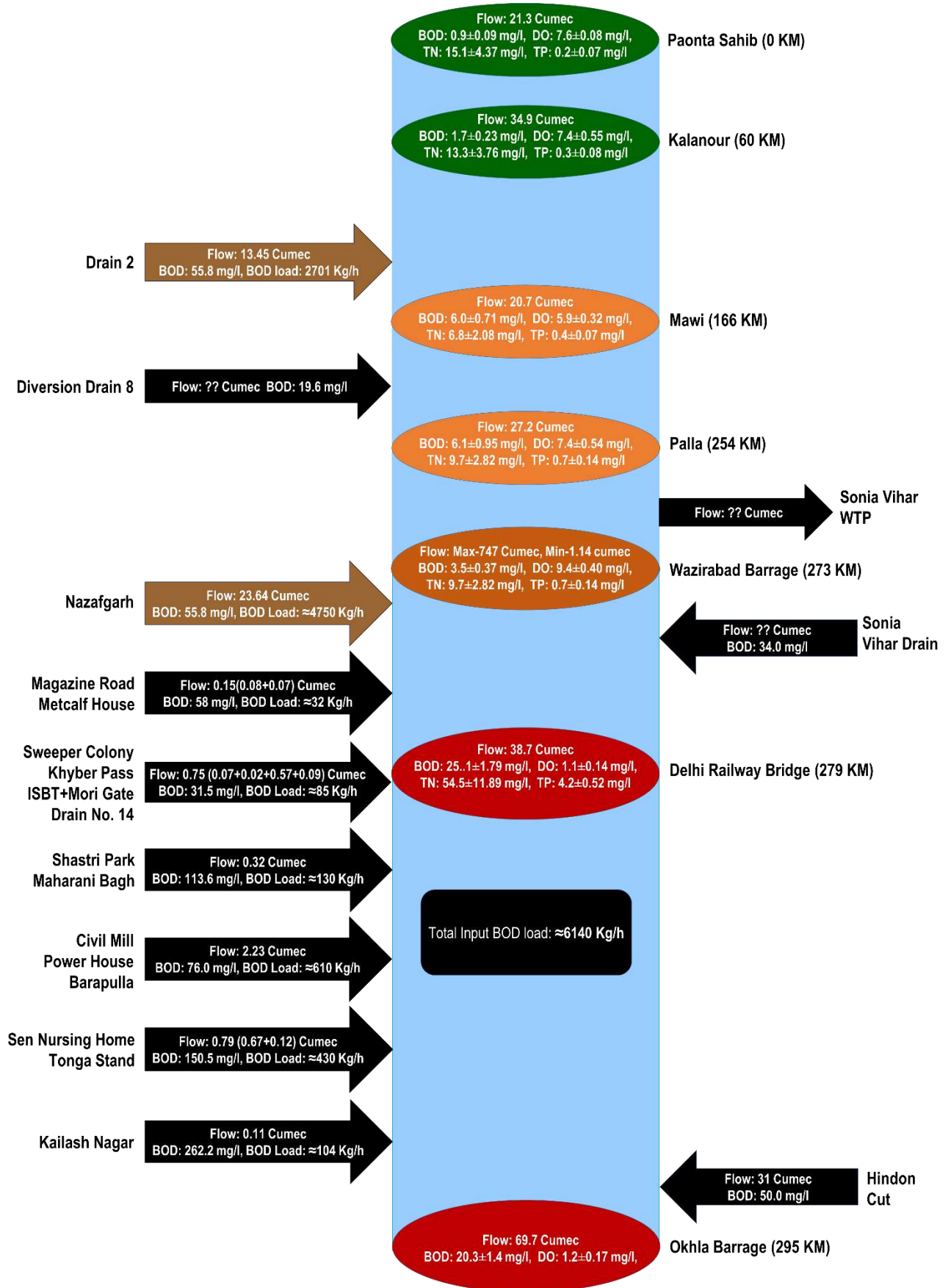


Fig. 4.51 Pollutant load influx and river water quality

When organic matter is discharged into a watercourse it serves as a food source for the bacteria present there, which sooner or later commence the breakdown of this matter to less complex organic substances and ultimately to simple compounds such as carbon dioxide and water. If previously unpolluted, the receiving water will be saturated with dissolved oxygen (DO), or nearly so, and the bacteria present in the water will be aerobic types. Thus the bacterial breakdown of the organic matter added will be an aerobic process - the bacteria will multiply, degrading the waste and utilising the DO as they do so. This is happening in River Yamuna upto Wazirabad Barrage.

If the quantity of organic waste present is sufficiently large, the rate of bacterial uptake of oxygen will outstrip that at which the DO is replenished from the atmosphere and from photosynthesis. Subsequently, the anaerobic bacteria become active and utilize the oxygen in sulphate (SO_4^{2-}) present in water and generate hydrogen sulphide resulting in obnoxious odour. This is the case with the river stretch below Wazirabad barrage.

From the above, it can be concluded that Delhi is the most critical stretch of Yamuna, however, the contamination starts from Paonta Sahib as is evident from the nutrients concentration in the river. In terms of organic contamination, the stretch downstream of Mawi is contaminated and needs immediate attention. The DO values also indicate the same. Although, the water quality upto Wazirabad barrage is good for fish proliferation, the reduction in DO values is a concern. The river is almost dead below Wazirabad barrage.

4.7.2 Impact of e-flow release on river water quality

The proposed e-flow for maintaining 0.60 m depth will require release of approx. 22.81-43.66 cumec flow from Hathnikund barrage during non-monsoon period, resulting in approx. 9.49-64.14 cumec of flow becoming available at Wazirabad. If this flow will be discharged in the river, it will result in dilution and reduction in BOD concentration of river from 25 mg/l to approx. 12-21 mg/l, with highest concentration in May. This dilution will not lead to elimination of emanating bad odour and sustenance of aquatic life. For achieving BOD concentration of around 5 mg/l, 10 time dilution will be required, requiring an addition flow of approx. 390 cumec which is not a sustainable solution. Instead, treatment of the incoming drains carrying sewage / wastewater is recommended as more viable solution.

Way Forward: The diurnal variation in the river water quality for pH, temperature, conductivity, dissolved solids, DO, BOD, nutrients (N & P), phytoplanktons, alkalinity, and microbes is required to be monitored for the non-monsoon period for computing the assimilative capacity of the river and better understanding of river quality.

Chapter 5

INTEGRATED HYDROLOGICAL AND HYDRODYNAMIC MODELING

5.1 Integrated Modeling Approach

The integrated hydrologic and hydrodynamic modeling approach has been adopted to assess e-flows between Hathnikund barrage and Okhla barrage on Yamuna river and compute the releases required from Hathnikund barrage for maintaining these e-flows. The hydrological model SWAT has been used to simulate streamflow (discharge), overland flow, groundwater recharge, evapotranspiration (ET) and total water yield in the study reach of Yamuna. For model calibration and validation, observed discharge available for the years 1977-1981 and 2001-2016 at five gauging sites (i.e. Kalanaur, Karnal, Mawi, Baghpat and Delhi Railway Bridge) have been compared with simulated flow conditions. After calibration and validation, the virgin flows (considering no structure between Paonta Sahib and DRB) have been computed and compared with regulated flows (considering Hathnikund barrage downstream of Paonta Sahib). For the hydrodynamic analysis of streamflows in the study reach of Yamuna river, the one dimensional (1D) hydrodynamic model HEC-RAS has been employed and the hydrodynamic variables such as maximum water depth, hydraulic depth, wetted perimeter, top width and water velocity for the range of discharges as available at Hathnikund barrage have been computed at different sections of the river. HEC-RAS has been used to derive depth vs discharge curves at different river sections. These curves have been further utilized to estimate the minimum flows, based on SWAT modeling, that are required to be released from Hathnikund barrage for maintaining suitable physical habitat for indicator fish species for the whole river reach from Hathnikund to Okhla barrage.

5.2 Hydrologic Modeling using SWAT

The key points of employing SWAT in the present study are given below:

- **SWAT Model:** Hydrological model setup to generate regulated (controlled) and unregulated (virgin) discharge scenarios at different gauging sites between Hathnikund and Okhla Barrage.
- **Data Inputs:** Model data inputs comprise different physical/topographical data layers such as SRTM 30 meter DEM, Landuse/Landcover (LULC) map, soil map with multiple parameters, and observed meteorological variables such as daily minimum-maximum temperature, precipitation, solar radiation, wind speed and humidity.
- **SWAT Simulation:** Simulation runs at daily time step.
- **Model Calibration:** Multi-site calibration performed in SWATCUP by applying SUFI2 method utilizing daily observed discharge available at different sections of the river.
- **Computation of Unregulated (virgin) Discharge:** To estimate the availability of flows at different gauging sites during lean/ non-monsoon season.

5.2.1 Generation of database for hydrologic modelling

The watershed characteristics of Yamuna river (from Hathnikund to Okhla barrage) are shown in Fig. 5.1. The map also illustrates the gauging sites (discharge), various inlets (water

sources meeting Yamuna river) and outlets (sources diverting water from the Yamuna river) for which the respective data was available. The LULC and soil maps of the region are also shown in Fig. 5.1 which are required for hydrologic modeling using SWAT (refer Chapter 3). Necessary meteorological parameters such as rainfall etc. were also processed.

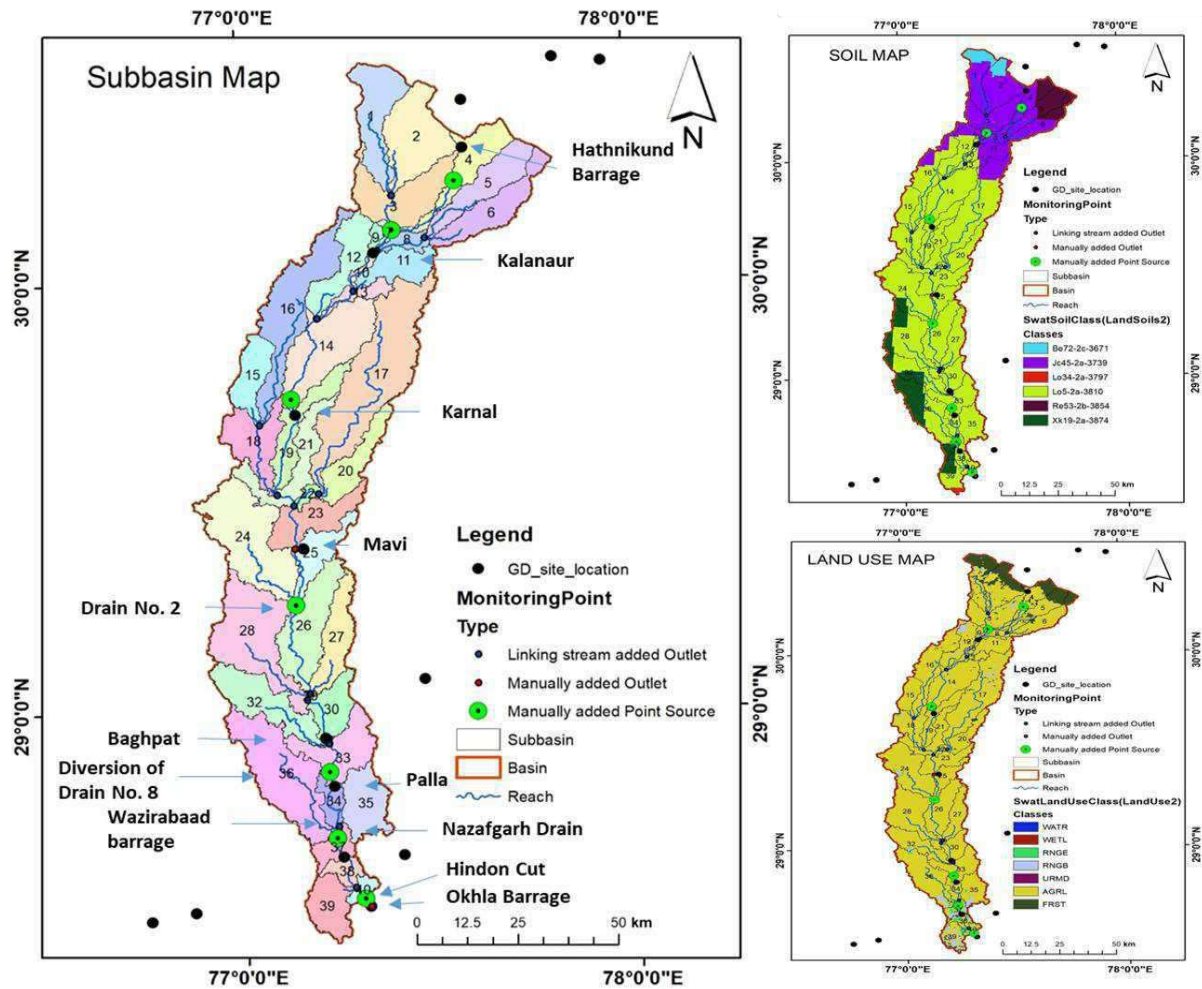


Fig. 5.1 Sub-basin wise watershed characteristics of Yamuna river (from Hathnikund to Okhla barrage) along with LULC and soil maps.

5.2.2 Model calibration and simulation of flows

The SWAT model was setup for the entire study reach from Hathnikund to Okhla barrage. For model calibration and validation, data pertaining to the periods 1977-1981 and 2001-2016 was utilized. The data corresponding to the period 1977-1981 was specifically employed to evaluate baseflows prior to the commencement of large groundwater withdrawals in the region and have been assumed to simulate the scenario similar to pre-regulated conditions. The optimization algorithm, SWAT Calibration and Uncertainty Program (CUP) based Sequential Uncertainty Parameter Fitting Approach 2 (SUFI2), was applied for the model calibration, validation, and parameterization. For calibration, a multi-site calibration scheme has been implemented and the parameters were optimized. In SUFI2, modified Nash-Sutcliffe (MNS) and coefficient of determination R^2 equations have been used as an objective function. The results of calibration and validation, for both time periods, are illustrated on a monthly time scale in Fig. 5.2 through the regression plots. The

calibration and validation results for all gauging stations are found to be satisfactory with $R^2 \geq 70\%$ (maximum $R^2 = 0.99$).

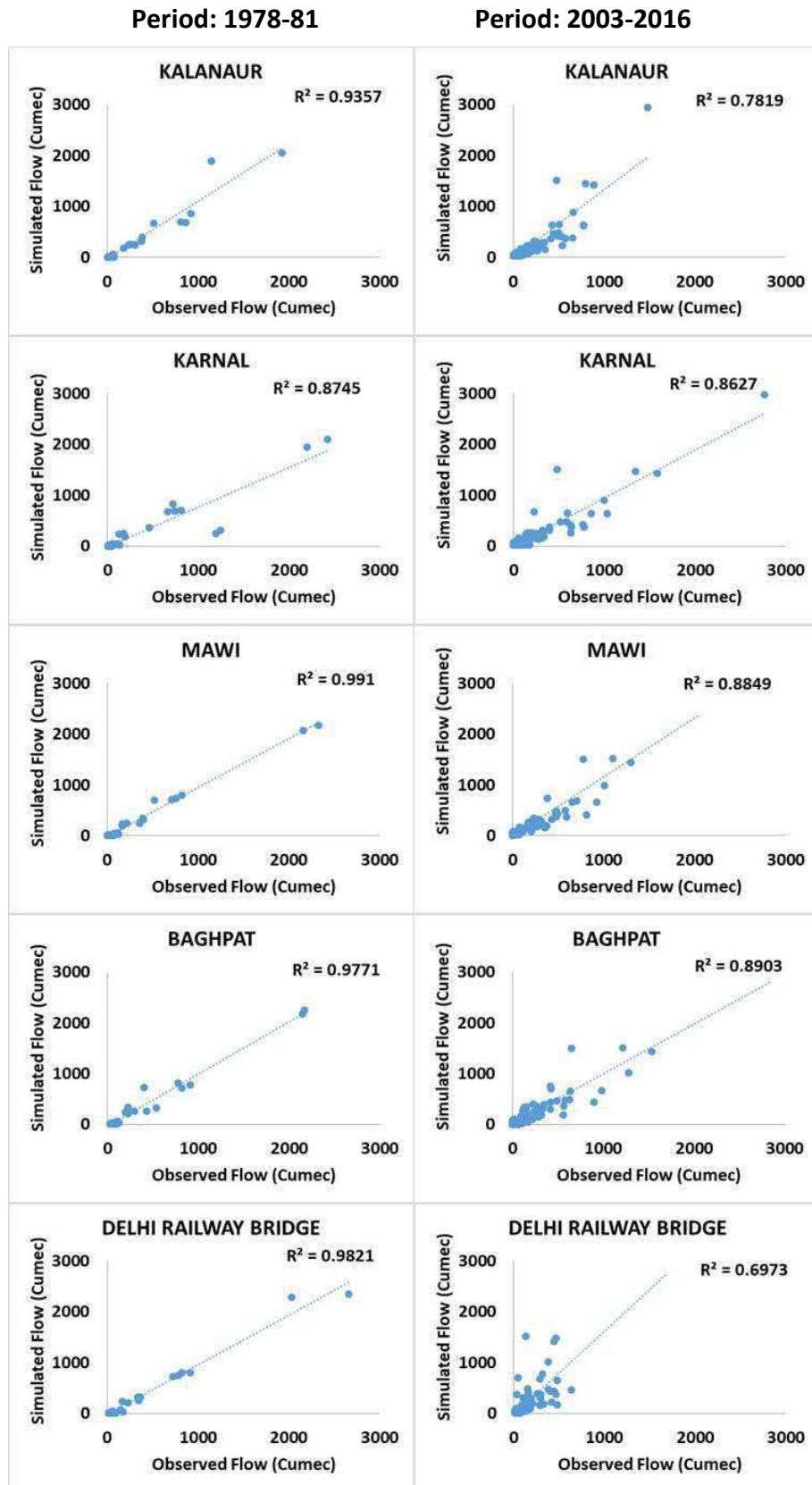


Fig. 5.2 Results of calibration and validation from SUF2 at five gauging locations during 1978-1981 and 2003-2016.

5.2.2.1 Unregulated versus regulated flows

(a) Period 1977-1981

To compare the virgin flows (considering no structure at Hathnikund) versus regulated flows (considering the presence of barrage at Hathnikund), the SWAT model was calibrated against the observed flows monitored during 1977-1981 at the five gauging sites. Subsequently, the optimized parameter values such as curve number, groundwater delayed flow, baseflow etc. were incorporated in SWAT to simulate the virgin flows downstream of Yamuna river (from Hathnikund to Okhla).

Since major groundwater withdrawals commenced in the 1980s, it has been presumed that the model calibration parameters pertaining to the period 1977-81 can be employed in SWAT to simulate the unregulated flow conditions and assess the groundwater contribution to the non-monsoon flows in the Yamuna river. The calibrated parameter values during this time period have been implemented in SWAT for the period 2001-2016. The simulated regulated and non-regulated flows for the years 1977-1981 are shown in Fig. 5.3

As mentioned in Chapter 4, a total of 14 unique locations (including the 05 gauging sites) have been identified in study reach between Hathnikund and Okhla barrages to illustrate the simulated flows. Time series plots for each of these locations shown in Fig. 5.3, compare the availability of flow at the given location during both regulated and unregulated conditions. These time series plots highlight the flow variability during monsoon and non-monsoon time periods, and help in assessing the changes in river flow from upstream end to downstream end of the study reach.

(b) Period 2001-2016

The calibrated model was used to generate the regulated and non-regulated flows for the existing conditions during the period 2001-2016 which correspond to the period of heavy groundwater withdrawals and lowering of the water table compared to the period 1977-81. The regulated flows have been compared with unregulated flows at the 14 identified locations (refer Fig. 5.4) to highlight variations (availability and losses) in discharge from the upstream end to the downstream end of the study reach. These plots aided in identifying significant losses and availability of minimum flows in the study reach.

5.2.2.2 Baseflows in the study reach

Figure 5.5 shows the long term monthly water balance components for the period 1978-81. Simulation runs corresponding to the period 1978-81 and 2003-2016 have shown that the baseflows have on an average decreased by upto 37% during the months of March, April and May. Hydrograph analyses using the baseflow filter program which is based on the digital filtering method have shown that maximum depletion is in the reach between Mawi and Baghpat during the months of April and May. Base flow index (BFI) is an important baseflow characteristic and indicates the contribution of baseflow to the river flow. A BFI close to 0.0 means a river has a low proportion of baseflow, while a BFI close to 1.0 shows a

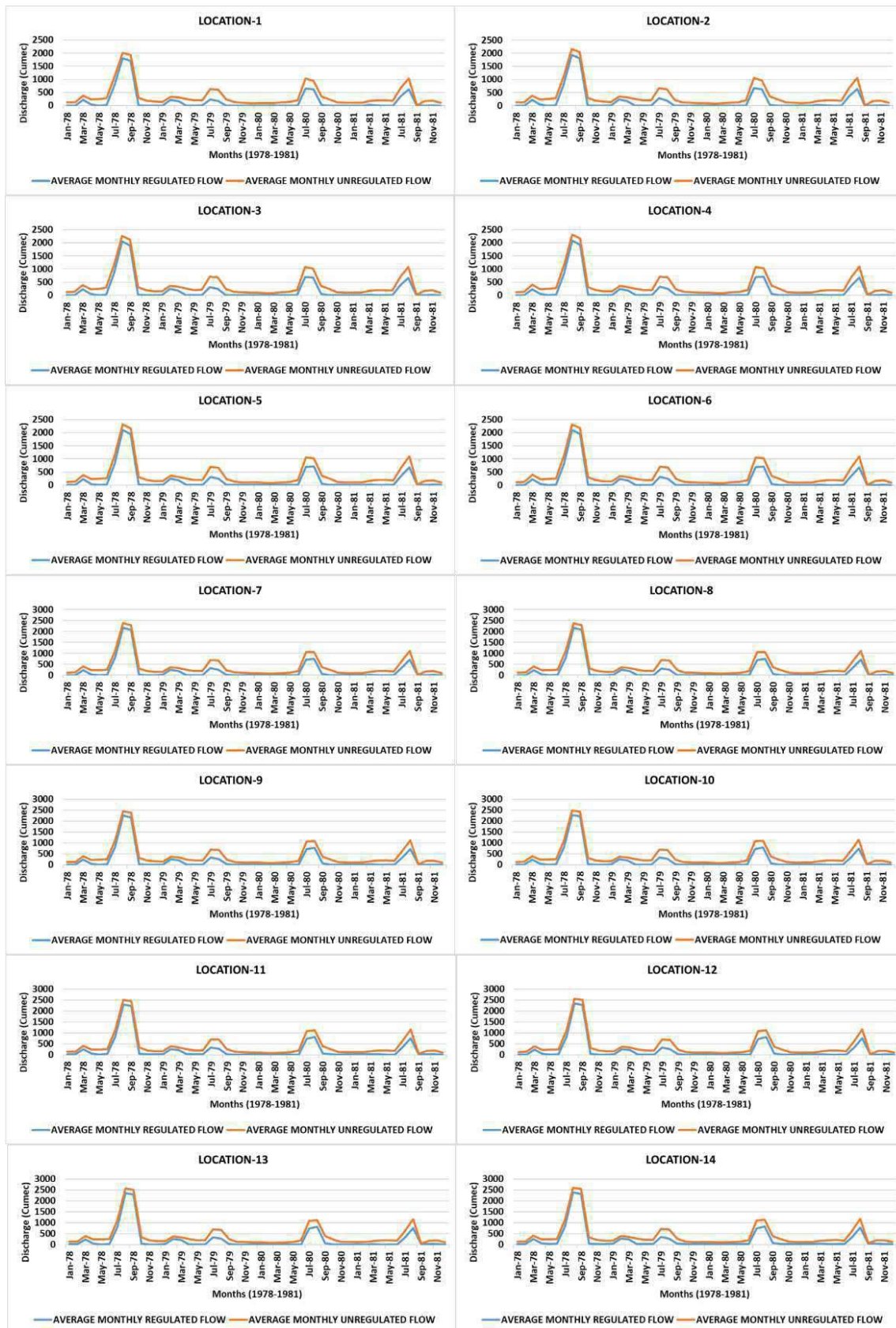


Fig. 5.3 Regulated vs unregulated flows during 1978-1981 at selected 14 locations in between Hathnikund to Okhla barrage.

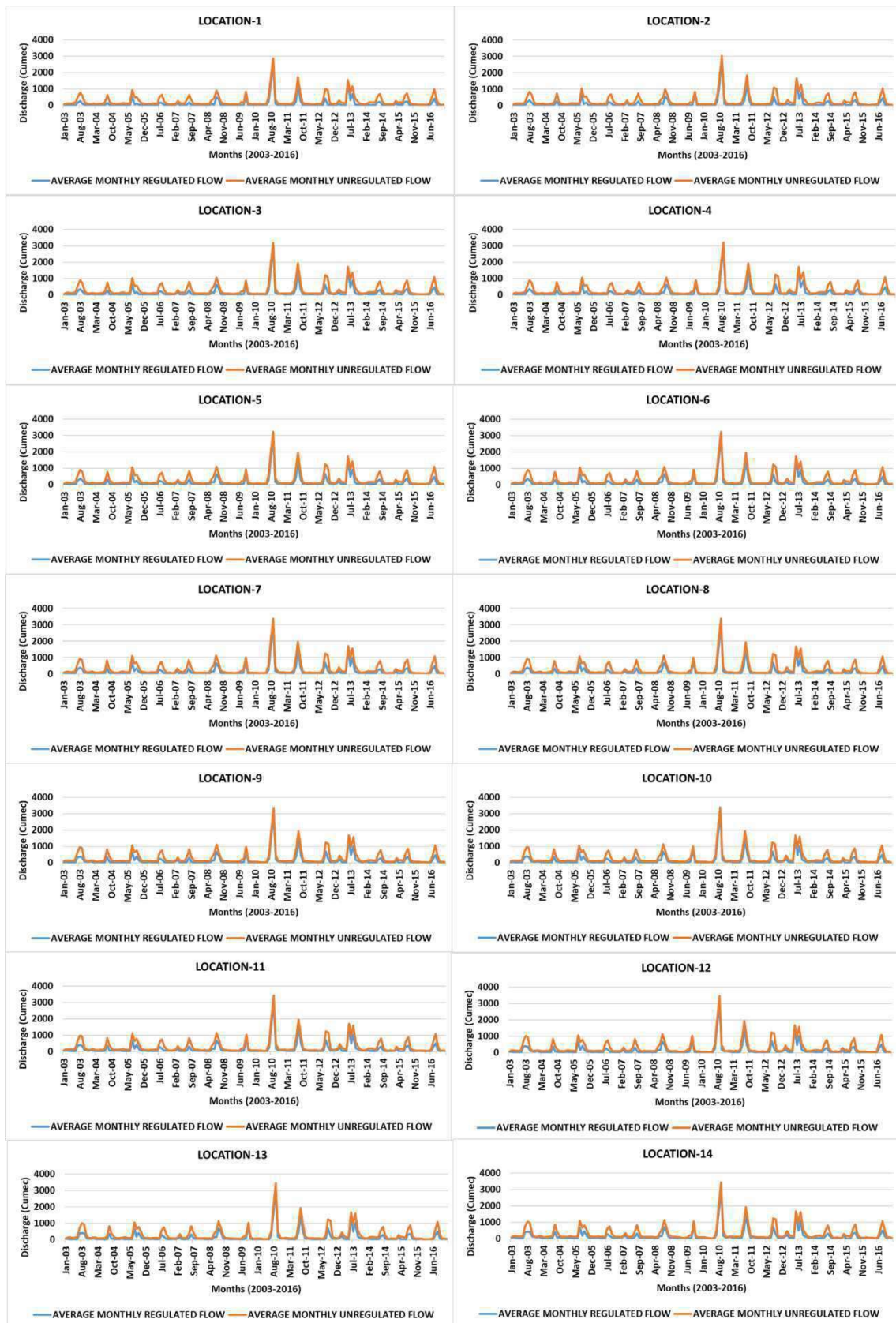


Fig. 5.4 Regulated vs unregulated flows during 2003-2016 at selected 14 locations in between Hathnikund to Okhla barrage.

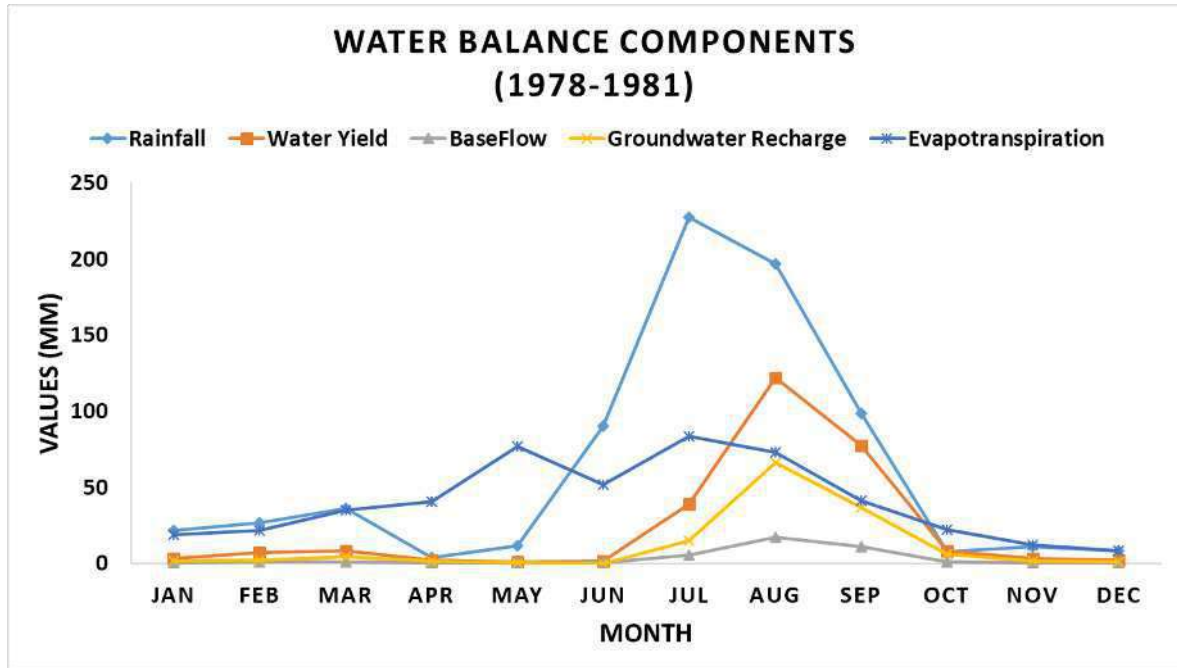


Fig. 5.5 Long term monthly water balance components (period 1978-81) for the study reach between Hathnikund and Okhla barrage

high proportion of baseflow. For the study reach, the ratio of baseflow to total river flow is found to be higher in the non-monsoon season than in the monsoon season, thus resulting in a higher BFI. This pattern is representative of other gauges in the study reach. A decreasing trend in BFI for all the seasons was found for Baghpat, and for non-monsoon and lean seasons for Mawi. Decreases in BFI are linked to prolonged over-abstraction of groundwater, which is evident from Figs. 4.5(a)-(d), that reveal declining groundwater levels in the Mawi-Baghpat reach. Figure 5.6 illustrates the declining trend of mean monthly baseflows for the month of May for Baghpat.

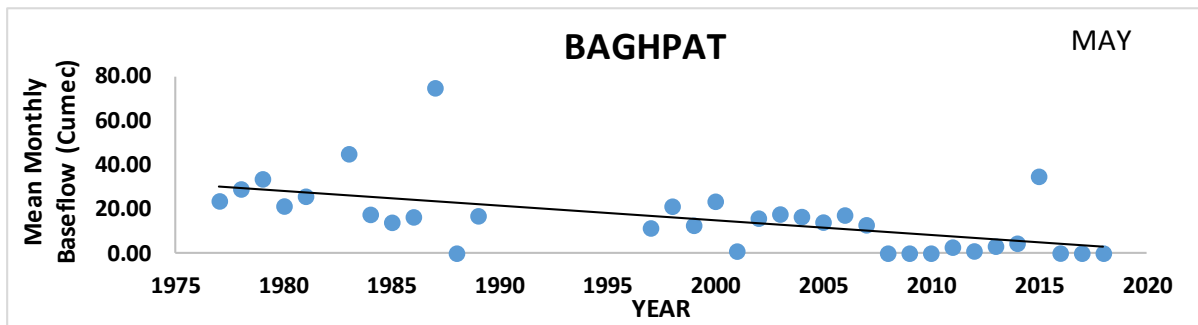


Fig. 5.6 Variation in mean monthly baseflows for the month of May for Baghpat

5.2.3 Conclusions from SWAT based analysis

The calibration and validation results show a good match between observed and simulated flows compared at the five gauge locations during the time periods 1978-1981 and 2003-2016. The calibrated model has been employed to simulate unregulated discharge (i.e.

virgin flows) at 14 locations (including the gauging sites) considering no structure at Hathnikund. Virgin flows at all gauging sites have been compared with the regulated flow conditions to estimate the actual flow availability as compared to regulated conditions downstream of Hathnikund barrage in River Yamuna for the time periods 1977-1981 and 2001-2016.

Simulations using the calibrated SWAT model for unregulated and regulated flows show that during the time period 1978-1981, significant amount of flow is available even during non-monsoon season for unregulated flow conditions (i.e. virgin flows) compared to the regulated conditions. In case of the non-monsoon scenario of time period 2003-2016, the average monthly regulated flow is further reduced during January and February at all the gauging sites compared to the non-monsoon scenario of time period 1978-81. Therefore, the simulated discharge scenarios from SWAT, generated at different locations between Hathnikund and Okhla barrage, are found helpful in the assessment of flow availability during both non-monsoon and monsoon seasons

5.3 Hydrodynamic Modeling using HEC-RAS

The key points of employing HEC-RAS in the present study are given below:

- **HEC-RAS 1D Model:** Hydrodynamic model setup to compute depth vs. discharge curves, water surface elevation, and velocity at different cross sections. These parameters are found necessary to compute the e-flows. Boundary conditions along with several hydrodynamic variables are necessary to setup HEC-RAS 1D for steady state analysis. For establishing the depth vs. discharge curves, several model runs were taken corresponding to boundary conditions at the upstream and downstream end of the study reach.
- **Boundary Conditions:** The upstream boundary condition comprise of steady flow values at Hathnikund barrage. These values were derived from probability analysis of observed inflows and releases at Hathnikund Barrage for dry, wet and normal years for different seasons (refer Section 5.4). Downstream boundary condition corresponds to normal depth computed from downstream slope value. Standard and measured hydrodynamic variables have been utilized to construct the HEC-RAS model.
- **Setup Cross-Sections:** Surveyed river cross-sections (total 306 sections; refer Chapter 4) at very close intervals were incorporated in the model to account for variations in discharge, flow depth and velocity.
- **Depth vs Discharge curves:** Depth vs discharge curves have been derived at different river sections (total 13 identified locations; 14th identified location corresponds to Okhla barrage) utilizing discharge for non-monsoon and monsoon seasons for the computation of e-flows.

5.3.1 Generation of Database for Hydrodynamic Modeling

HEC-RAS requires river cross-sections at various locations to compute the stage-discharge relationship at different sites in the river. Based on initial simulation studies performed using HEC-RAS, it was concluded that the HEC-RAS 1D model needs to be setup with river cross-sections spaced at very close intervals to maintain high accuracy in the simulated values, especially for studies pertaining to assessment of e-flows. Further observations are noted below.

- As per the initial HEC-RAS simulation using high resolution DEM, it was observed that river cross-sections generated from DEM do not provide smooth profile and vertical accuracy, therefore, computational uncertainty (or error) in the results is enhanced.
- Surveyed river cross-sections from CWC were not spaced at sufficiently close intervals and could not account for significant variability of flows and depths in the study reach.
- Several surveyed river cross-sections obtained from CWC did not cover the whole flood plain of Yamuna. An attempt was made to extrapolate these values from DEM, which gave lot of computational errors (in terms of abnormal depths and velocities in many sections).

In the first stakeholder committee meeting, experts suggested that for generation of accurate e-flows, high precision and cross-sections at close intervals are needed; DEM generated cross-sections should not be relied upon. Therefore, necessary field surveys were carried out to determine river cross-sections at every at 1 km (with an interval of 250 m near gauging or confluence sites) in the study reach.

Total locations where spacing interval was 250 m within a distance of 1 km are 14 in number, with the 14th location falling at Okhla barrage (refer Table 4.3). At each such location, 05 cross-sections were surveyed located 250 m apart within a reach of 1 km. The details of field survey undertaken to obtain river cross-sections at close intervals are provided in Chapter 4.

All these surveyed cross-sections were incorporated in HEC-RAS to generate the hydrodynamics variables such as depth etc. As an illustration, cross sections at 13 locations in HEC-RAS are shown in Fig. 5.7. The Manning's roughness coefficients for the study reach were obtained from CWC.

5.3.2 Simulation of Flows using HEC-RAS

For the computation of flows, water depth, and velocities, the HEC-RAS model has been setup and simulations were performed in the selected reach of Yamuna river from Hathnikund to Okhla barrage. The HEC-RAS setup and cross section details are presented in Fig. 5.8. The HEC-RAS based outputs (in form of maps) have been shown in Fig. 5.9, which illustrate the hydrodynamic characteristics of the selected portion of Yamuna river.

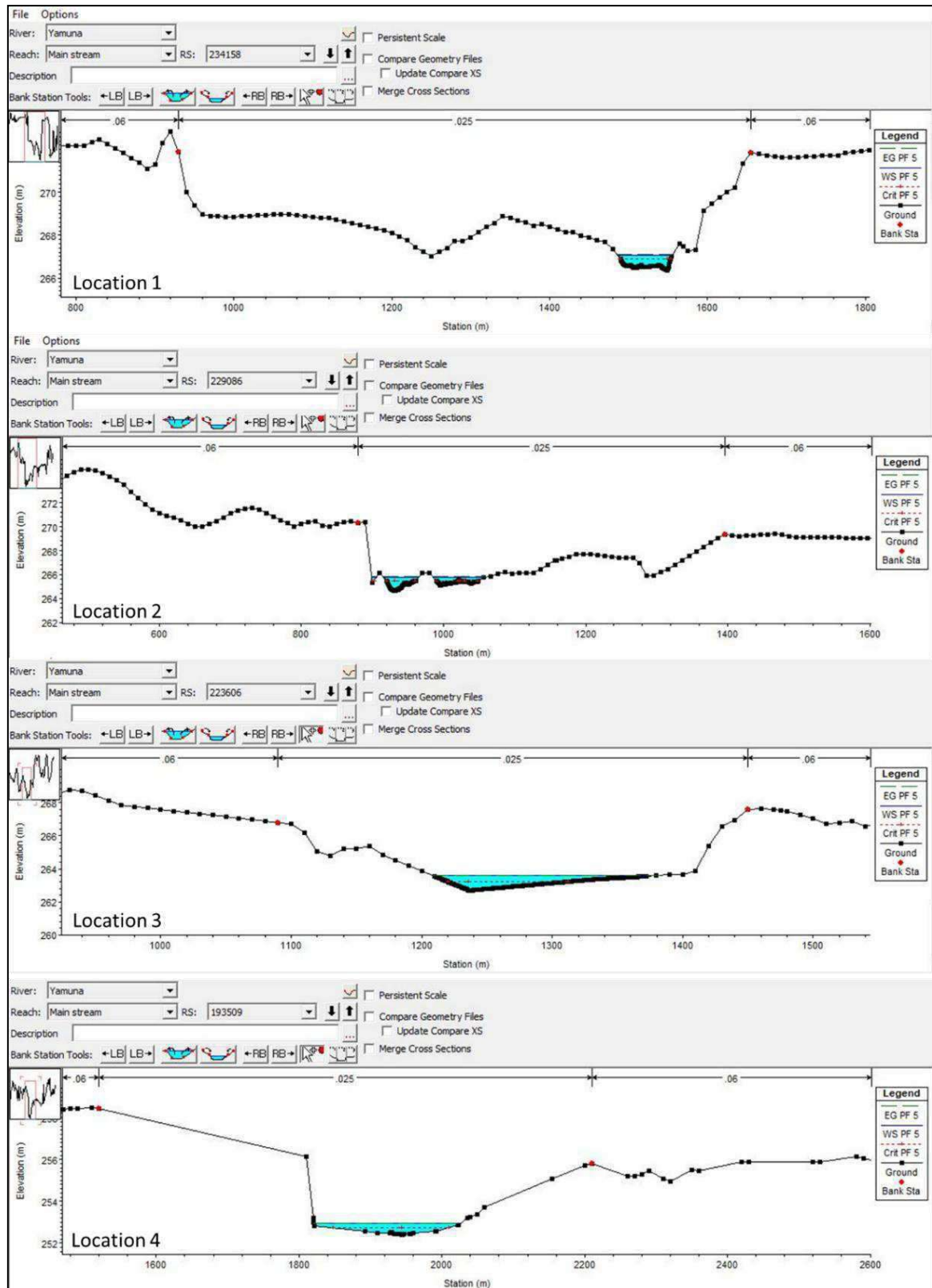


Fig. 5.7 Cross sections showing water level plotted at 13 locations from Hathnikund to Okhla (contd...)

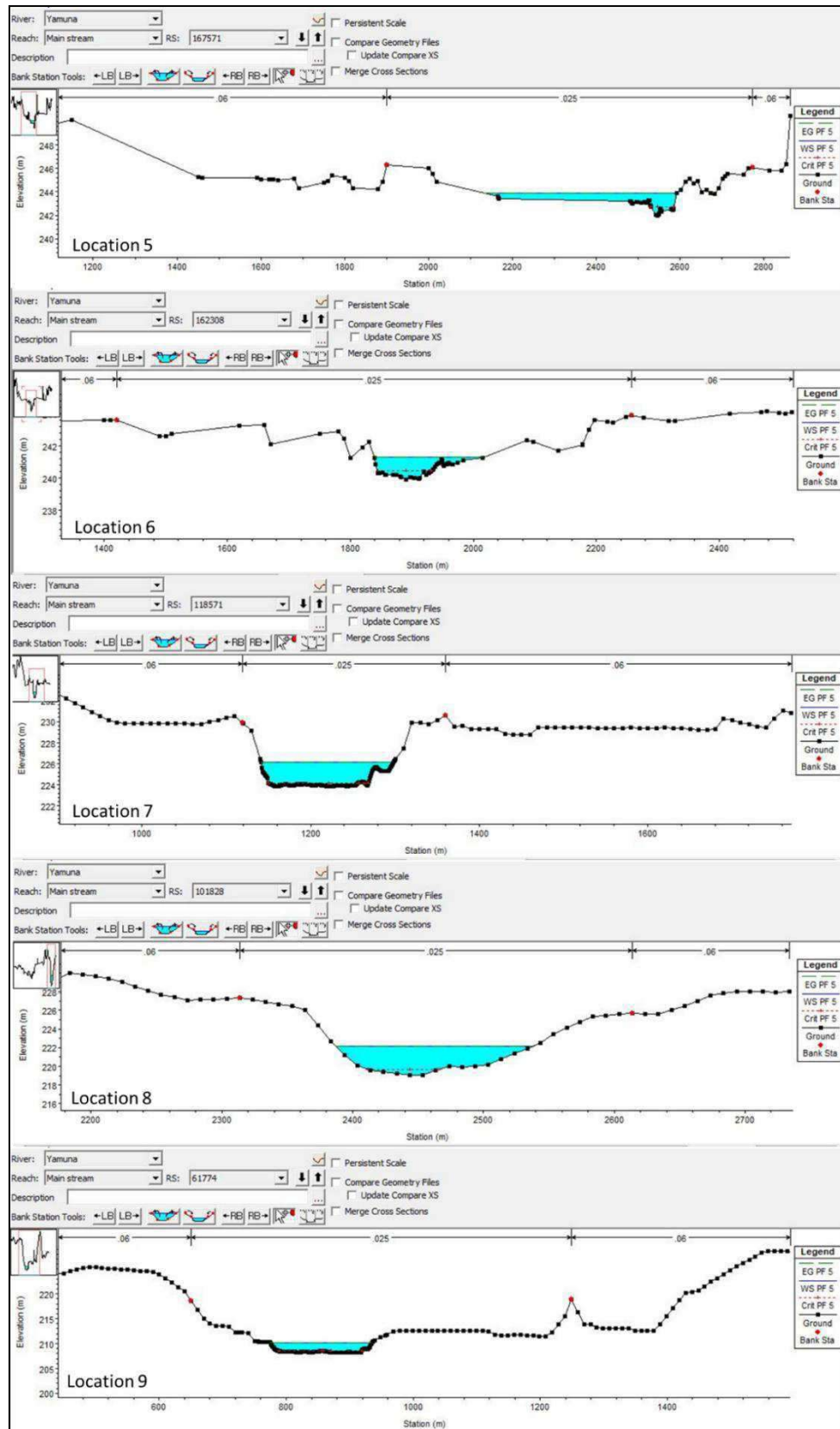


Fig. 5.7 Cross sections showing water level plotted at 13 locations from Hathnikund to Okhla (contd...)

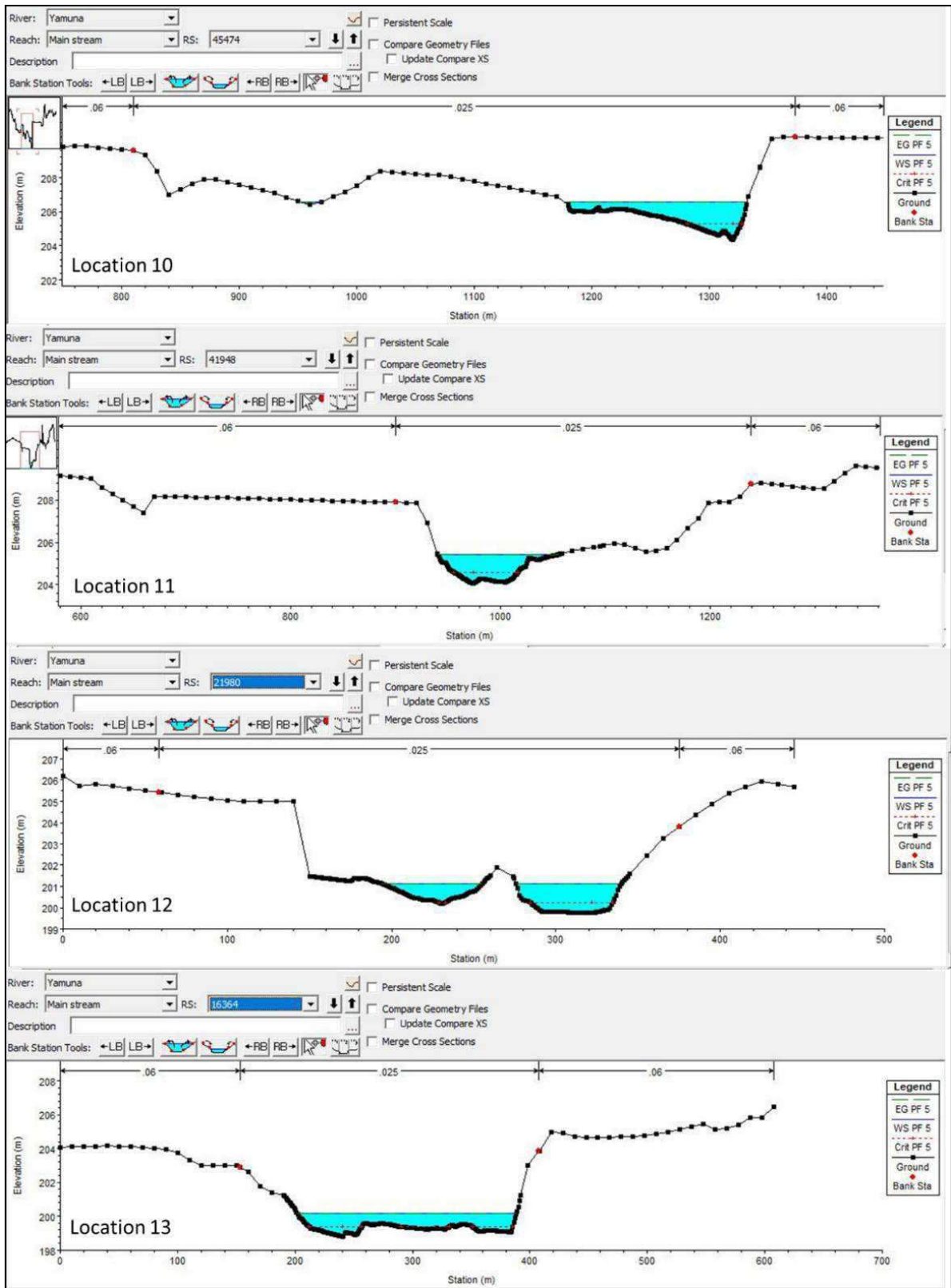


Fig. 5.7: Cross sections showing water level plotted at 13 locations from Hathnikund to Okhla.

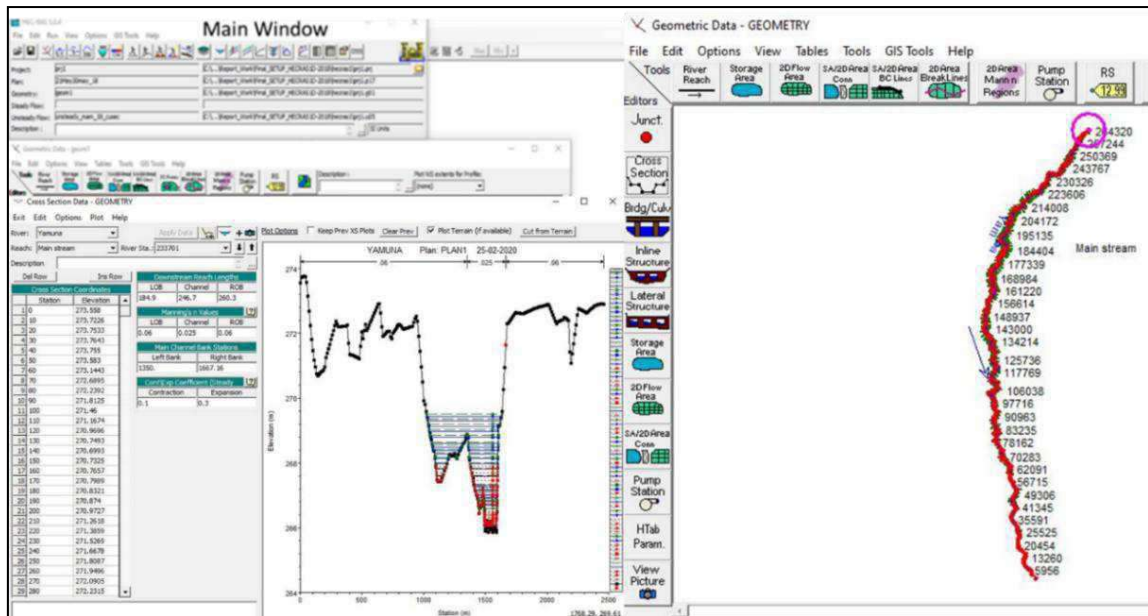


Fig. 5.8: HEC-RAS model setup with river cross sections geometry.

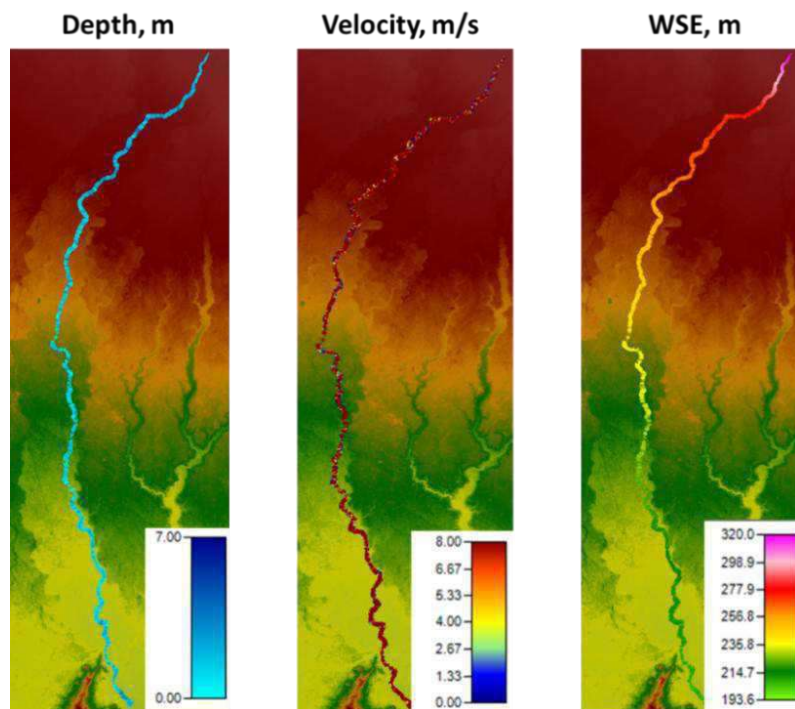


Fig. 5.9 HEC-RAS output in terms of depth, velocity and water surface elevation

5.4 Depth vs Discharge Relationships using HEC-RAS

To obtain the flow values corresponding to habitat suitability depth values for indicator fish species (refer Chapter 6), depth versus discharge curves are required to be developed covering the whole hydrologic regime. For this purpose, probability analysis of observed inflows and releases at Hathnikund Barrage was carried out, and, average flows for dry, wet and normal years for different seasons (monsoon, lean, non-monsoon) have been identified as summarized in Table 5.1.

Considering the minimum and maximum flow values for different seasons, 20 flow values have been chosen for HEC-RAS simulations as listed in Table 5.2, that vary from 5 to 1000 cumec. These 20 flow values constitute the upstream boundary condition for different simulations performed using HEC-RAS 1D model populated with surveyed river cross-sections. To formulate the depth vs discharge relationships for the 13 identified locations, the model output corresponding to the 13 locations, at every 250 m interval, was extracted. The maximum depth of water level was computed by detecting minimum channel elevation from water surface elevation. To achieve better accuracy, the output corresponding to first and last 250 m cross-section (falling within the 1 km reach of every identified location) was neglected and the depth and discharge of three middle cross-sections were averaged to arrive at the depth and discharge of the respective identified location. Such depth and discharge data were generated corresponding to different flow values listed in Table 5.2 for each of the 13 locations.

The simulated depth values have been plotted against the corresponding flow values to arrive at the depth vs discharge curves. The depth vs discharge curves derived from HEC-RAS simulations are shown in Fig. 5.10 for 13 locations (including the gauging sites at Kalanaur, Karnal, Mawi, Baghpat and Delhi Railway Bridge) in the study reach.

Using the developed depth vs discharge curves for different sites, the minimum flows required to be released from Hathnikund barrage for maintaining suitable physical habitat for indicator fish species in terms of flow depth have been estimated, as described in Chapter 6.

Table 5.1 Summary of average seasonal flow statistics for inflows and releases from Hathnikund Barrage

Average seasonal inflow at Hathnikund (cumec)				
S N	Season	Dry Year (2004-05)	Normal Year (2014-15)	Wet Year (2013-14)
I	Monsoon (June, July, Aug, Sep)	286	424	973
II	Lean (Dec, Jan, Feb, Mar)	107	117	107
III	Non-Monsoon/Non Lean (Apr, May, Oct, Nov)	113	135	180
Average seasonal outflow at Hathnikund (cumec)				
S N	Season	Dry Year (2007-08)	Normal Year (2009-10)	Wet Year (2013-14)
I	Monsoon (June, July, Aug, Sep)*	50	145	99
II	Lean (Dec, Jan, Feb, Mar)	5	5	25
III	Non-Monsoon/Non Lean (Apr, May, Oct, Nov)	5	8	8

* In normal year 2009-10, the Sept 2019 outflow is very high

Table 5.2 Flow values selected for HEC-RAS simulations

Season	Min	Max	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Monsoon (June, July, Aug, Sep)	140	973											100	200	300	400	500	600	700	800	900	1000
Lean (Dec, Jan, Feb, Mar)	5	164	5	10	20	30	40	50	60	70	80	90	100	200								
Non-Monsoon (Apr, May, Oct, Nov)	18	678		10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700			

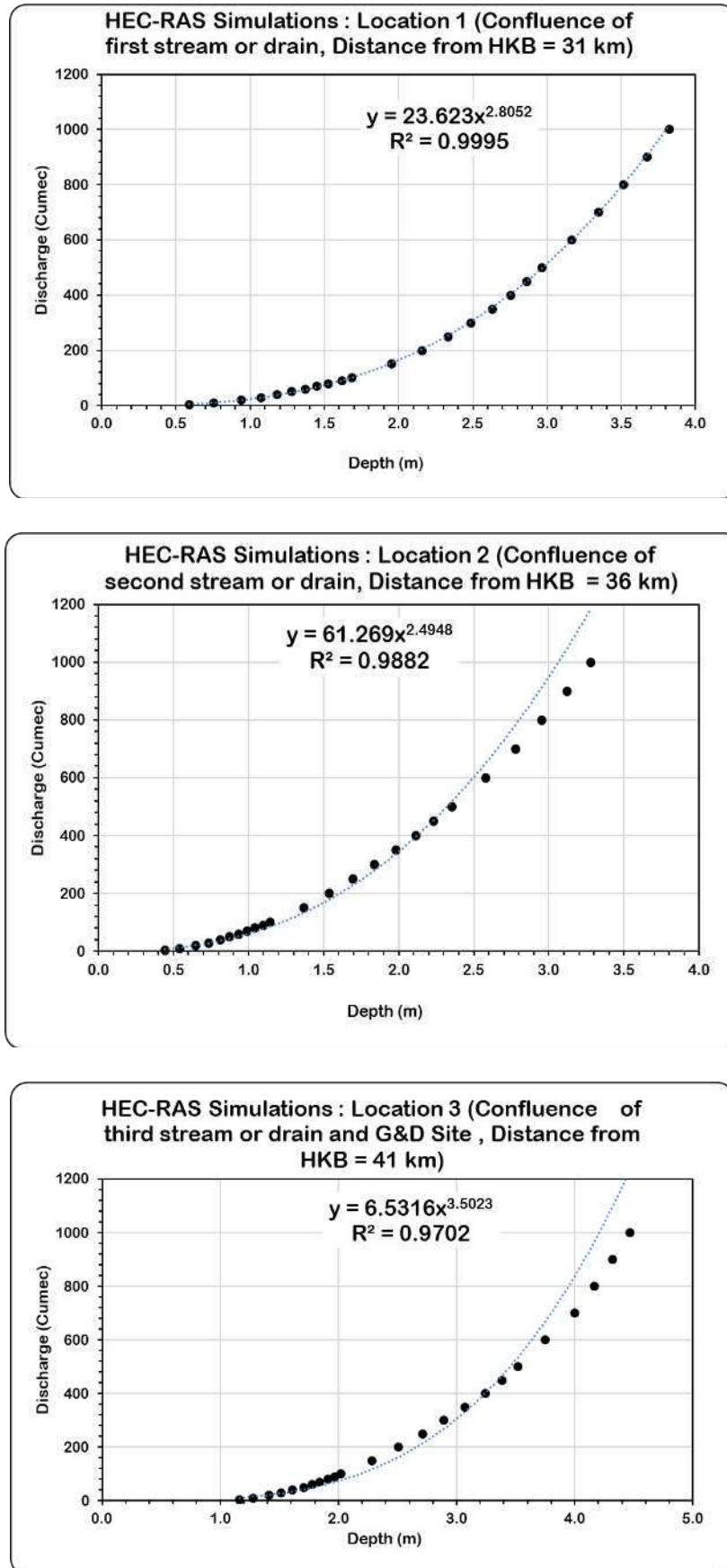


Fig. 5.10 Depth vs discharge curves corresponding to 13 locations between Hathnikund Barrage (HKB) to Okhla barrage (contd..)

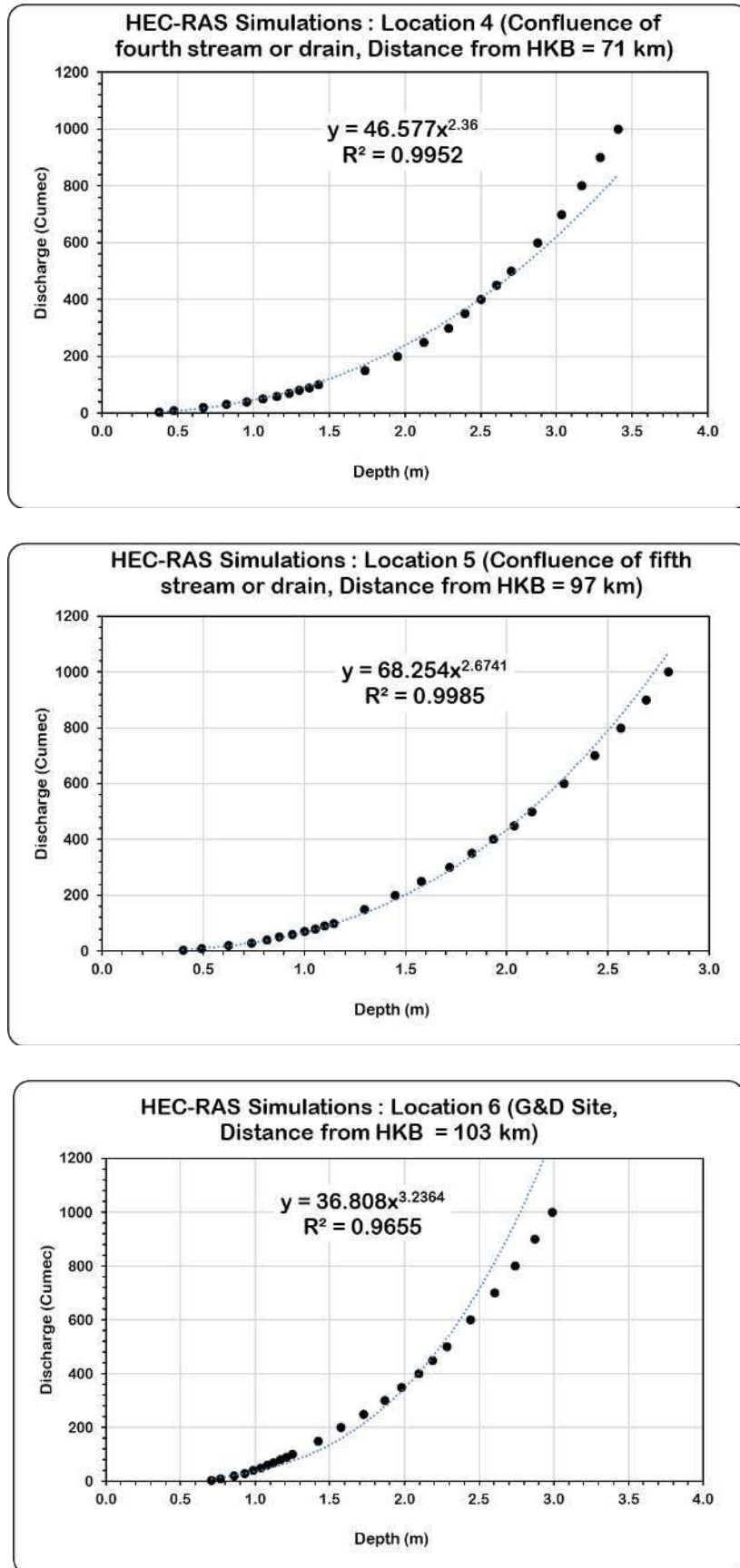


Fig. 5.10 Depth vs discharge curves corresponding to 13 locations between Hathnikund Barrage (HKB) to Okhla barrage (contd..)

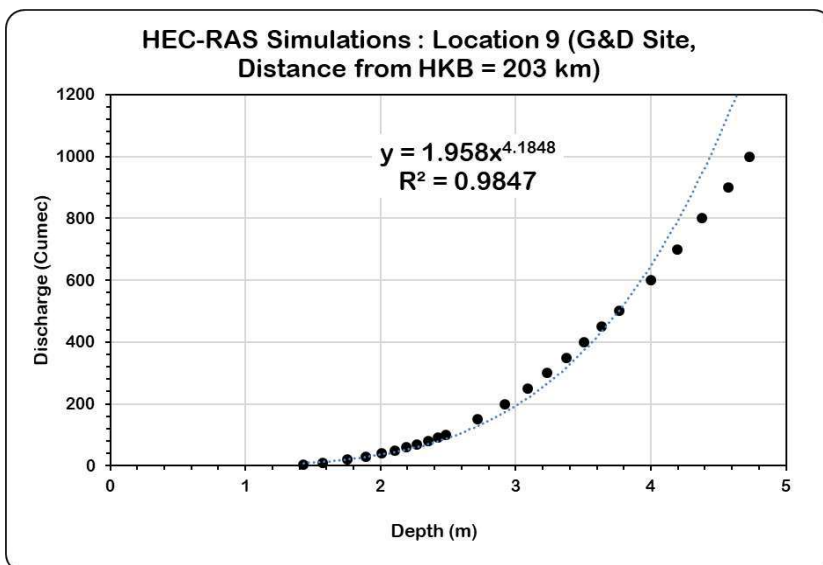
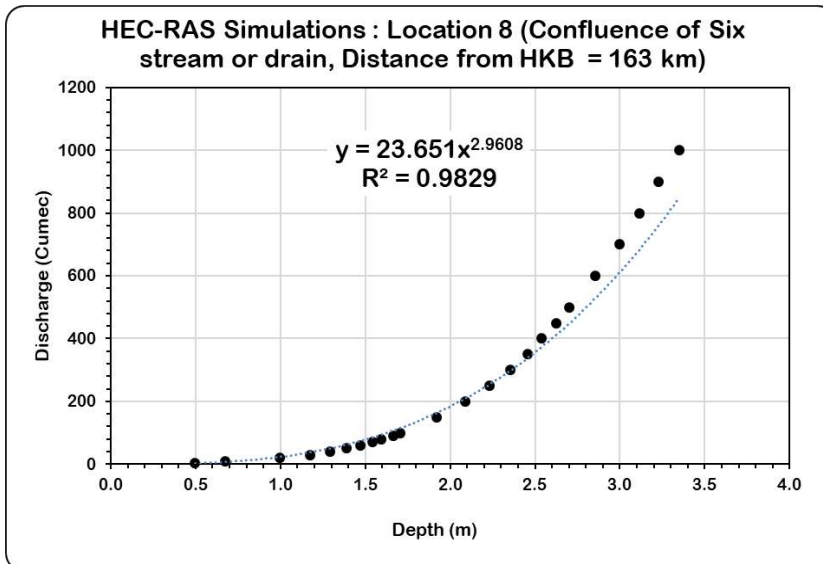
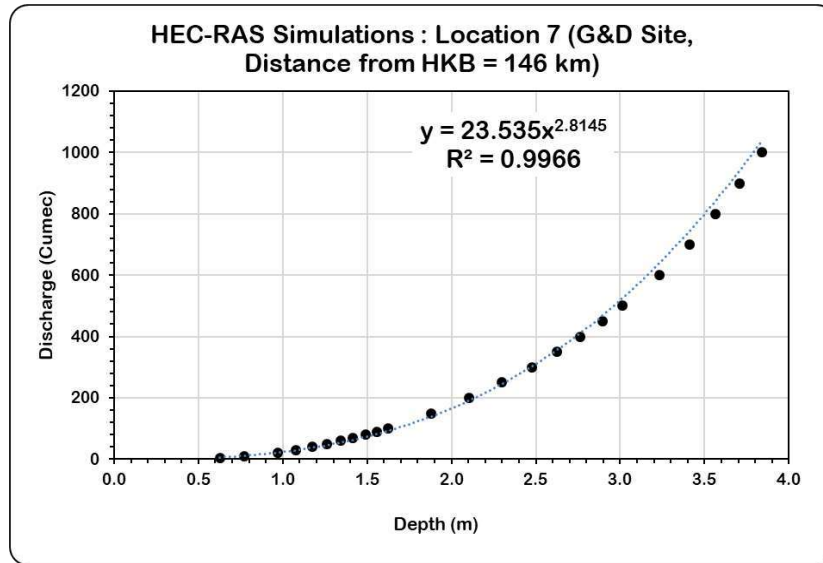


Fig. 5.10 Depth vs discharge curves corresponding to 13 locations between Hathnikund Barrage (HKB) to Okhla barrage (contd..)

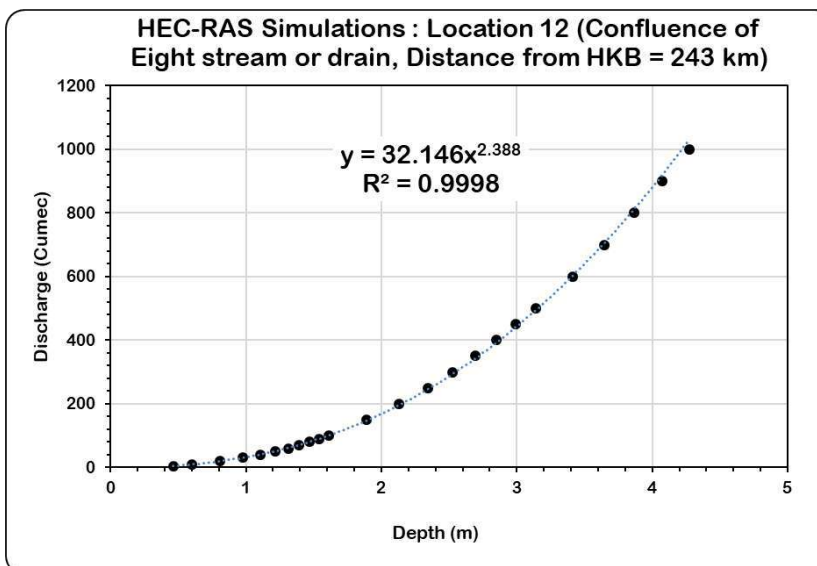
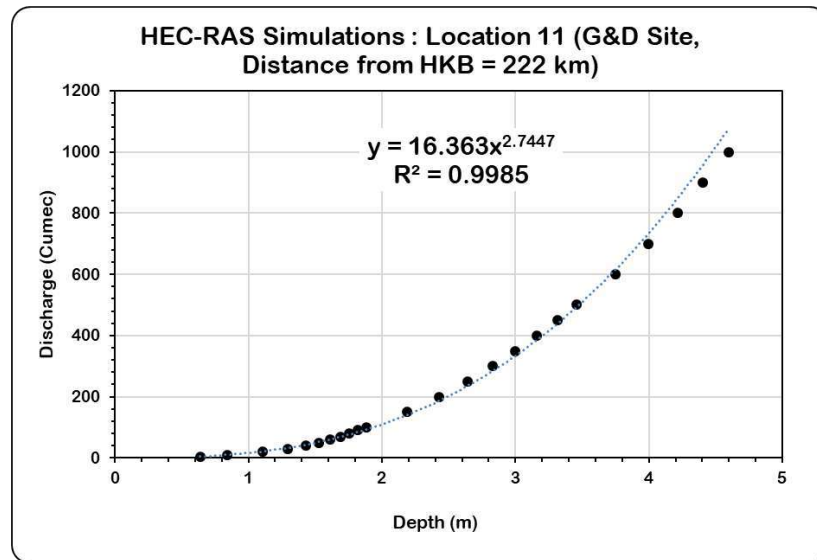
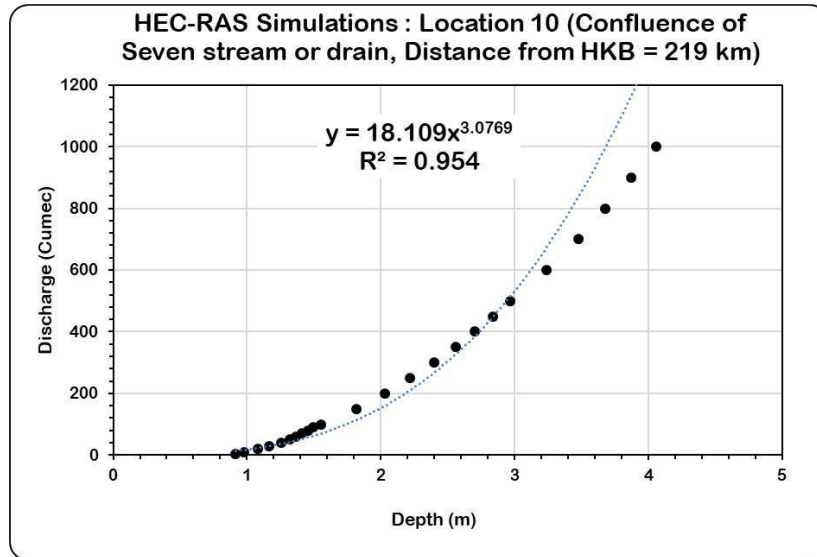


Fig. 5.10 Depth vs discharge curves corresponding to 13 locations between Hathnikund Barrage (HKB) to Okhla barrage (contd..)

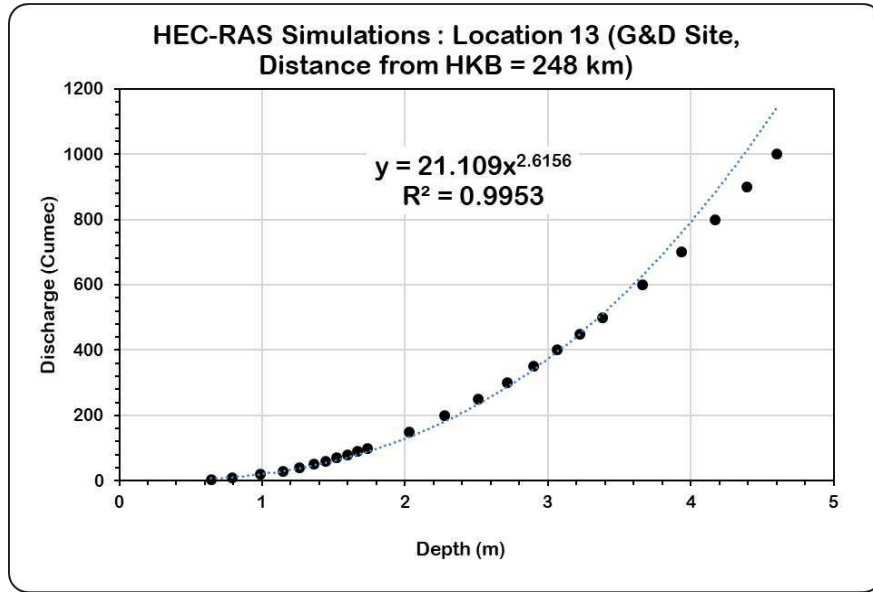


Fig. 5.10 Depth vs discharge curves corresponding to 13 locations between Hathnikund Barrage (HKB) to Okhla barrage

Chapter 6

E-FLOWS FOR SUSTAINING INDICATOR AQUATIC SPECIES

6.1 Indicator Fish Species in Yamuna River

River Yamuna is one of the major tributaries of river Ganga, and it is home to many fish species reported in river Ganga. More than 140 species of fish have been reported to inhabit river Yamuna, however, during last few decades, the fish catch composition has reduced due to extreme pollution of river water. As per the comprehensive survey conducted by the Central Inland Fisheries Research Institute (CIFRI) from headwaters of river Yamuna upto Delhi, 93 fish species belonging to 23 families occur in river Yamuna (Sharma et al., 2014, 2017). The important iconic fishes of river Yamuna are: Golden Mahseer (*Tor putitora*), Snow trout (*Schizothorax richardsonii*), Kalaban (*Bangana dero*), Indian trout (*Raiamas bola*), Chagunius carp (*Chagunius chagunio*) and Calbasu carp (*Labeo calbasu*). As per the existing information, the river segment between Hathnikund Barrage and Panipat is considered as a more important river habitat in terms of fish diversity and this section of the river inhabits many important iconic fish species of river Yamuna (except snow trout). Further, it is observed that the important reophilic species such as *Bangana dero* and *Raiamas bola* are reported to occur between Hathnikund barrage and Panipat. The river receives heavy loads of domestic and industrial wastes along its course through Haryana, Delhi and Uttar Pradesh. This results in change in the fish species composition, change in trophic structure and abundance of invasive species in the lower reaches of the river (Kazmi and Hansen, 1997; Mishra and Moza, 1997; Moza and Mishra, 2003; Mishra et al., 2007; Vass et al., 2010).

Given this background, a rapid field survey was conducted in the study reach of river Yamuna for identification of indicator fish species and for determining the e-flow requirement for maintaining ecological integrity and sustaining fisheries resources of river Yamuna. A field team comprising of NIH scientists, and, river and fish ecology expert from Wildlife Institute of India carried out field sampling between Hathnikund barrage and Panipat during the month of October 2019. Another visit was undertaken in the month of February 2020. Fish and river habitat variables such as flow and depth measurements were carried out at four locations, Hathnikund, Yamuna Nagar, Panipat and above Delhi segment. Fish sampling was performed using monofilamentous cast net (size 10 mm) and gillnets of different mesh size (12 mm; 16 mm & 24 mm). In addition, on site fish catch from different fishermen were recorded. At each sampling location availability of flow and depth at every 1 m interval were recorded across the river channel at multiple locations (Fig. 6.1). The site downstream of Hathnikund barrage was relatively shallow, hence the measurements taken here were made manually, whereas at Yamuna Nagar and near Panipat, boats of local fishermen were used for measuring depth and flow. Similarly, flow and depth use by target flow indicator fishes were recorded at each catch location at the time of fish sampling. Flow measurement was recorded using flow probe hand-held meter (Global waters, USA) and depth was recorded using graduated measuring rod and depth finder (Model: DT1-H-B, Hawkeye, USA). Based on the habitat feature recorded in different segments of Yamuna

river and use by the indicator fish species, the habitat suitability curves were generated as per Johnson et al. (2017).



Fig. 6.1 Measurement of fish habitat variables at Yamuna Nagar in river Yamuna

6.2 Fish Diversity in Study Reach of Yamuna River

During the present survey, 40 species of fishes were recorded in the river sector from Hathnikund to above the Delhi segment during the sampling period. The list of fish species recorded during the sampling period is listed Table 6.1. Members of cyprinidae family are dominant members in the fish assemblage structure. The common cyprinid fishes recorded during survey are: *Bangana (Labeo) dero*, *Raiamas bola*, *Chagunius chagunio*, *Cirrhinus reba*, *Labeo calbasu*, *Labeo rohita*, *Garra gotyla* and *Systomus sarana* (Fig. 6.2). Surprisingly, the most charismatic and conservation significant species, Golden Mahseer (*Tor putitora*) was not recorded in Yamuna river below Hathnikund barrage. Historically, this species was reported to be present in the downstream reaches of river Yamuna and few individuals of Golden Mahseer were reported in recent study by Central Inland Fisheries Research Institute (Sharma et al., 2014). It is a well known fact that depletion of Golden Mahseer in downstream reaches of river Yamuna is mainly attributed to modifications in the river habitat (changes in substrate composition), volume of water, over fishing and pollution. However, the presence of good population of reophilic species such as *Bangana dero* and *Raiamas bola* between Hathnikund and Panipat indicate that the habitat condition and quality of water is still conducive for such species. The record of reophilic species such as *Bangana dero* and *Raiamas bola* in this river sector is in accordance with earlier report on fishes of river Yamuna in these sectors (Sharma et al., 2014). These species contribute considerably in local fish catch in Yamuna River between Hathnikund and Panipat and play a major role in local economics (Fig. 6.2). Other than economically important fish species, many small fish species such as *Aspirodia morar*, *Barilius bendalasis*, *Barilius vagra*, *Pethia chonconius*, *Puntius chola* and *Puntius sophore* (Fig. 6.3) are commonly present in the river

sector between Hathnikund and below Panipat. However, the condition of Yamuna river below Panipat deteriorates further because of large-scale modification in river bed and input of more pollution into the river channel. As a result, it exhibits more abundance of non-native invasive and pollution tolerant species such as *Cyprinus carpio* and *Tilapia nilotica*, which constitute over 90% of fish catch in this section (Fig. 6.4).

Table 6.1 List of fish species recorded at Hathnikund, Yamuna Nagar, Panipat and below Panipat

S. No.	Species	Hathnikund	Yamuna Nagar	Panipat	Below Panipat
1.	<i>Amblypharyngodon mola</i>		√	√	√
2.	<i>Aspirodia morar</i>			√	√
3.	<i>Bangana dero</i>	√	√	√	
4.	<i>Barilius bendelisis</i>	√	√		
5.	<i>Barilius vagra</i>	√	√		
6.	<i>Chagunius chagunio</i>		√		
7.	<i>Chela laubuca</i>			√	
8.	<i>Cirrhinus mirgala</i>		√	√	
9.	<i>Cirrhinus reba</i>		√	√	
10.	<i>Cyprinus carpio</i>			√	√
11.	<i>Cyprinus specularies</i>				√
12.	<i>Devario devario</i>	√	√		
13.	<i>Garra gotyla</i>	√			
14.	<i>Glossogobius giuris</i>		√		
15.	<i>Labeo bata</i>		√		
16.	<i>Labeo pangusia</i>	√			
17.	<i>Laboe calbasu</i>		√		
18.	<i>Labeo rohita</i>		√	√	
19.	<i>Lepidocephalus guntea</i>		√	√	
20.	<i>Mastacembelus armatus</i>		√	√	
21.	<i>Mystus cavasius</i>		√	√	
22.	<i>Mystus vittatus</i>		√	√	
23.	<i>Osteobrama cotia</i>		√	√	
24.	<i>Pethia conchoniis</i>		√	√	
25.	<i>Pethio ticto</i>		√		
26.	<i>Puntius chola</i>		√	√	
27.	<i>Puntius sophore</i>		√	√	
28.	<i>Pseudoambasis ranga</i>		√		
29.	<i>Raiamas bola</i>	√	√	√	
30.	<i>Rasbora danicorinus</i>		√		
31.	<i>Salmostoma bacalia</i>		√	√	
32.	<i>Securicula gora</i>			√	√
33.	<i>Sperota aor</i>		√		
34.	<i>Sperota seenghala</i>			√	
35.	<i>Systemus sarana</i>			√	√
36.	<i>Tarquilabeo latius</i>	√			
37.	<i>Tilapia nilotica</i>				√
38.	<i>Trichogaster fasciata</i>		√		
39.	<i>Wallago attu</i>		√	√	√
40.	<i>Xanotodon cancila</i>		√	√	



Labeo calbasu



Labeo rohita



Chagunius chagunio



Bangana dero



Raiamas bola



Systomus sarana



Cirrhinus reba



Garra gotyla

Fig. 6.2 Common cyprinid fishes recorded in Yamuna River between Hathnikund and Panipat



Aspirodia morar



Barilius bendalasis



Devario devario



Barilius vagra



Rasbora daniconius



Puntius chola



Pethia conchonius



Puntius sophore

Fig. 6.3 Common minnows and barbs recorded in Yamuna River between Hathnikund and Panipat



Cyprinus carpio



Tilapia nilotica

Fig. 6.4 Dominant exotic fish species recorded downstream of Panipat in Yamuna River

6.3 River Habitat Condition at Sampling Points in Yamuna River

Three major fish habitats types such as Pools, Riffles and Runs were observed at all the sampling points in River Yamuna. Pools are deeper section of the channel unit, where water velocity is very less or almost nil (Fig. 6.5a). Deeper pools with rocky and boundary bed materials are predominant in river segment between Hathnikund and Yamuna Nagar, whereas very wide and shallow pools with sandy bed materials were observed in river channel below Panipat. Riffles are swift flowing section of the channel unit, where water velocity is at the maximum and bed materials often consist of large and small boulders (Fig. 6.5b). This type of habitat was observed only in the river sector just below Hathnikund barrage. Runs are transitional zones between pool and riffle habitat, where velocity is low and substratum is mostly homogenous, usually gravel or sand bed (Fig. 6.5c). This type of habitat is more common in river sector between Yamuna Nagar and Panipat.



(a) Pool



(b) Riffle



(c) Run

Fig. 6.5 Different types of fish habitats in Yamuna river

6.4 Ecology and Habitat Requirement of Indicator Fish Species for E-Flow Estimation

Based on the present study and historical information, three conservation significant species are selected and their ecological requirements (flow and depth preference) are considered for estimating e-flow requirement in Yamuna river segment stretching from Hathnikund to above the Delhi segment. Here, we have proposed two options for estimation of e-flow, as described below.

6.4.1 Option 1: Restoring the river habitat to historical condition

For restoring the river habitat to the historical condition, the conservation significant species Golden Mahseer may be selected as indicator species (Fig. 6.6). Though this species is not available downstream of Hathnikund barrage, the habitat suitability curve for Golden Mahseer generated from upstream reaches of Yamuna River and other tributaries of River Ganga has been used for estimating e-flow downstream of Hathnikund barrage. Here, it is assumed that the estimated flow based on Golden Mahseer may improve the habitat condition suitable for repopulating the Golden Mahseer in the downstream reaches of the Yamuna river. It may be noted here that the estimated flow will provide more suitable habitat in terms of volume, but does not guarantee in bringing back the river habitat features such as substrate heterogeneity suitable for Golden Mahseer.



Fig. 6.6 The Golden Mahseer, *Tor putitora*

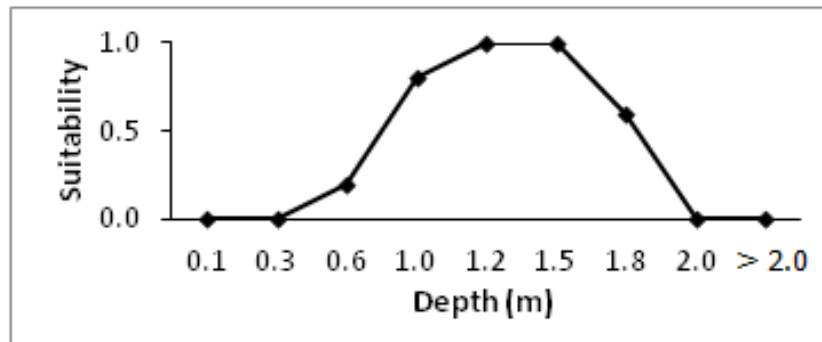
Ecology of the Golden Mahseer (Tor putitora)

The Golden Mahseer is one of the endangered, mighty game fish of India. It is a migratory species which attains a maximum weight of upto 54 kg (Talwar and Jhingran, 1991). This species is well known for its utility in angling sports (Fig. 6.6). It inhabits the montane and sub-montane regions, in streams and rivers. This species is native to Himalayan river system and distributed at altitudes ranging from 300 m to 1000 m. It occurs in rapid streams with rocky bottom, riverine pools. The fish is a column feeder in freshwater found in subtropical conditions with temperatures 12°C - 30°C. It is omnivorous in food habits during adult stage and feed on periphytic algae and diatoms in juvenile stage (IUCN, 2011). It migrates from

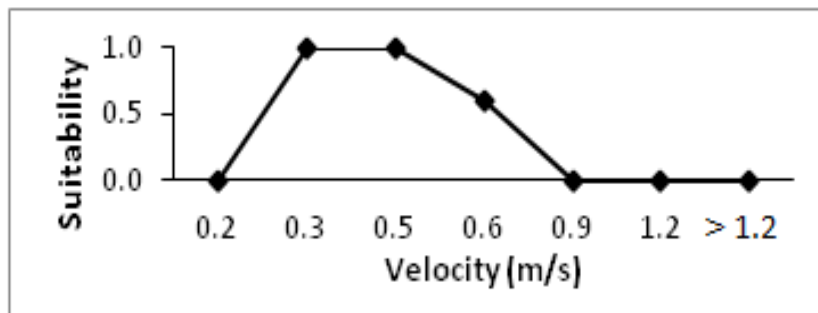
the foot hills to upper reaches of the river and tributaries for spawning and finds suitable habitat such as clean, stable, well-oxygenated, gravel habitats for spawning (Sharma, 1984). However, the feeding and breeding habitats are almost lost throughout their distributional range. Their population is fast depleting and at present are chiefly localised to certain major river systems and is fast approaching extinction in the streams of northern India. Large fishes are only found in some of the perennial pools. This species is declining from its natural habitat due to reduction in volume of water, river habitat modifications, over fishing and pollution (IUCN, 2011). The summary of species biology is given Table 6.2. The adult Golden Mahseer prefers depth > 1 m and velocity > 0.1 m/sec at pool habitat. Based on the field observations in Alaknanda and Bhagirathi rivers, the habitat suitability curve generated for Golden Mahseer is presented in Fig. 6.7.

Table 6.2 Summary of the biology and flow-related ecological requirements of Golden Mahseer (*Tor putitora*) in Alaknanda and Bhagirathi river basin

Observed Requirements	Adults	Juveniles	Spawning	Incubation and Larval development
Depth	Deep (>1.5 m)	Shallow (<0.75-1.5 m)	Shallow to high (0.5 - 2.0 m)	Shallow to high
Velocity	Medium to high (0.5-1.5 m/s)	Low to medium (0.1-1.5 m/s)	Low to medium (0.1-1.0 m/s)	Low to medium (0.1-0.5 m/s)
Habitat	Riffles, pools, glides	Pools, backwater pools closer to the banks and run habitats	riffles, backwater pools	Backwater Pools and secondary channels
Substratum	Bed rock, Boulders, Cobbles, gravel to sandy bottom	Cobbles, gravel to sandy bottom	Bedrock undercut, Boulder undercut, Gravel bed	Cobbles, gravel to sandy bottom Leaf litter
Temperature	12-30 °C	12-20 °C	<12 °C	10-15°C
Dissolved O ₂	8-12 mg/l	8-12 mg/l	8-12 mg/l	8-12 mg/l
Food	Omnivorous: small fishes, benthic invertebrate's larvae, mollusc, crab, fronts and seeds etc.	Benthic invertebrates larvae, worms etc.,	Not applicable	Periphytic algae and diatoms
Breeding Period	March – April; October to December			
Passage Requirement	Moves long distance to streams associated with main river, nearby side channels, shallow water and pools to breed			



a) Depth suitability curve



b) Velocity suitability curve

Fig. 6.7 Habitat suitability curves for Golden Mahseer (*Tor putitora*)

6.4.2 Option 2: Based on the current fish community assemblage

For making an e-flow assessment based on the current fish community assemblage occurring in the Yamuna river between Hathnikund and Okhla barrage, the results of present survey revealed that the river sector between Hathnikund and Panipat has good population of reophilic species such as *Bangana (Labeo) dero* and *Raiamas bola*. These two species are relatively flow sensitive, which also indicate better quality river habitat in terms of water quality. These two reophilic species live in riffle/run habitat with moderately flowing channel unit.

Ecology of the Kalaban (*Bangana (Labeo) dero*)

Bangana (Labeo) dero is one of the Indian native carps and constitutes a large percentage of fish catch in river Yamuna in the segment between Hathnikund barrage and Panipat. This species can be easily distinguished from other Indian minor carps by a narrow, round body and presence of the characteristic groove on the head tip (Fig. 6.8). *Bangana dero* lives in riffle and run habitats with moderate velocity. It is a bottom dwelling fish, feeds on diatoms, algae and detritus matters. Field observations made in Yamuna river at Hathnikund, Yamuna Nagar and Panipat show that it prefers the depth range from 60 to 90 cm and velocity in the

range of 0.1 to 0.2 m/sec at riffle/ run habitat. Based on field observations in Yamuna river, the habitat suitability curve generated for *Bangana dero* is presented in Fig. 6.10.



Fig. 6.8 The Kalaban, *Bangana dero*

Table 6.3 Summary of the biology and flow-related ecological requirements of Kalaban (*Bangana dero*) in Yamuna river basin

Observed Requirements	Adults	Juveniles	Spawning	Incubation and Larval development
Depth	Prefers 60-90 cm in Run/ Riffle habitat	Shallow (<30– 40 cm)	No information	No information
Velocity	Medium to high (0.1- 0.2m/s)	Low to medium (>0.1 m/s)	-	-
Habitat	Riffle, run and pools edges	Pools, backwater pools closer to the banks and run habitats	-	-
Substratum	Boulders & Cobbles	Cobbles, gravel to sandy bottom	-	-
Temperature	20-30 °C	20-25 °C	-	-
Dissolved O₂	6-8 mg/l	6-8 mg/l	-	-
Food	Diatoms and algal feeder	Algae	-	-
Breeding Period	September to November			
Passage Requirement	Moves to upstream and side channels & streams associated with main river			

Ecology of the Indian trout - Raiamas bola

Raiamas bola is one of the elegant and popular game fish of India. It occurs in streams and rivers of foot-hills of Himalaya and it is also found in upper reaches of river Ganga and

Yamuna. It is one of the minor carps and forms a major portion of the local fish catch. This species can be easily distinguished from other Indian minor carps by a streamlined body with many blue colour spots on the lateral side of the body (Fig. 6.9). It thrives in riffle and run habitat with moderate velocity. Mostly it is found in surface layer of river channel, where they largely forage on drifting aquatic insects, terrestrial insects and small fishes. During the field survey, this species was recorded in Yamuna river at Yamuna Nagar and Panipat, it shares the habitat with *Bangana dero* and prefers depth ranges similar to *Bangana dero* i.e. from 60 to 90 cm and velocity in the range of 0.1 to 0.2 m/s at run habitat. The habitat suitability curve generated for *Raiamas bola* is presented in Fig. 6.10.



Fig. 6.9 Indian trout, *Raiamas bola*

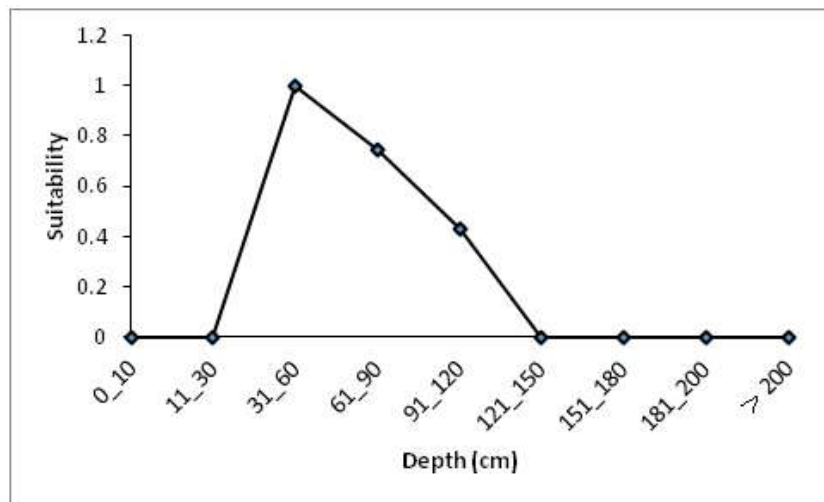
Table 6.4 Summary of the biology and flow-related ecological requirements of Indian trout (*Raiamas bola*) in Yamuna river basin

Observed Requirements	Adults	Juveniles	Spawning	Incubation and Larval development
Depth	Prefers 60-90 cm in Run/ Riffle habitat	Shallow run habitat (<30- 40 cm)	No information	No information
Velocity	Medium to high (0.1-0.2m/s)	Low to medium (>0.1 m/s)	-	-
Habitat	Riffle & run habitat	Run habitat	-	-
Substratum	Lives in upper layer of river channel (Surface guild)	Sandy and grass bed	-	-
Temperature	20-30 °C	20-20 °C	-	-
Dissolved O₂	6-8mg/l	6-8 mg/l	-	-
Food	Mostly drifted terrestrial and aquatic insects	Insects and other animal matters	-	-
Breeding Period	September to November			
Passage Requirement	Moves to upstream and side channels & streams associated with main river			

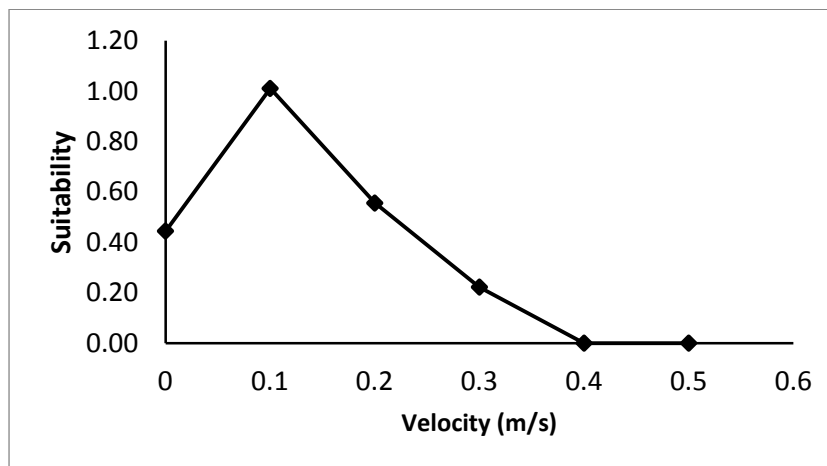
6.5 Habitat Suitability for Indicator Fishes of Yamuna river

The selected indicator species, *Bangana dero* and *Raiamas bola* are thriving well in run habitat of channel with depth ranging from 60 to 90 cm and with velocity of 0.1 m/s (Fig. 6.10). Further, it is observed that wherever these species are present, the other economically important species besides other small barbs and minnows also thrive well. Hence, ensuring minimum water depth of 60 cm and flow of 0.1 m/s at riffle/run habitat of river Yamuna will safeguard the fish diversity in Yamuna river.

If it is desired to restore the Golden Mahseer population in the downstream sector of the Yamuna River below Hathnikund barrage, then the habitat suitability of Golden Mahseer can be selected for estimating e-flows i.e., depth > 1 m and with velocity > 0.1 m/s.



a) Depth suitability curve



b) Velocity suitability curve

Fig. 6.10 Habitat suitability curves of *Bangana dero* and *Raiamas bola*

6.6 Suggested E-Flow Regime

The flow regime of a river has direct influence on the aquatic ecosystem. Although, there are a number of components of flow regime and related hydraulic and geomorphologic changes in the river, yet, water depth is considered as the most important criteria for e-flow assessment in the present case due to two reasons: (i) for e-flow implementation purposes, other hydraulic variables have more complex relationships with respect to the change in flows; (ii) provision of proper water depth according to different seasons will also ensure lateral and longitudinal connectivity required for various river functions and for survival and growth of fish species.

For converting the habitat suitability depth values into the flow values, depth versus discharge curves were developed covering the whole hydrologic regime using HEC-RAS simulations, as described in detail in Chapter 5. Using the developed depth vs discharge curves for different sites, the minimum desirable flow values required for maintaining suitable physical habitat in terms of desirable flow depths (i.e., 0.60 m, 0.75 m, 0.90 m, and for inundating the floodplains) at 13 identified locations (refer Section 5.3.1) have been estimated.

Further, the flows required to be released from Hathnikund barrage for maintaining the minimum desirable amount of flows at different sites during different seasons have been estimated using the flow series simulated by the calibrated hydrologic model SWAT. The regression plots along with the equations developed for the flows at each of the 13 identified locations are given in Annexure 2.

It needs to be mentioned here, that the linear regression equations between releases from Hathnikund barrage and simulated flows at these 13 locations have very good coefficient of determination ($R^2 > 0.6$) for most of the months, but, as we go farther from Hathnikund barrage, R^2 value decreases due to more uncertainty arising due to rainfall events occurring in the catchment downstream of Hathnikund barrage. If we exclude these points, more than 50% of the points are falling within 20% error band. Moreover, for the estimation of final recommended releases, we are using the releases required for the month of May and subsequently building the recommended releases series using the natural variability. R^2 values for May is most significant and coefficient of determination R^2 values for May for all these 13 locations are more than 0.6.

The different magnitudes of flows required to be released from Hathnikund barrage for maintaining desirable depth at these 13 locations during different months are presented in the Tables A3.1 - A3.13 provided in Annexure 3.

The release required from Hathnikund barrage during a specific month (say May) is computed by taking the maximum of the releases estimated from Hathnikund barrage for meeting the minimum depth requirement of 0.60 m at the 13 different locations corresponding to the specific month. Table 6.5 shows the releases required from Hathnikund barrage for maintaining required habitat conditions at all the 13 locations between Hathnikund to Okhla barrage during the different months of an year.

For carrying out various functions, the aquatic ecosystem needs natural flow variability, within the year, for its sustenance. Incorporation of natural variability of flows may be carried either through taking different optimum depths for different seasons (viz., 0.60 m for lean season, 0.75 m for non-monsoon & non-lean and 0.90 m for monsoon season) or taking minimum depth (0.60 m) for lean season and modifying the releases as per the existing natural variability as observed in long-term historical data. Although, the analysis has been carried out for both the cases, it is recommended to choose the latter option as it better represents the natural variability.

Accordingly, we have estimated the releases required from Hathnikund Barrage for the month of May (being the driest month at all the G&D sites downstream of Hathnikund barrage) and subsequently, built upon the releases required during different months by using the ratio of average flows of the consecutive months keeping in mind that these computed values for different months are not less than the releases required for maintaining 0.60 m at all the 13 identified locations.

The final recommended releases from Hathnikund barrage for maintaining required habitat conditions between Hathnikund and Okhla barrage during the different months of a year are given in Table 6.6 and also illustrated in Fig. 6.11.

As evident from Table 6.5, these recommended releases from Hathnikund barrage are approximately 30% of the inflows at Hathnikund barrage which is comparable to the e-flow recommendations in the MOWR, RD & GR Notification dated 9th Oct 2018 for Upper Ganga basin upto Haridwar that suggests 20%, 25% and 30% of inflows as environmental flows during lean season, non-monsoon & non-lean season, and monsoon season, respectively.

As evident from Fig. 6.11, the recommended minimum releases for non-monsoon season are slightly higher than the current average monthly releases from Hathnikund barrage, however, for the monsoon months of July and August, the current average monthly releases are much higher than the recommended releases. Since during the monsoon months of July and August, inflows at Hathnikund are significantly higher than the diversion capacity of barrage, the flow regime during these monsoon months will be the same as the current releases. Therefore, after implementation of recommended minimum releases from Hathnikund barrage, the flow regime downstream of Hathnikund barrage will comprise of recommended minimum releases during non-monsoon season and current releases during monsoon season.

It may be noted here that this analysis is based on water requirement of indicator fish species, however, the biodiversity, livelihood and spiritual groups can link their requirements to specific features of the river channel at the study sites.

Table 6.7 provides the expected flows at Wazirabad barrage for recommended values of flows released from Hathnikund barrage in a year with average rain for the present scenario, after meeting out all the current demands of water upstream of Wazirabad barrage.

Table 6.5 Releases required from Hathnikund barrage for maintaining suitable habitat at all the downstream locations

Month	Inflows at Hathnikund (cumec)			Releases (cumec) from Hathnikund required for maintaining E-Flows															
				For maintaining 0.60 m depth					For maintaining 0.75 m depth					For maintaining 0.90 m depth					For inundating floodplains
	Median Max.	Median	Median Min.	Min. required releases	Releases incorporating natural variability (starting from May)	% of Median Max.	% of Median	% of Median Min.	Min. required releases	Releases incorporating natural variability (starting from May)	% of Median Max.	% of Median	% of Median Min.	Min. required releases	Releases incorporating natural variability (starting from May)	% of Median Max.	% of Median	% of Median Min.	Min. required releases (once in a month)
Jan	108.28	75.71	55.99	20.73	22.81	21.07	30.13	40.74	24.63	30.06	27.76	39.70	53.69	30.23	46.37	42.82	61.25	82.82	
Feb	143.68	77.60	57.43	20.54	23.38	16.27	30.13	40.71	27.55	30.81	21.44	39.70	53.65	37.11	47.53	33.08	61.25	82.76	
Mar	163.22	85.92	61.09	20.39	25.89	15.86	30.13	42.38	31.95	34.11	20.90	39.70	55.84	48.63	52.62	32.24	61.25	86.14	
Apr	170.04	95.23	71.40	27.54	28.69	16.87	30.13	40.19	39.71	39.71	23.35	41.70	55.62	57.97	58.33	34.30	61.25	81.69	
May	187.34	111.96	70.29	33.73	33.73	18.01	30.13	47.99	44.45	44.45	23.73	39.70	63.24	68.57	68.57	36.60	61.25	97.56	
Jun	307.78	147.53	73.62	30.72	44.45	14.44	30.13	60.38	35.84	58.57	19.03	39.70	79.56	48.74	90.36	29.36	61.25	122.74	
Jul	1,472.82	524.95	147.80	37.96	158.16	10.74	30.13	107.01	41.37	208.41	14.15	39.70	141.01	45.87	321.52	21.83	61.25	217.54	1398.18
Aug	1,873.81	729.60	357.98	3.06	219.82	11.73	30.13	61.41	7.31	289.66	15.46	39.70	80.91	12.91	446.86	23.85	61.25	124.83	1631.01
Sep	1,003.18	493.28	197.97	-9.46	148.62	14.81	30.13	75.07	-1.29	195.84	19.52	39.70	98.92	16.39	302.12	30.12	61.25	152.61	
Oct	288.24	144.92	96.69	16.26	43.66	15.15	30.13	45.16	26.80	57.54	19.96	39.70	59.51	44.72	88.76	30.79	61.25	91.80	
Nov	131.87	89.66	63.20	16.19	27.01	20.48	30.13	42.74	29.78	35.59	26.99	39.70	56.32	48.12	54.91	41.64	61.25	86.89	
Dec	115.42	80.71	59.66	18.23	24.32	21.07	30.13	40.76	28.84	32.04	27.76	39.70	53.71	43.17	49.43	42.83	61.25	82.86	

Table 6.6 Final recommended releases required from Hathnikund barrage for maintaining suitable habitat at all downstream locations between Hathnikund and Okhla barrage

Month	Average monthly inflows at Hathnikund barrage (cumec)	Average monthly releases from Hathnikund barrage (cumec)	Recommended minimum releases from Hathnikund barrage incorporating natural variability (cumec)	Flow regime obtained after implementing recommended minimum releases (cumec)	For inundating floodplains (cumec) - once a month
Jan	48.49	9.97	22.81	22.81	
Feb	37.96	9.97	23.38	23.38	
Mar	45.93	9.97	25.89	25.89	
Apr	71.31	9.97	28.69	28.69	
May	57.06	9.97	33.73	33.73	
Jun	115.22	17.66	44.45	44.45	
Jul	661.72	274.57	158.16	274.57	1398
Aug	841.81	298.14	219.82	298.14	1631
Sep	462.09	160.31	148.62	160.31	
Oct	150.76	29.73	43.66	43.66	
Nov	67.63	9.97	27.01	27.01	
Dec	57.51	9.97	24.32	24.32	

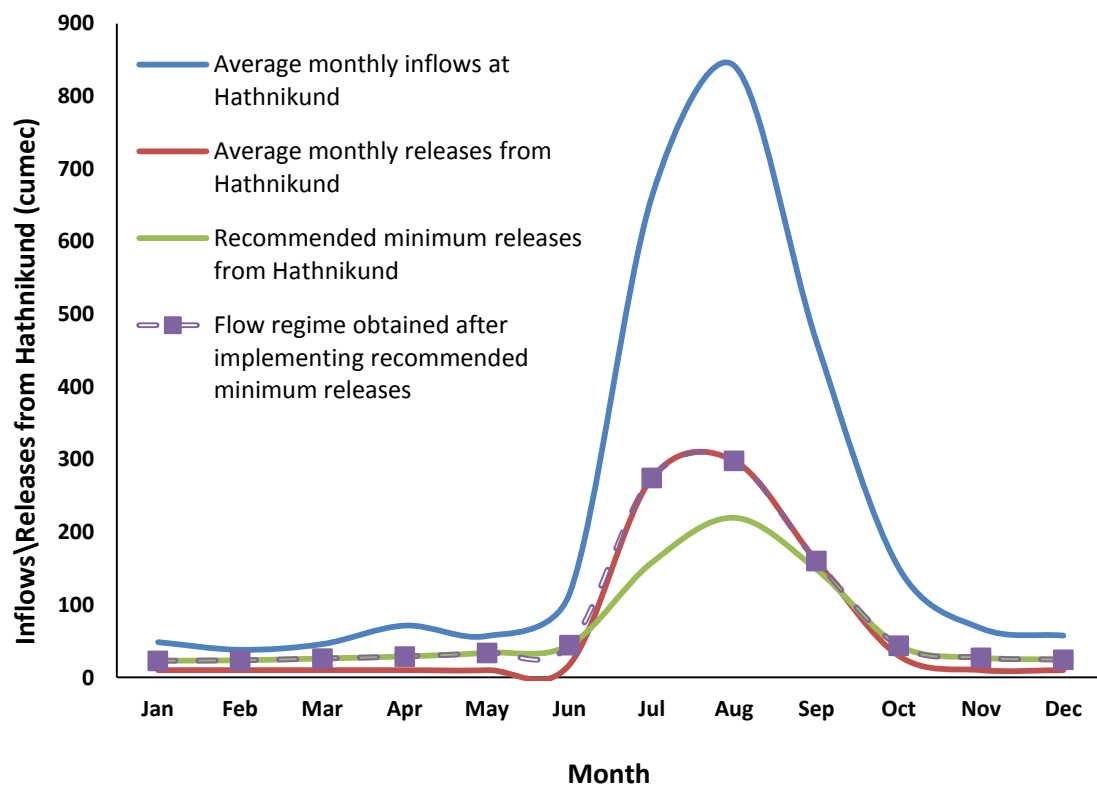


Fig. 6.11 Recommended releases from Hathnikund Barrage for sustaining downstream ecosystem upto Okhla barrage

Table 6.7 Expected flows at Wazirabad barrage for recommended values of flows released from Hathnikund barrage

Month	Recommended releases from Hathnikund barrage (cumec)	Expected flows at Wazirabad barrage under average conditions (cumec)
Jun	44.45	28.41
Jul	158.16	245.27
Aug	219.82	350.78
Sep	148.62	259.14
Oct	43.66	64.14
Nov	27.01	40.41
Dec	24.32	33.40
Jan	22.81	34.05
Feb	23.38	27.01
Mar	25.89	18.50
Apr	28.69	12.02
May	33.73	9.49

Chapter 7

MANAGEMENT OPTIONS TO MAINTAIN RECOMMENDED E-FLOWS**7.1 Available Water at Hathnikund Barrage**

In the present scenario, approximately 47.5% and 9.8% of inflows at Hathnikund barrage are diverted to Western Yamuna Canal (WYC) command and Eastern Yamuna Canal (EYC) command, respectively, during monsoon season, while 78.5% and 13.0% of inflows at Hathnikund barrage are diverted to WYC and EYC commands, respectively, during non-monsoon season (Table 7.1). Thus, only 42.7% and a meagre 8.5% of inflows at Hathnikund barrage are released into the river during monsoon and non-monsoon seasons, respectively. Figures 7.1 and 7.2 show the observed time series of inflows, diversions and releases at Hathnikund barrage.

Table 7.1 Diversion and releases from Hathnikund barrage

Season	Observed Conditions		
	% of flows diverted to WYC command	% of flows diverted to EYC command	% of flows released from Hathnikund barrage
Monsoon	47.5	9.8	42.7
Non-monsoon	78.5	13.0	8.5

7.2 Management Options

It is apparent from Table 7.1 and Figs. 7.1-7.2 that during the monsoon season sufficient flows are being released downstream from the Hathnikund barrage; however, releases during non-monsoon season are significantly low and do not meet the e-flow requirement in the downstream reaches of Yamuna river. In such case, possible management options for maintaining e-flows are listed below.

- Reduction in diversions to WYC/EYC by increasing the irrigation efficiency in WYC and EYC commands, keeping in view the crop water requirement
- Regulate groundwater withdrawal in the basin especially in the Mawi-Baghpat stretch and augment groundwater recharge in order to sustain baseflows
- Augmentation of non-monsoon inflows at Hathnikund barrage by creating storage of monsoon runoff in the upstream reaches
- Treatment of effluent coming through various drains meeting river Yamuna

The management options are discussed in detail in subsequent sections.

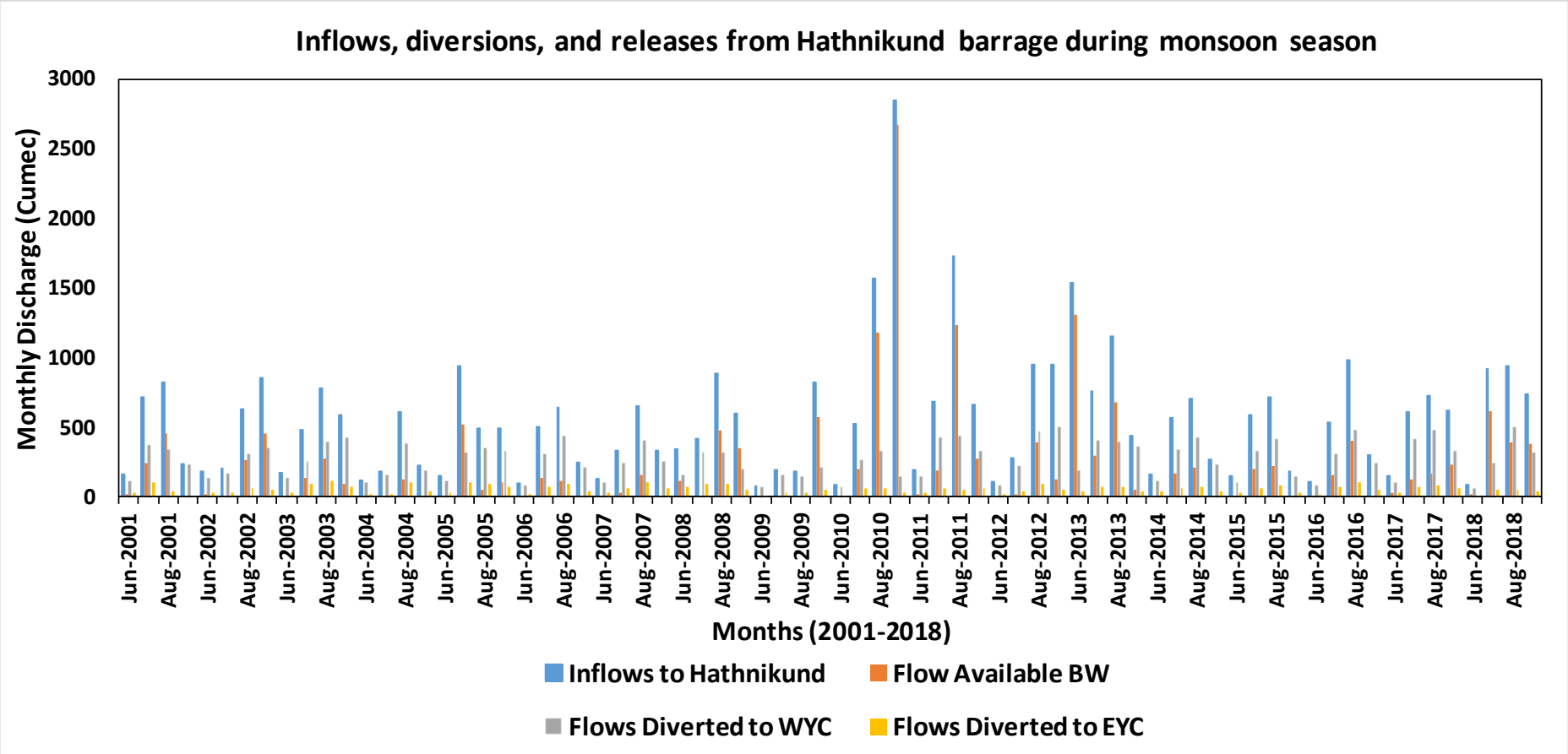


Fig. 7.1 Observed time series of inflows, diversions and releases from Hathnikund Barrage during monsoon season.

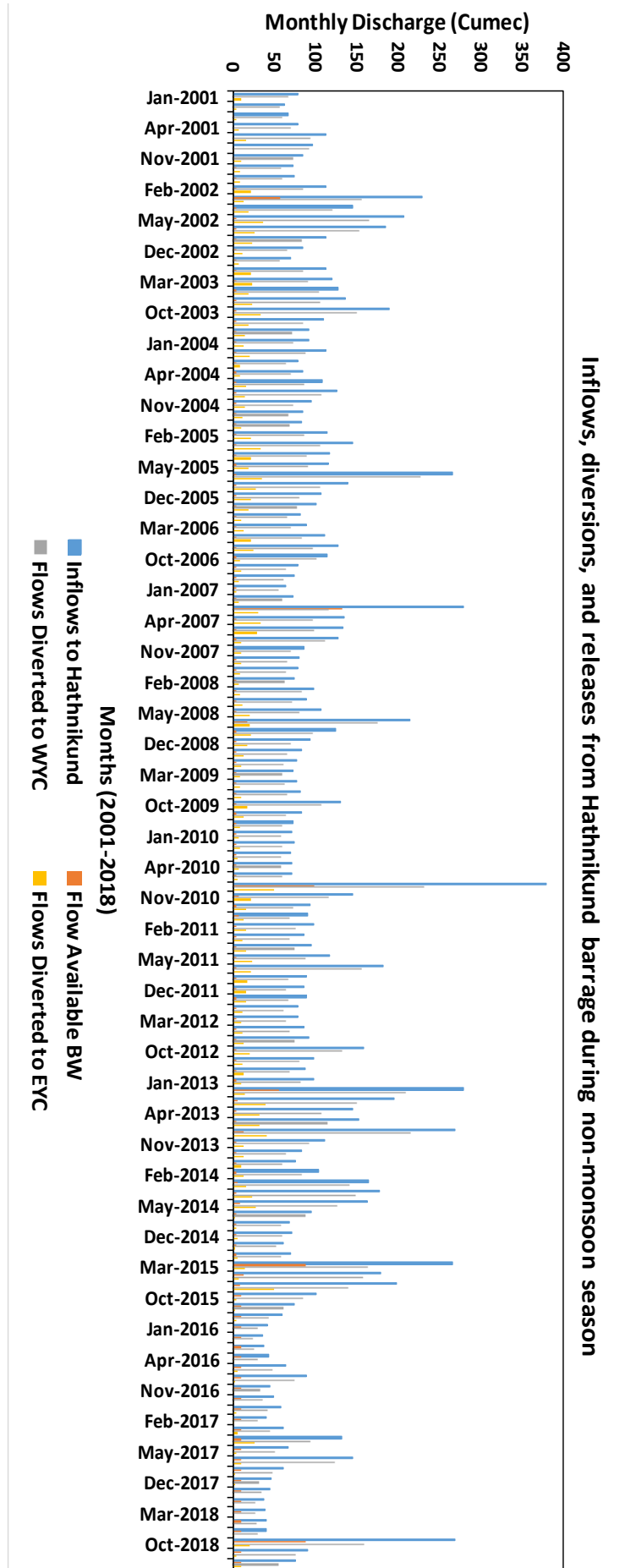


Fig. 7.2 Observed time series of inflows, diversions and releases from Hathnikund Barrage during non-monsoon season.

7.2.1 Increase in irrigation efficiency and reduction in diversions to WYC/EYC

The increase in releases recommended from Hathnikund Barrage for maintaining e-flows would lead to reduction in diversions to WYC/EYC during the lean and non-monsoon season. Table 7.2 presents the average diversions from Hathnikund Barrage under existing scenario and average available diversions at Hathnikund Barrage under recommended scenario of minimum e-flows along with desirable percent increase in irrigation efficiency for different months of the year. The percent decrease in available diversions at Hathnikund Barrage for recommended minimum releases is equivalent to the desirable percent increase in irrigation efficiency.

The percent increase (except for monsoon months) in irrigation efficiency varies from 7% to 26% for different months. As per CWC (2014) guidelines for 'Improving Water Use Efficiency in Irrigation, Domestic & Industrial Sectors', the scope for increasing efficiency using surface water is 30% while in respect of groundwater it is 20%. The desirable increase in irrigation efficiency in WYC / EYC falls very well within the scope of above guidelines.

Policy Measures for improving Efficiencies: Besides charging of irrigation water on volumetric basis and linking it to reliability, timeliness, and adequacy of irrigation water supplies; the incentives & disincentives listed below may also be considered (CWC, 2014):

- Institution of awards at minor/major distributary level for implementing scientific water management procedures
- Providing incentives to Water Users Associations, in the form of reduced bulk rates for water, subsidized inputs etc.
- Creating disincentives for growing water intensive crops in soils and climate that are not conducive for such crops.

Adoption of scientific water management practices such as proper assessment of command area size, proper fixing of outlet sizes to match the crop water requirements, scientific estimation of crop water demands, scheduling of irrigation based on soil-water-plant interactions, minimising evaporation losses from irrigated fields through use of mulches, conjunctive use of surface water and groundwater, blending of water for irrigation application in salinity-affected areas, and technological up-gradation by adoption of sprinkler/micro-sprinkler/drip irrigation systems can help in achieving the desirable level of irrigation efficiency.

7.2.2 Regulate groundwater withdrawal in the basin and augment groundwater recharge to sustain baseflows

The major water intensive crops grown in large parts of WYC and EYC are paddy, sugarcane and wheat. Water guzzler crops like paddy and sugarcane have almost 100 percent assured irrigation in Haryana and UP canal commands and these areas totally depend on surface and groundwater resources. Provision of subsidised electricity to farmers has led to indiscriminate groundwater exploitation and excessive water use in agriculture. High consumption of water for irrigation mainly supported through groundwater is causing hydrological and economic distress manifested through depleting water tables and mounting energy subsidies for groundwater pumping. In short, with respect to the rate of

Table 7.2 Desirable increase in irrigation efficiency for maintaining e-flows downstream of Hathnikund Barrage

Month	Present Scenario					Recommended Scenario		
	Average Inflows to Hathnikund Barrage (cumec)	Average releases from Hathnikund Barrage (cumec)	Average diversions from Hathnikund Barrage (cumec)	% Diversion to WYC	% Diversion to EYC	Recommended minimum releases from Hathnikund Barrage for maintaining e-flows (cumec)	Average availability for diversions at Hathnikund Barrage (cumec)	Desirable % increase in irrigation efficiency
	I	II	III	IV	V	VI	VII	VIII
			(II-I)				(I-VI)	((III-VII)/III*100)
Jan	73.67	5.66	68.02	88.52	11.48	23.00	50.67	25.50
Feb	87.34	8.15	79.19	89.14	10.86	23.00	64.34	18.75
Mar	116.02	19.31	96.71	87.57	12.43	26.00	90.02	6.92
Apr	104.83	5.92	98.91	84.77	15.23	29.00	75.83	23.33
May	112.43	5.90	106.53	83.65	16.35	34.00	78.43	26.37
Jun	216.48	83.96	132.52	79.75	20.25	44.00	172.48	NA
Jul	524.32	170.16	354.16	81.74	18.26	158.00	366.32	NA
Aug	842.58	378.71	463.88	83.20	16.80	220.00	622.58	NA
Sep	664.06	310.93	353.12	84.75	15.25	149.00	515.06	NA
Oct	174.20	16.26	157.94	88.31	11.69	44.00	130.20	17.56
Nov	94.24	5.67	88.57	86.46	13.54	27.00	67.24	24.09
Dec	78.57	5.74	72.83	85.51	14.49	24.00	54.57	25.07

irrigation water applied, Haryana and Western UP do not display a sustainable economic water productivity scenario. The non-judicious irrigation water application in these regions is unsustainable in the medium to long term (Sharma et al., 2018).

There is a need to focus on bringing efficiency in irrigating water guzzler crops like rice and sugarcane, especially in regions where their irrigation water productivity is low despite high land productivity. In case of paddy, the states can consider diversifying the existing rice based cropping pattern towards other less water consuming crops like maize with assured processing technology support and dairy farming and/or can invest in water saving technologies like precision irrigation or SRI (System of Rice Intensification) practices for improving water use efficiency. Considering low water requirement, SRI practice is particularly very useful during non-monsoon cultivation of paddy.

Although paddy is the crop of Kharif (monsoon) season and there is not much problem of water availability during this season, yet, due to more assured water supply through canal systems, farmers have shifted from traditional Rabi crops (wheat) to paddy/sugarcane cultivation during Rabi season for better monetary returns. This needs to be discouraged through policy interventions. In Haryana, cotton crop is also grown by farmers. As an option, farmers in Haryana may also consider increasing area under cotton crop by replacing water guzzling paddy crop and employing efficient water use practices, thereby considerably reducing groundwater pumpage.

Unlike rice, wheat crop responds favourably to optimal irrigation and cannot withstand excessive water application. However, if the water stress prevails during the crop's critical growth stage, it may result in negative impact on the crop yield. If water management technologies like sprinkler irrigation is implemented in the commands, there is further scope of conserving the available water resources and thereby sustainably improving the productivity as well as profitability.

Sugarcane is one of the most water intensive crops grown in the canal commands. Micro/drip irrigation may be adopted by farmers to economize on water application and achieve higher productivity and water- and fertilizer-use efficiency. Drip tapes are especially useful for sugarcane as these are laid sub-surface causing no hindrance in agricultural activities even during using implements and their life is three years which coincides well with life of sugarcane.

As discussed in Chapter 4 and 5, as a consequence of large withdrawals of groundwater in the riparian states of Haryana and Uttar Pradesh, groundwater levels have receded all along the river stretch from downstream of Kalanaur to Baghpat, which in turn has affected the baseflow contribution to the flows in Yamuna in this stretch during the non-monsoon period. Between Hathnikund and Okhla barrage, maximum depletion ranging from 10 to 20 m is recorded in the Mawi-Baghpat reach.

There is an urgent need to regulate groundwater draft in Haryana and Western Uttar Pradesh. Adoption of measures discussed above would not only arrest the alarming decline of groundwater levels but would also sustain necessary baseflows to Yamuna river during the non-monsoon season in the long run.

7.2.3 Augmentation of non-monsoon inflows at Hathnikund barrage by creating storage of monsoon runoff in the upstream reaches

Non-monsoon inflows at Hathnikund barrage may be augmented by creating storage structures in the upstream reaches and conserve a portion of monsoon flows. In this regard, three multi-purpose storage projects — Lakhwar, Kishau and Renuka — in the Upper Yamuna Basin are already under consideration by Department of Water Resources, River Development and Ganga Rejuvenation.

These three projects are expected to augment the seasonal water availability in the downstream sections of the river. As per preliminary analysis by Uttarakhand Jal Vidyut Nigam Limited (UJVNL), Dehradun, it is estimated that the water availability corresponding to 90% dependability in the non-monsoon season from November to June will increase by approximately 168%. In this regard, a study at NIH Roorkee sponsored by UJVNL is under progress with the aim to assess the impact of different combinations of these three storage projects on the water availability at Hathnikund barrage in the monsoon period as well as the non-monsoon period.

It is envisaged that these storage structures shall provide the total benefits in terms of additional irrigation potential, water availability for various uses, and increased power generation capacity for the basin states.

7.2.4 Treatment of effluent coming through various drains meeting river Yamuna

The water quality of Yamuna River in Delhi stretch is very poor to sustain the river ecology, however, the deterioration in river water quality starts from Mawi. All the drains/streams meeting river Yamuna do not meet the criteria recommended by NGT vide its order dated 30.04.2019 w.r.t. application no. 1069/2018 in terms of pollutant load. NGT has recommended that treated sewage to be discharged in water bodies should have less than 10 mg/l BOD, however, the non-monsoon average BOD of the drains discharging in the river ranges from 19.6 mg/l to 262.2 mg/l. The high BOD in the drains indicates inadequate treatment of effluents being discharged in them. If the effluents joining river Yamuna through these drains are treated at source in line with NGT order, the river will become healthy to sustain biodiversity, else around 390 cumec flow will be required to be discharged from Wazirabad barrage, which is not a viable solution. Therefore, it is suggested to identify the industries/municipalities not treating the effluents to the desired levels and force them to treat the effluents before discharging in the drains meeting river Yamuna.

7.3 Concluding Remarks

To conserve the surface water and groundwater resources and improve the water availability in the WYC and EYC commands as well as sustain e-flows (both in terms of quantity and quality) in Yamuna river, a multi-dimensional approach is required that is based on different management possibilities and suitable technology as discussed in preceding sections.

Chapter 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 Inferences Drawn from the Study

The work documented in this report, envisaging to assess environmental flows for Yamuna river from Hathnikund barrage to Okhla barrage, essentially comprises of the following:

- Description of the study reach between Hathnikund and Okhla barrage
- Methodology adopted for assessment of environmental flows
- Build-up of database (collection of data from various sources and generating data from field investigations) and data analysis
- Integrated hydrological and hydrodynamic modeling based on SWAT and HEC-RAS 1D
- E-flows for sustaining indicator aquatic species
- Management options to maintain recommended e-flows

Major activities undertaken during the course of the study, and, inferences drawn from (1) field investigations and data analyses, (2) ecology and habitat requirements of indicator fish species, (3) integrated hydrological and hydrodynamic modeling, are summarized below. Recommendations emerging from the analysis are provided in Section 8.2.

8.1.1 Field investigations and data analyses

The assessment of environmental flows for the study reach is based on integrated hydrodynamic and hydrological modelling approach using SWAT and HEC-RAS 1D. A variety of datasets are required as model inputs as well as to validate the model outputs, such as observed river flows, inflows and releases from barrages, river cross sections, DEM, observed rainfall and temperature, land use land cover maps, soil maps etc. Besides the river water quality, the study also investigates the variation in groundwater levels over a period of more than four decades. All such necessary data were collected from respective agencies. In addition, exhaustive field surveys were carried out for the following:

- Identification of the indicator fish species and assessment of their habitat requirement based investigations in the river, and
- river cross-section surveys for total 306 lines at closely spaced intervals; the river cross-sections were taken at every 1 km for the whole reach, and for 14 selected stretches (at gauging sites or at confluence of canal/ drains/ natural streams and main river) 5 cross-sections were taken at every 250 m.

All the data were processed to analyse the river flows and water quality in different reaches.

Analysis of monthly flows has shown that in general, for most segments in the study reach, the discharge observed at downstream site is more than the discharge at upstream site barring a few months, which reveals that certain amount of flow is getting added into the river from intermediate catchment, from drains, and irrigation return flow etc. However, for

the Baghpat-DRB segment, the site at DRB is located downstream of Wazirabad barrage and the flow at this gauging site is largely influenced by the controlled releases from Wazirabad barrage and water contributed by various drains joining Yamuna between the barrage and DRB.

In view of large withdrawals of groundwater in the riparian states of Haryana and Uttar Pradesh, groundwater levels have receded all along the river stretch from downstream of Kalanaur upto Baghpat. The analysis of depth to groundwater levels for pre-monsoon and post-monsoon periods over a period of four decades from 1975 to 2018 has revealed maximum depletion ranging from 10 to 20 m in the Mawi-Baghpat reach.

Receding groundwater levels have in turn affected the baseflow contribution to the flows in Yamuna. Hydrograph analyses based on digital filtering method have shown that maximum depletion in baseflows is in the reach between Mawi and Baghpat during the months of April and May. Base flow index (BFI) is an important baseflow characteristic and indicates the contribution of baseflow to the river flow. For the study reach, the ratio of baseflow to total river flow is found to be higher in the non-monsoon season than in the monsoon season, thus resulting in a higher BFI for non-monsoon season. This pattern is representative of other gauges in the study reach and shows the importance of baseflows in sustaining river flows during non-monsoon period. A decreasing trend in BFI for all the seasons was found for Baghpat, and for non-monsoon season for Mawi. Decreases in BFI are linked to prolonged over-abstraction of groundwater, which is evident from declining groundwater levels in the Mawi-Baghpat reach.

Water quality analysis have shown that between the Wazirabad and Okhla barrage, the river receives approximately 6140 kg/hr BOD load out of which around 70% load is contributed through Nazafgarh drain. The average non-monsoonal DO value in the river stretch is 1.1 ± 0.14 mg/l as O₂. However, during the field survey by NIH team, the DO value in this stretch was non-detectable indicating the BOD load to the river higher than the assimilative capacity of the river. Thus, Delhi is the most critical stretch of Yamuna, however, the contamination starts from Paonta Sahib as is evident from the nutrients concentration in the river. In terms of organic contamination, the stretch downstream of Mawi is contaminated and needs immediate attention. The DO values also indicate the same. Although, the water quality upto Wazirabad barrage is good for fish proliferation, the reduction in DO values is a cause for concern.

8.1.2 Fish diversity in study reach and habitat requirement of indicator fish species

Two rapid field surveys were conducted in the study reach of river Yamuna for identification of indicator fish species and for determining the e-flow requirement for maintaining ecological integrity and sustaining fisheries resources of river Yamuna. During the survey, 40 species of fishes were recorded in the river sector from Hathnikund to above the Delhi segment. The Golden Mahseer (*Tor putitora*), the most charismatic and conservation significant species, was not recorded in Yamuna river below Hathnikund barrage. Historically, this species was reported to be present in the downstream reaches of river Yamuna. It is a well known fact that depletion of Golden Mahseer in downstream reaches of river Yamuna is mainly attributed to modifications in the river habitat (changes in substrate composition), volume of water, over fishing and pollution.

The presence of good population of reophilic species such as *Bangana dero* and *Raiamas bola* between Hathnikund and Panipat indicates that the habitat condition and quality of water is still conducive for such species. The condition of Yamuna river below Panipat deteriorates further because of large-scale modifications in river bed and increasing pollutant loads. As a result, it exhibits more abundance of non-native invasive and pollution tolerant species such as *Cyprinus carpio* and *Tilapia nilotica*, which constitute over 90% of fish catch in this stretch.

Field surveys have revealed three major fish habitat types such as pools, riffles and runs at the sampling sites in Yamuna river. Based on the present surveys and historical information, two options exist for estimation of e-flow.

- Option 1: For restoring the river habitat to historical condition, the conservation significant species Golden Mahseer may be selected as indicator species, although this species is not available downstream of Hathnikund barrage. The adult Golden Mahseer prefers depth > 1 m and velocity > 0.1 m/sec at pool habitat.
- Option 2: Based on the current fish community assemblage, the river sector between Hathnikund and Panipat has good population of reophilic species such as *Bangana (Labeo) dero* and *Raiamas bola*. These two reophilic species live in riffle/run habitat with moderately flowing channel unit.

The option of considering Golden Mahseer has not been explored further in the study since assessment of e-flow based on its habitat requirement will provide more suitable habitat in terms of volume, but does not guarantee in bringing back the river habitat features such as substrate heterogeneity suitable for Golden Mahseer.

The identified indicator species, *Bangana dero* and *Raiamas bola* are thriving well in run habitat of channel with depth ranging from 60 to 90 cm and velocity in the range of 0.1 m/s. The habitat suitability curves of these two species have been generated based on data recorded during field visits. It has been observed that wherever these species are present, the other economically important species, and, other small barbs and minnows also thrive well. *Hence, ensuring minimum water depth of 60 cm and flow of 0.1 m/s at riffle/run habitat in the river will safeguard the fish diversity in Yamuna river.*

8.1.3 Integrated modeling and development of e-flow regime

The integrated hydrologic and hydrodynamic modeling approach has been adopted to assess e-flows between Hathnikund barrage and Okhla barrage and compute the releases required from Hathnikund barrage for maintaining these e-flows. The hydrological model SWAT has been used to simulate streamflow (discharge), overland flow, groundwater recharge, evapotranspiration and total water yield in the study reach of Yamuna. For the hydrodynamic analysis of streamflows in Yamuna river, the HEC-RAS 1D model has been employed and the hydrodynamic variables such as maximum water depth, hydraulic depth, wetted perimeter, top width and water velocity for the range of discharges as available at Hathnikund barrage have been computed at different sections of the river.

Simulations using the calibrated SWAT model for unregulated and regulated flows show that significant amount of flow is available even during non-monsoon season for unregulated flow conditions (i.e. virgin flows) compared to the regulated conditions. The simulated discharge scenarios from SWAT, generated at different locations between Hathnikund and Okhla barrage, are found helpful in the assessment of flow availability during both non-monsoon and monsoon seasons

For converting the habitat suitability depth values into the flow values, depth versus discharge curves have been developed covering the whole hydrologic regime using HEC-RAS 1D simulations. Using the developed depth vs discharge curves for different sites, the minimum desirable flow values required for maintaining suitable physical habitat in terms of desirable flow depth of 60 cm, and, for inundating the floodplains at 13 identified locations, have been estimated. Further, the flows required to be released from Hathnikund barrage for maintaining the minimum desirable amount of flows at different sites during different seasons have been estimated using the flow series simulated by the calibrated hydrologic model SWAT. The release required from Hathnikund barrage during a specific month is computed by taking the maximum of the releases estimated from Hathnikund barrage for meeting the minimum depth requirement of 0.60 m at 13 identified locations corresponding to the specific month.

For carrying out various functions, the aquatic ecosystem needs natural flow variability, within the year, for its sustenance. Incorporation of natural variability of flows has been implemented by taking minimum depth (60 cm) for the month of May (this being the driest month at all the G&D sites downstream of Hathnikund barrage) and modifying the releases as per the existing natural variability observed in long-term historical data, with the condition that these computed values for different months are not less than the releases required for maintaining 60 cm at all the 13 identified locations.

8.2 Recommendations

8.2.1 Suggested e-flow regime

The final recommended releases from Hathnikund barrage for maintaining required habitat conditions between Hathnikund and Okhla barrage during the different months of a year are given in Table 8.1 and also illustrated in Fig. 8.1.

The recommended releases from Hathnikund barrage are approximately 30% of the inflows at Hathnikund barrage which is comparable to the e-flow recommendations in the MOWR, RD & GR Notification dated 9th Oct 2018 for Upper Ganga basin upto Haridwar that suggests 20%, 25% and 30% of inflows as environmental flows during lean season, non-monsoon & non-lean season, and monsoon season, respectively.

As evident from Fig. 8.1, the recommended minimum releases for non-monsoon season are slightly higher than the current average monthly releases from Hathnikund barrage, however, for the monsoon months of July and August, the current average monthly releases are much higher than the recommended releases. Since during the monsoon months of July and August, inflows at Hathnikund are significantly higher than the diversion capacity of

Table 8.1 Final recommended releases required from Hathnikund barrage for maintaining suitable habitat at all downstream locations between Hathnikund and Okhla barrage

Month	Average monthly inflows at Hathnikund barrage (cumec)	Average monthly releases from Hathnikund barrage (cumec)	Recommended minimum releases from Hathnikund barrage incorporating natural variability (cumec)	Flow regime obtained after implementing recommended minimum releases (cumec)	For inundating floodplains (cumec) - once a month
Jan	48.49	9.97	22.81	22.81	
Feb	37.96	9.97	23.38	23.38	
Mar	45.93	9.97	25.89	25.89	
Apr	71.31	9.97	28.69	28.69	
May	57.06	9.97	33.73	33.73	
Jun	115.22	17.66	44.45	44.45	
Jul	661.72	274.57	158.16	274.57	1398
Aug	841.81	298.14	219.82	298.14	1631
Sep	462.09	160.31	148.62	160.31	
Oct	150.76	29.73	43.66	43.66	
Nov	67.63	9.97	27.01	27.01	
Dec	57.51	9.97	24.32	24.32	

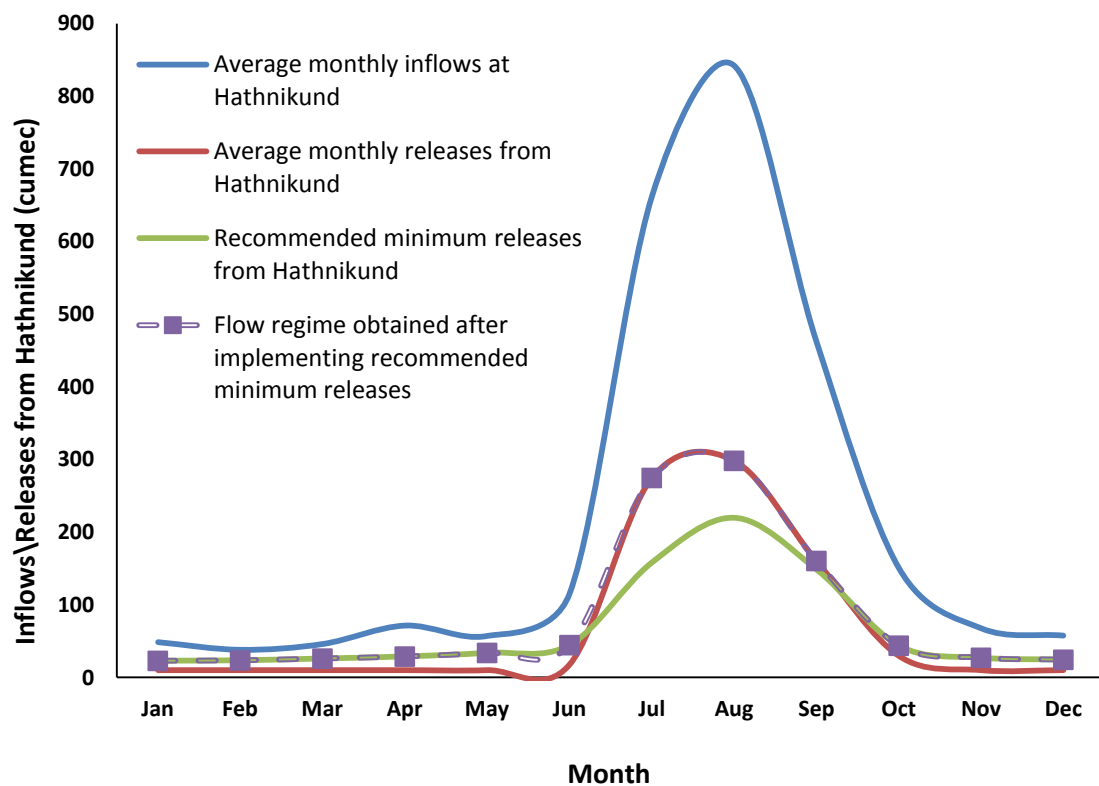


Fig. 8.1 Recommended releases from Hathnikund Barrage for sustaining downstream ecosystem upto Okhla barrage

barrage, the flow regime during these monsoon months will be the same as the current releases. Therefore, after implementation of recommended minimum releases from Hathnikund barrage, the flow regime downstream of Hathnikund barrage will comprise of recommended minimum releases during non-monsoon season and current releases during monsoon season.

It may be noted here that this analysis is based on water requirement of indicator fish species, however, the biodiversity, livelihood and spiritual groups can link their requirements to specific features of the river channel at the study sites.

Table 8.2 provides the expected flows at Wazirabad barrage for recommended values of flows released from Hathnikund barrage in a year with average rain for the present scenario after meeting out all the current demands of water, upstream of Wazirabad barrage.

Table 8.2 Expected flows at Wazirabad barrage for recommended values of flows released from Hathnikund barrage

Month	Recommended minimum releases from Hathnikund barrage (cumec)	Expected flows at Wazirabad barrage under average conditions (cumec)
Jun	44.45	28.41
Jul	158.16	245.27
Aug	219.82	350.78
Sep	148.62	259.14
Oct	43.66	64.14
Nov	27.01	40.41
Dec	24.32	33.40
Jan	22.81	34.05
Feb	23.38	27.01
Mar	25.89	18.50
Apr	28.69	12.02
May	33.73	9.49

8.2.2 Management options to maintain recommended e-flows

In the present scenario, approximately 47.5% and 9.8% of inflows at Hathnikund barrage are diverted to WYC and EYC commands, respectively, during monsoon season, while 78.5% and 13.0% of inflows at Hathnikund barrage are diverted to WYC and EYC commands, respectively, during non-monsoon season. Thus, only 42.7% and a meagre 8.5% of inflows at Hathnikund barrage are released into the river during monsoon and non-monsoon seasons, respectively. The releases during non-monsoon season are significantly low and do not meet the e-flow requirement in the downstream reaches of Yamuna river. Possible management strategies for maintaining e-flows are recommended below.

- Reduction in diversions to WYC/EYC by increasing the irrigation efficiency in WYC and EYC commands, keeping in view the crop water requirement
- Regulate groundwater withdrawal in the basin especially in the Mawi-Baghpat stretch and augment groundwater recharge in order to sustain baseflows
- Augmentation of non-monsoon inflows at Hathnikund barrage by creating storage of monsoon runoff in the upstream reaches
- Treatment of effluent coming through various drains meeting river Yamuna

It is observed that all the drains/streams meeting river Yamuna do not meet the criteria recommended by NGT vide its order dated 30.04.2019 w.r.t. application no. 1069/2018 in terms of pollutant load. NGT has recommended that treated sewage to be discharged in water bodies should have less than 10 mg/l BOD, however, the non-monsoon average BOD of the drains discharging in the river ranges from 19.6 mg/l to 262.2 mg/l. The high BOD in the drains indicates inadequate treatment of effluents being discharged in them. If the effluents joining river Yamuna through these drains are treated at source in line with NGT order, the river will become healthy to sustain biodiversity, else around 390 cumec flow will be required to be discharged from Wazirabad barrage, which is not a viable solution as such quantum of flows were not available during non-monsoon season even in pristine conditions.

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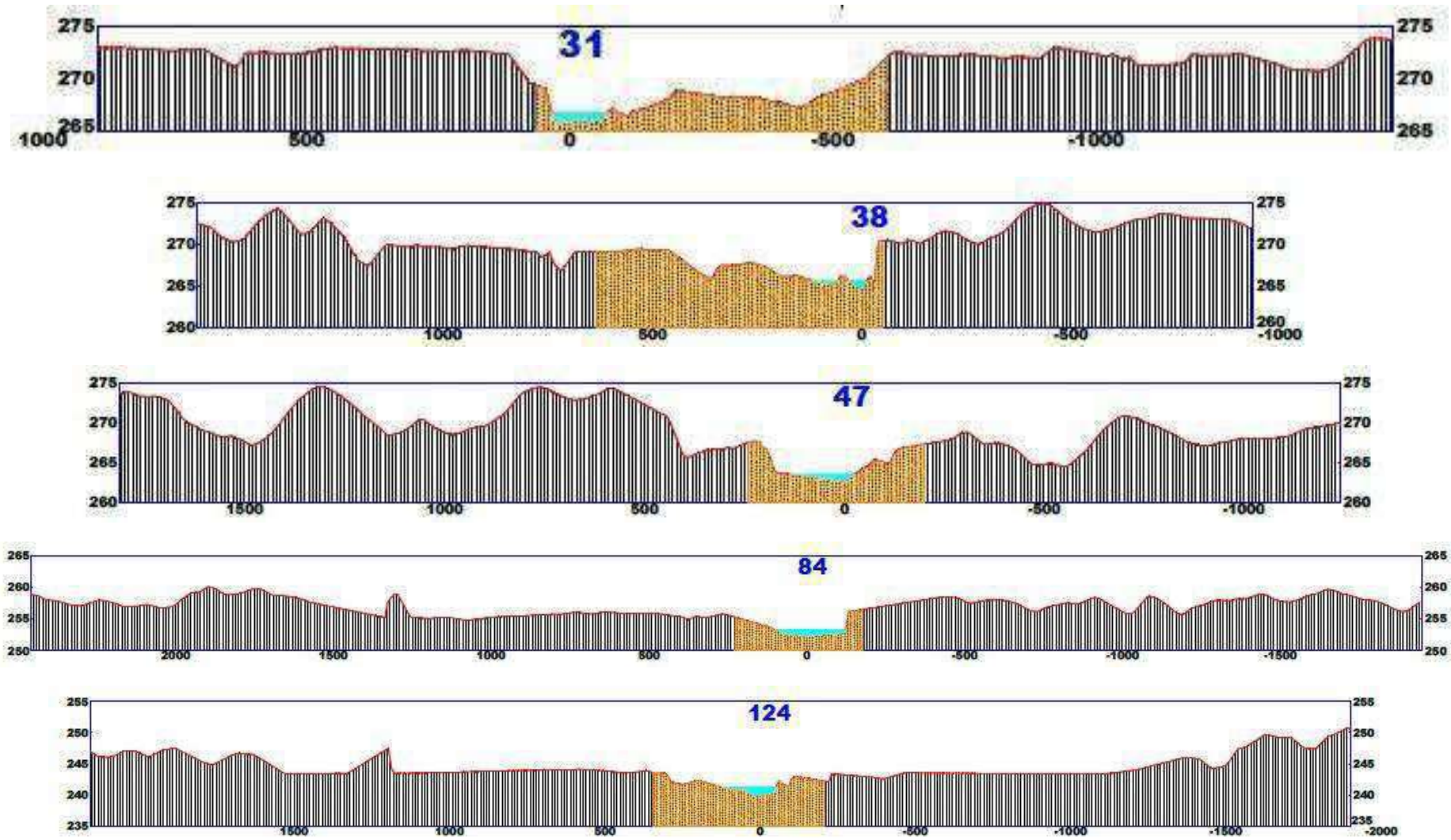
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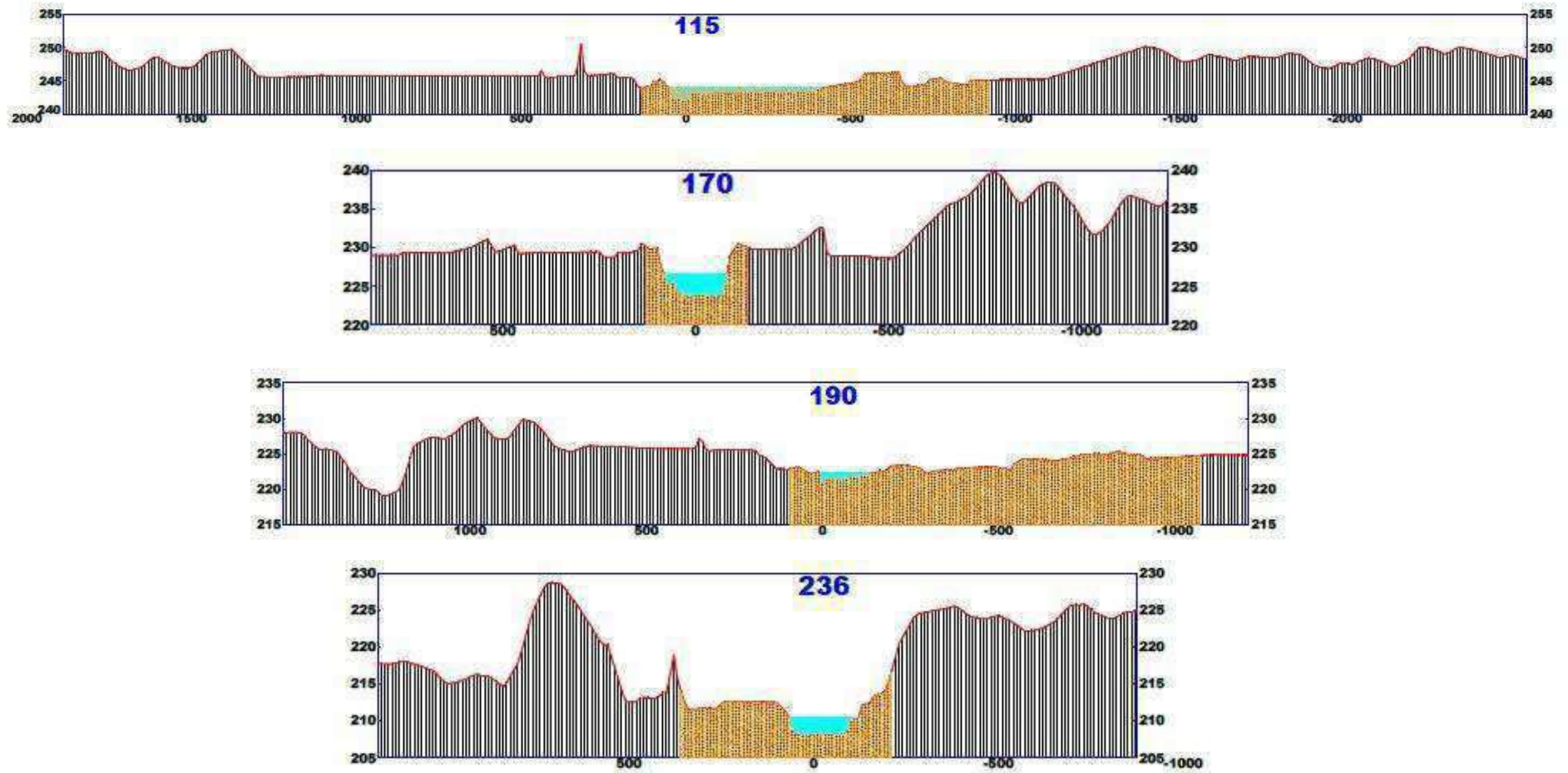
Annexure 1

River cross-sections along Yamuna river

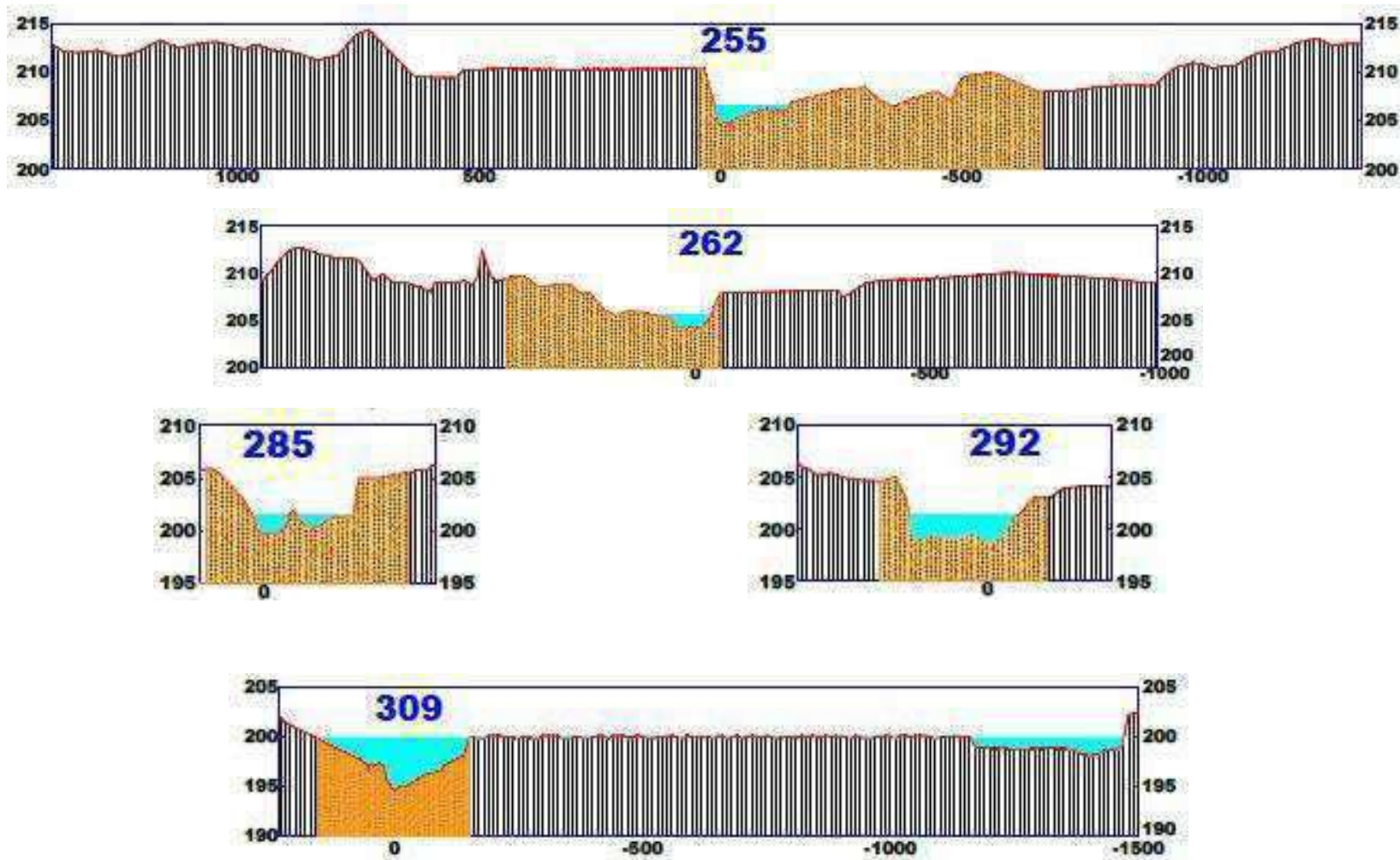
ANNEXURE 1



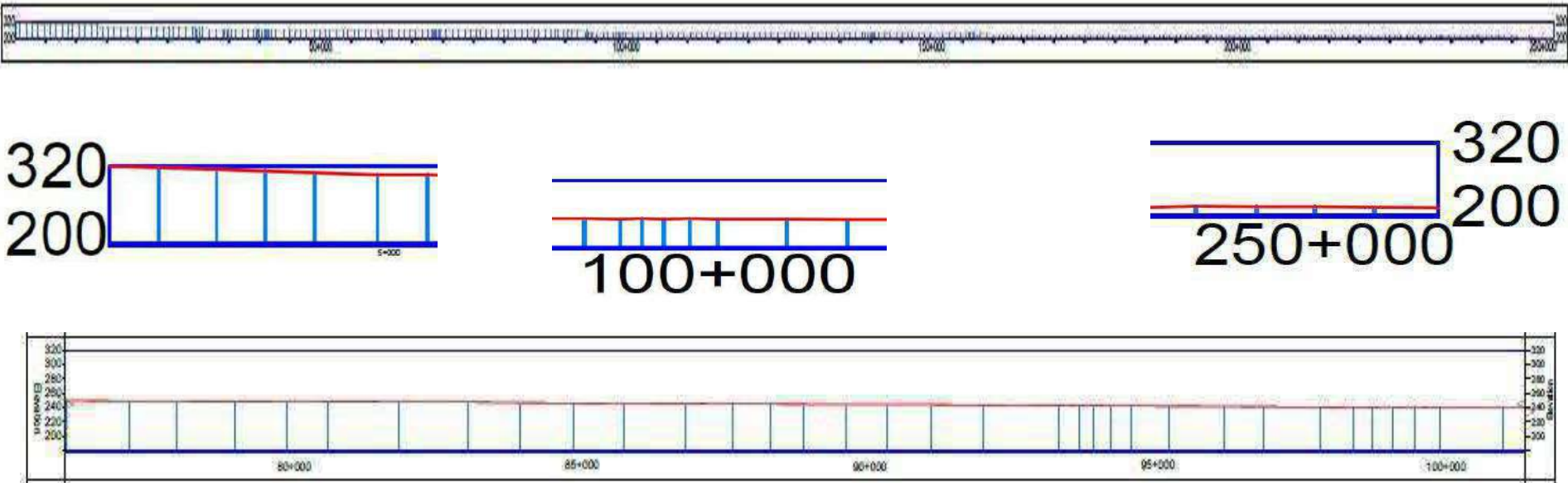
Few surveyed river cross-sections along Yamuna river



Few surveyed river cross-sections along Yamuna river



Few surveyed river cross-sections along Yamuna river



Longitudinal profile and selected sections

Annexure 2

**Hathnikund Releases vs Simulated Discharge
at Selected Sites for Different Months**

ANNEXURE 2

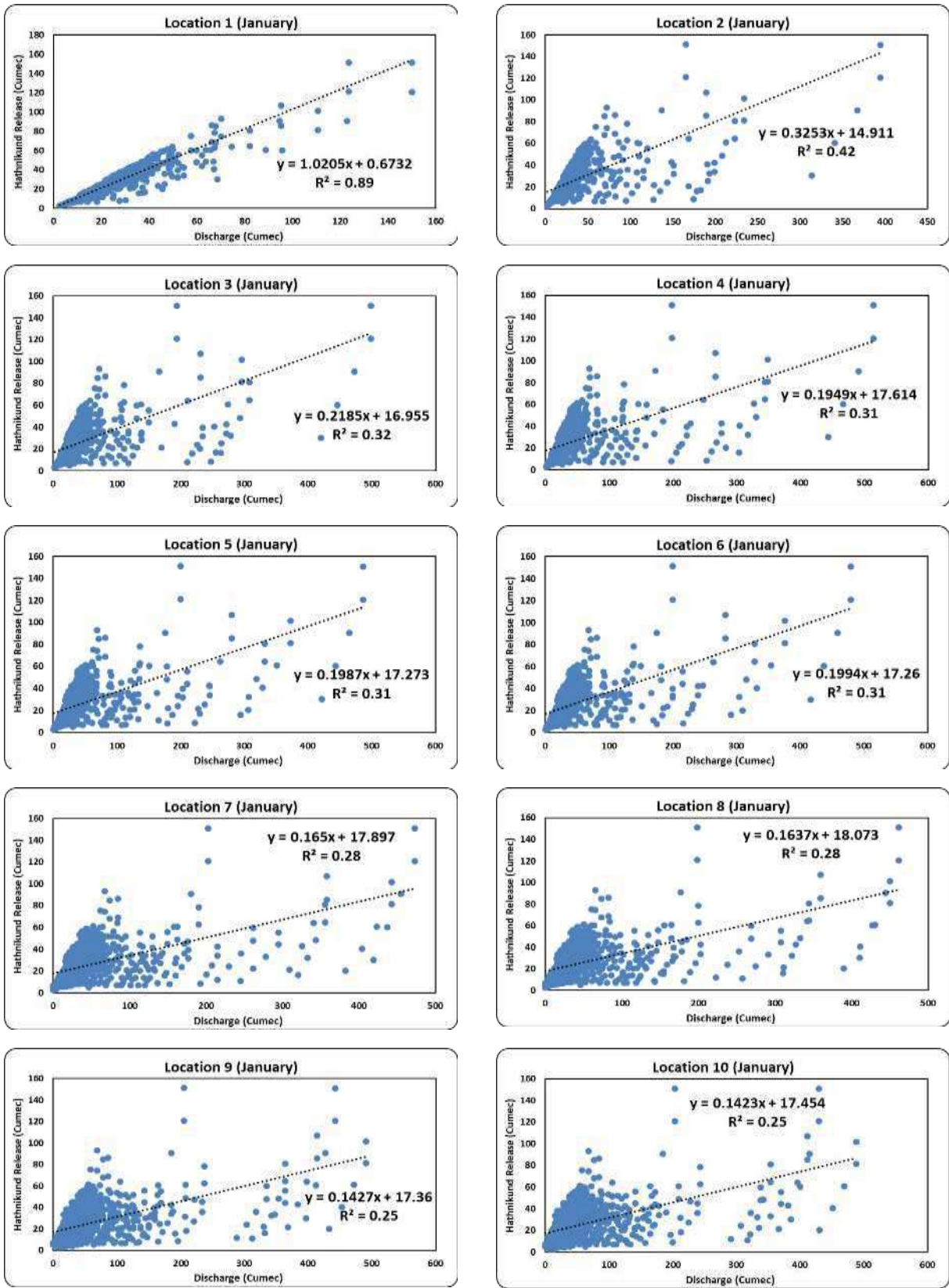


Fig. A2.1 Hathnikund releases vs simulated discharge on selected sites for month of January (contd...)

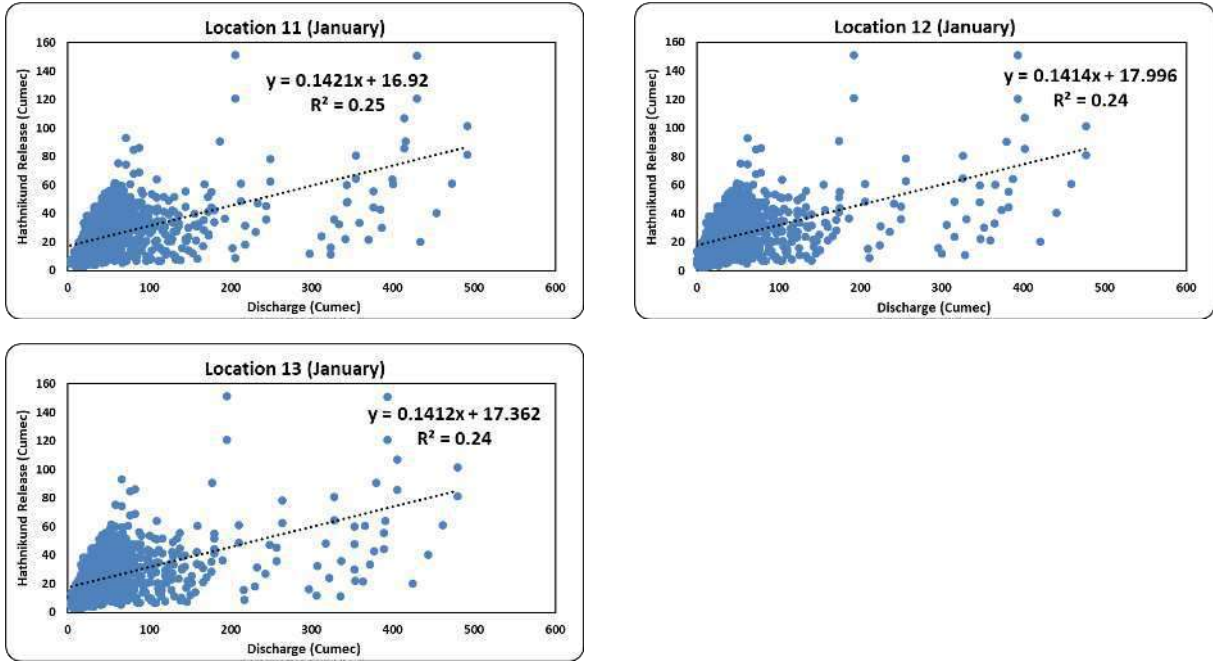


Fig. A2.1 Hathnikund releases vs simulated discharge on selected sites for month of January

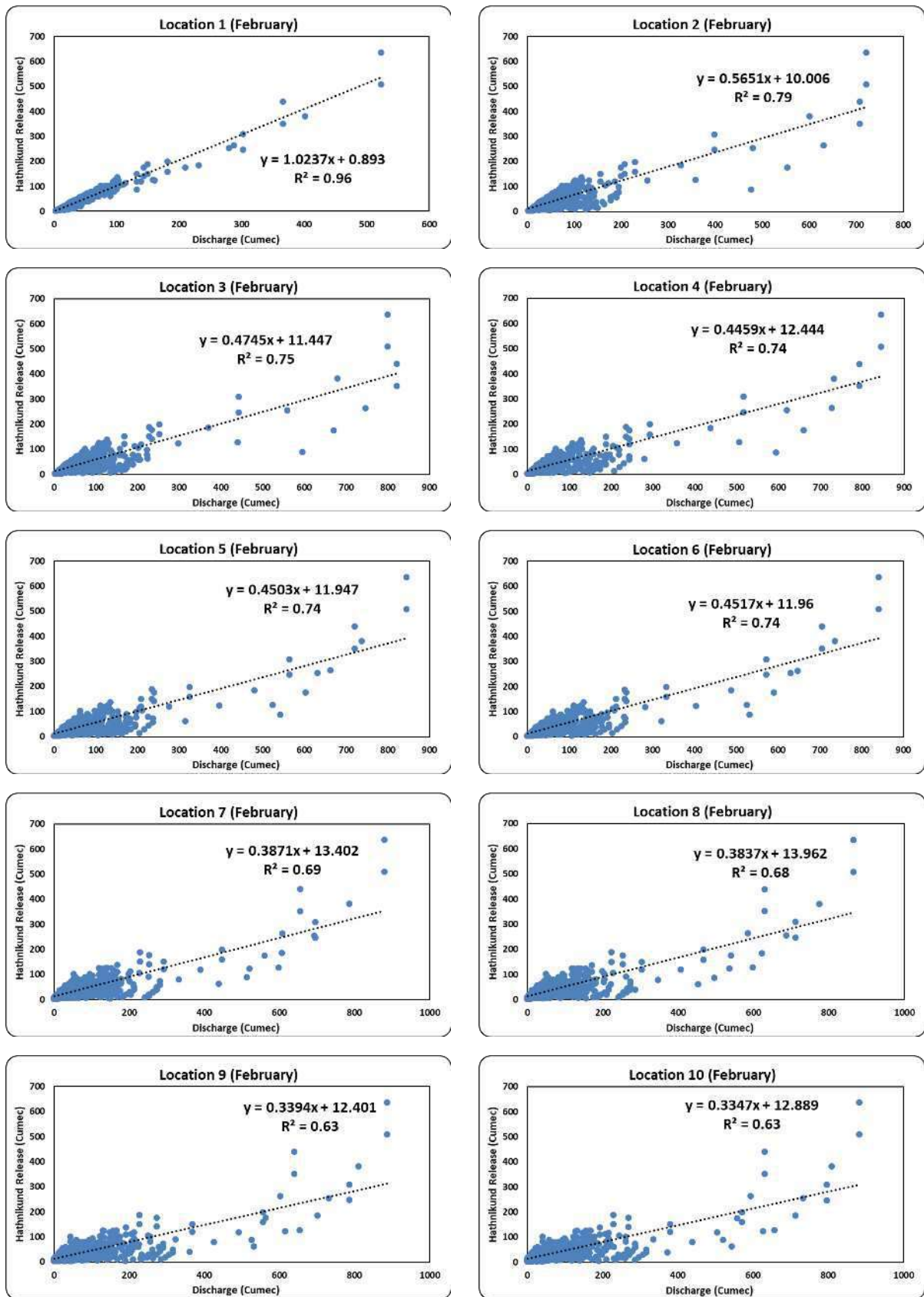


Fig. A2.2 Hathnikund release vs simulated discharge on selected sites for month of February (contd...)

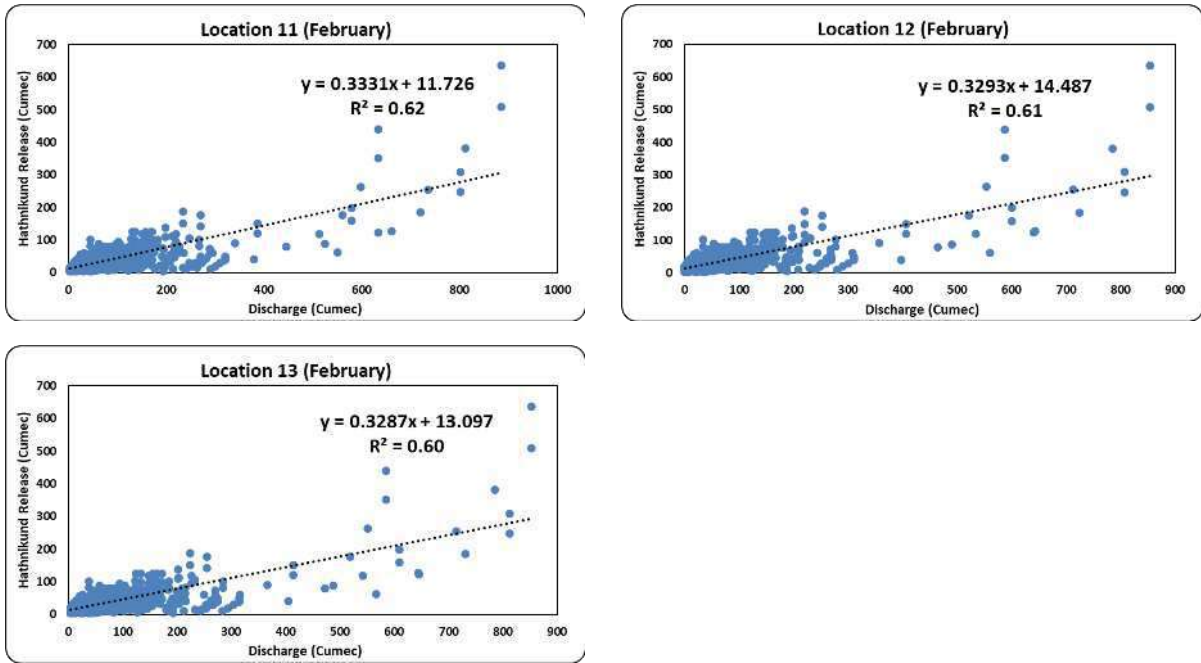


Fig. A2.2 Hathnikund release vs simulated discharge on selected sites for month of February

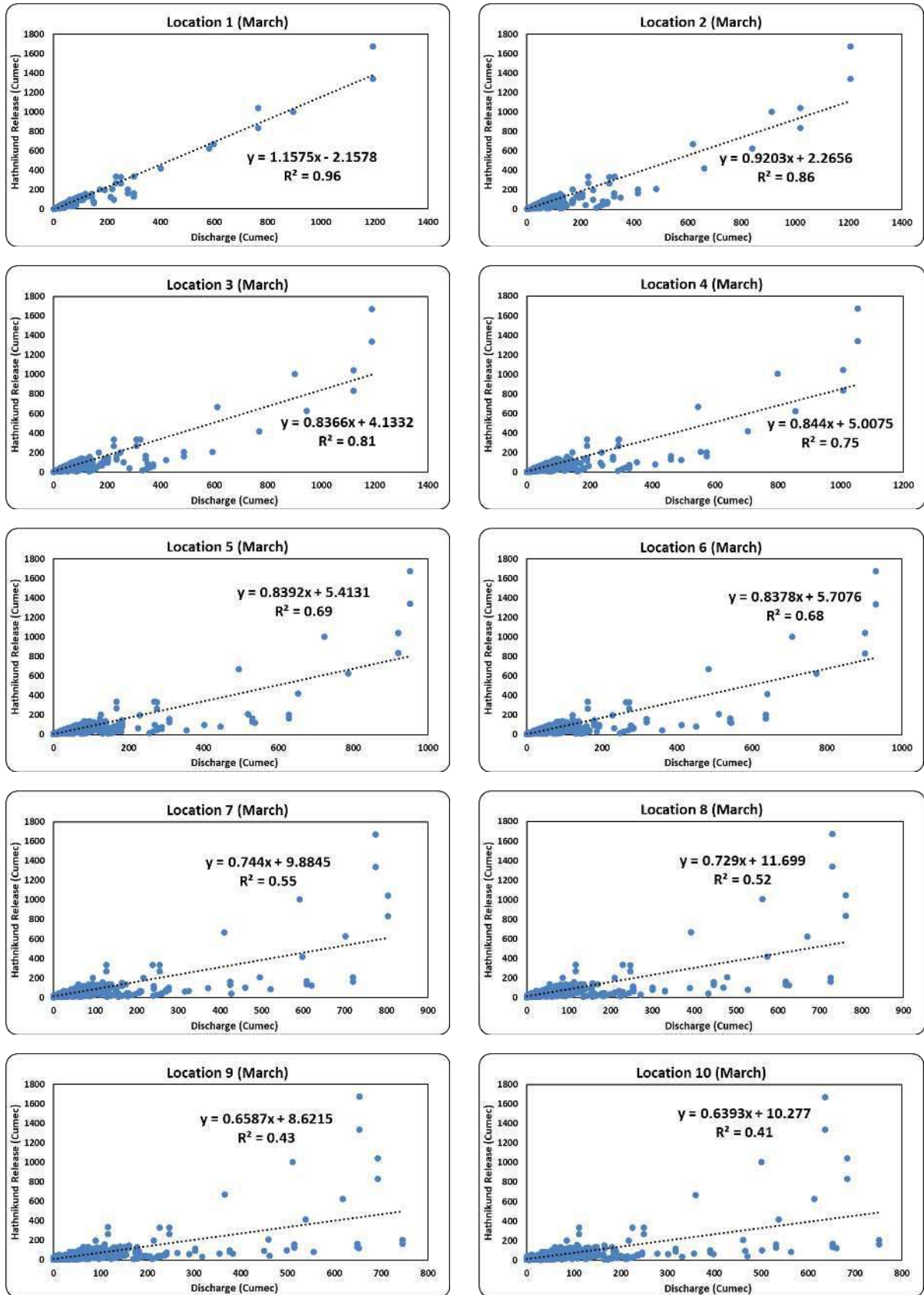


Fig. A2.3 Hathnikund release vs simulated discharge on selected sites for month of March (contd...)

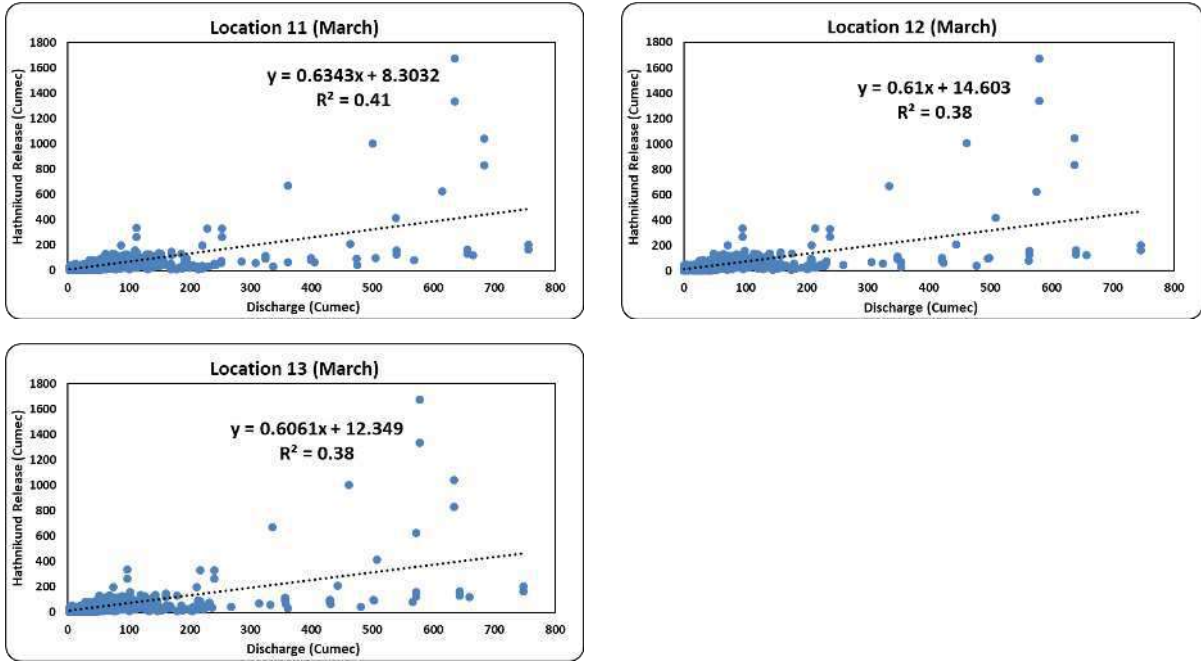


Fig. A2.3 Hathnikund release vs simulated discharge on selected sites for month of March

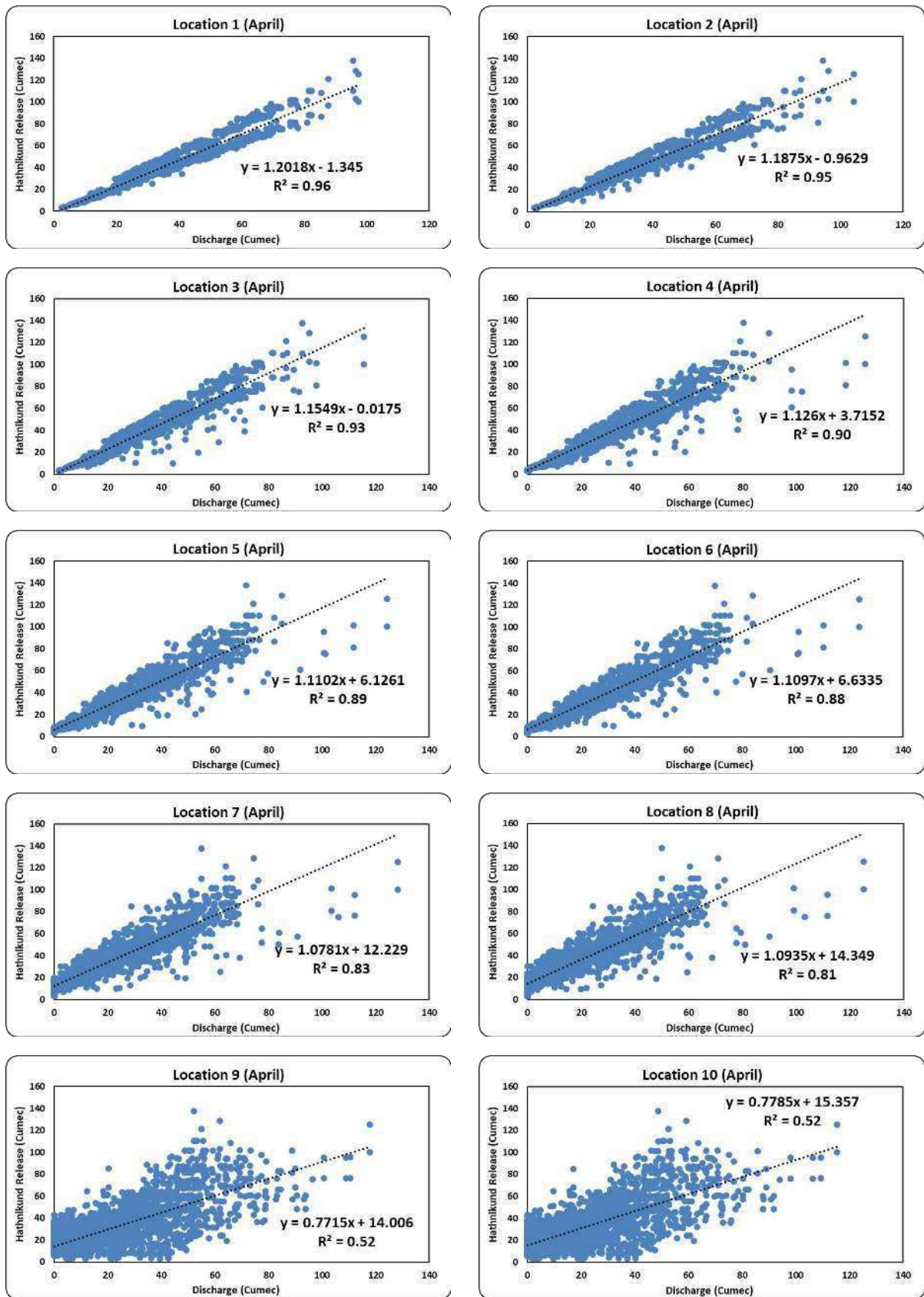


Fig. A2.4 Hathnikund release vs simulated discharge on selected sites for month of April (contd...)

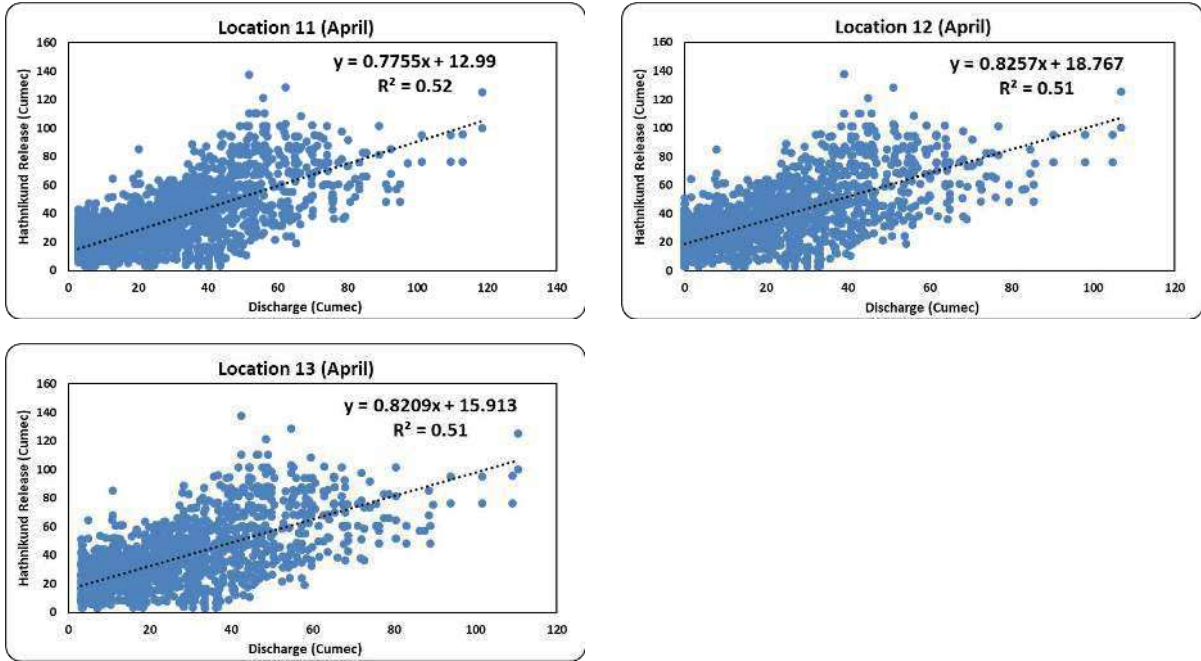


Fig. A2.4 Hathnikund release vs simulated discharge on selected sites for month of April

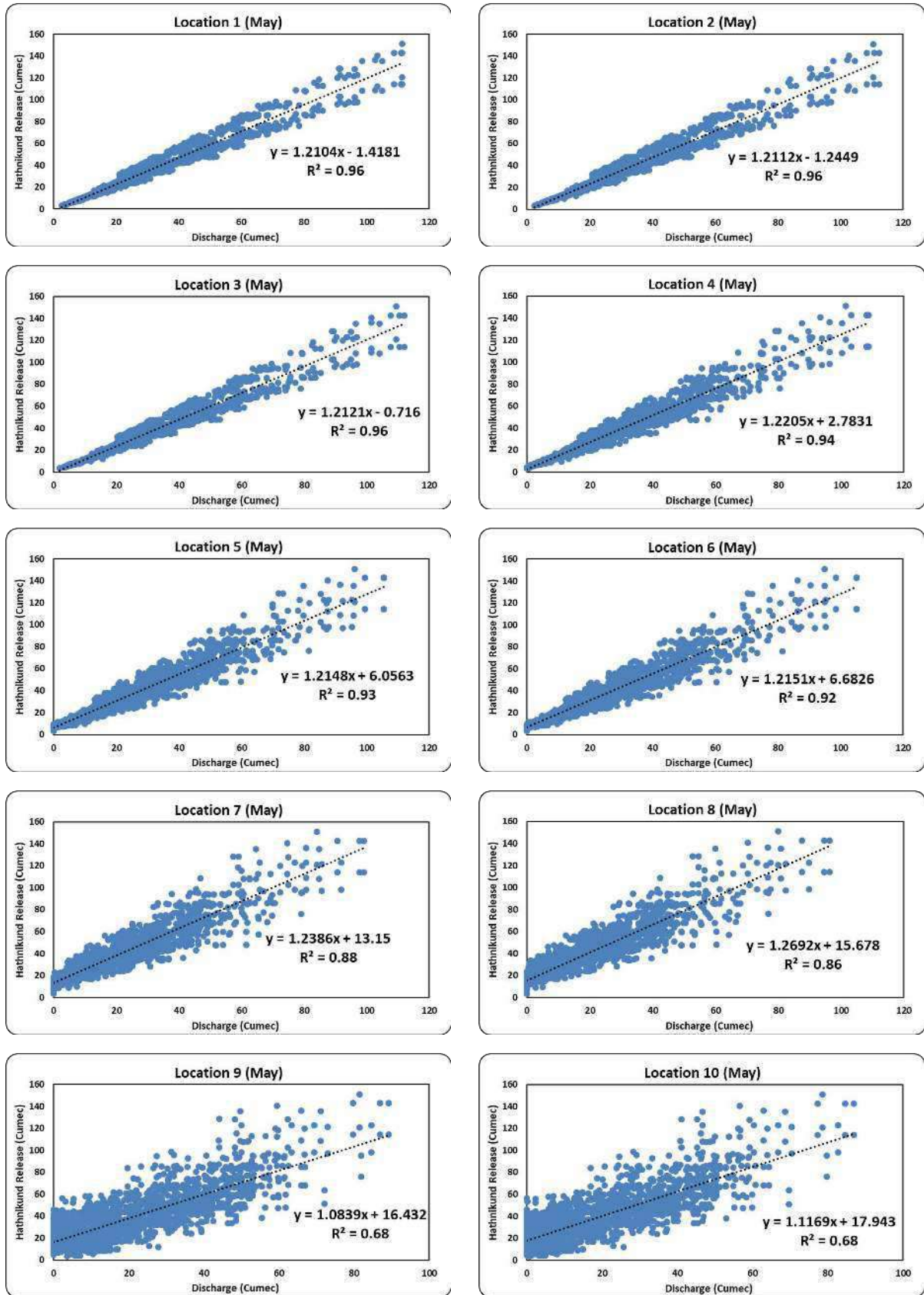


Fig. A2.5 Hathnikund release vs simulated discharge on selected sites for month of May (contd...)

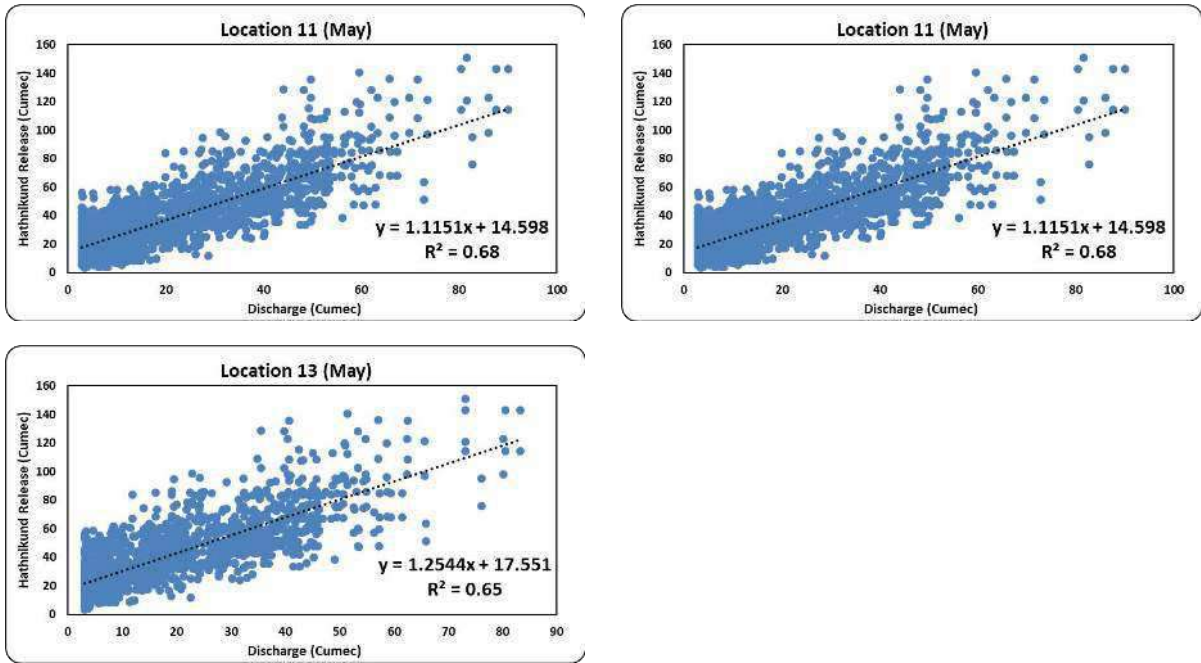


Fig. A2.5 Hathnikund release vs simulated discharge on selected sites for month of May

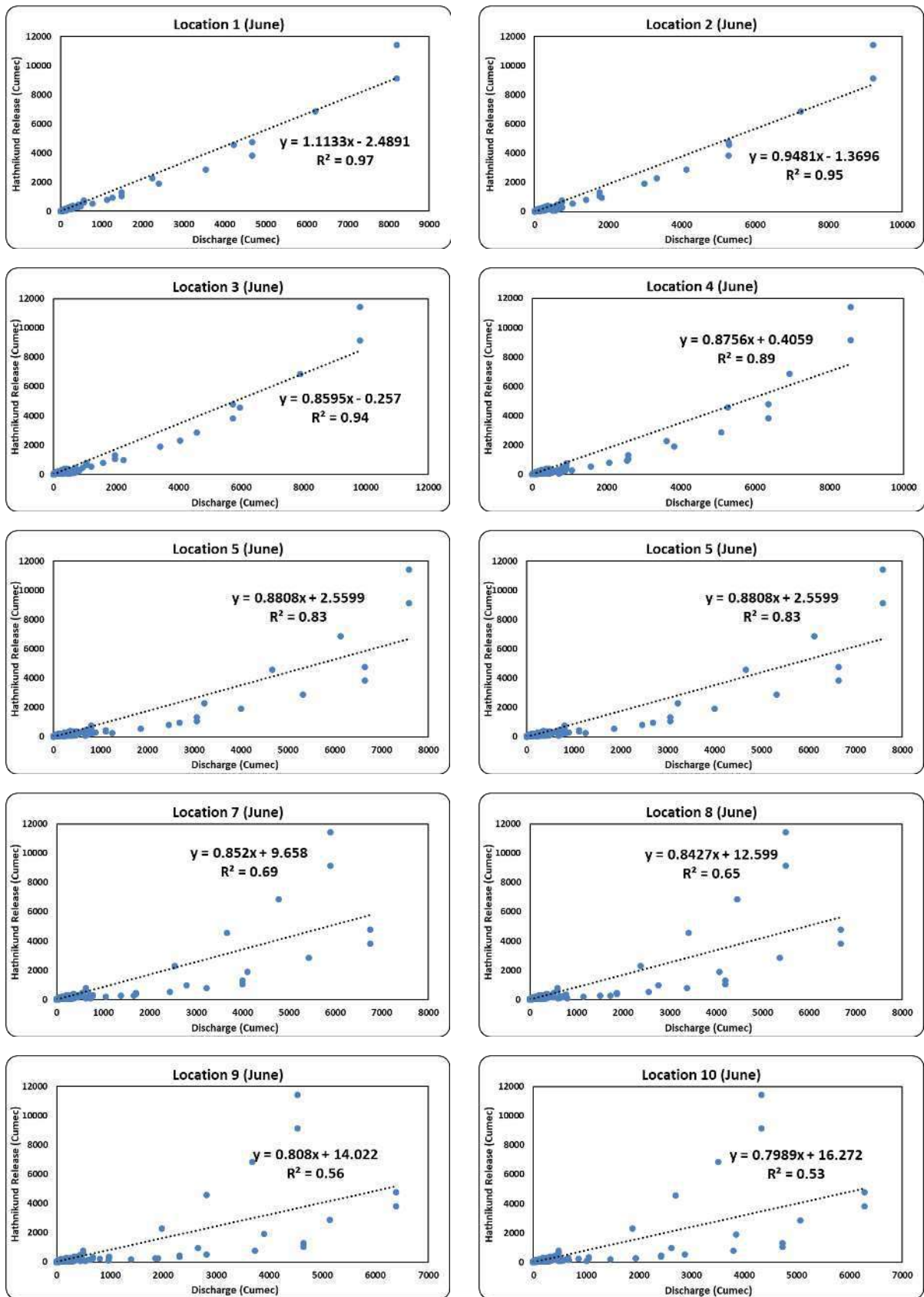


Fig. A2.6 Hathnikund release vs simulated discharge on selected sites for month of June (contd...)

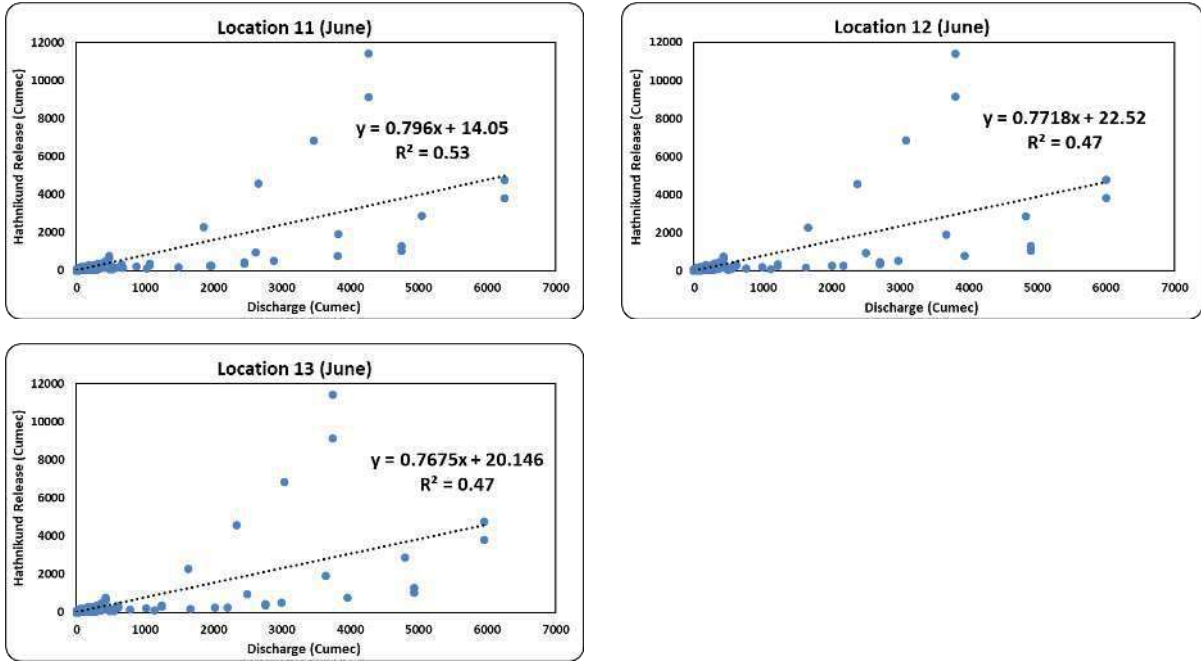


Fig. A2.6 Hathnikund release vs simulated discharge on selected sites for month of June

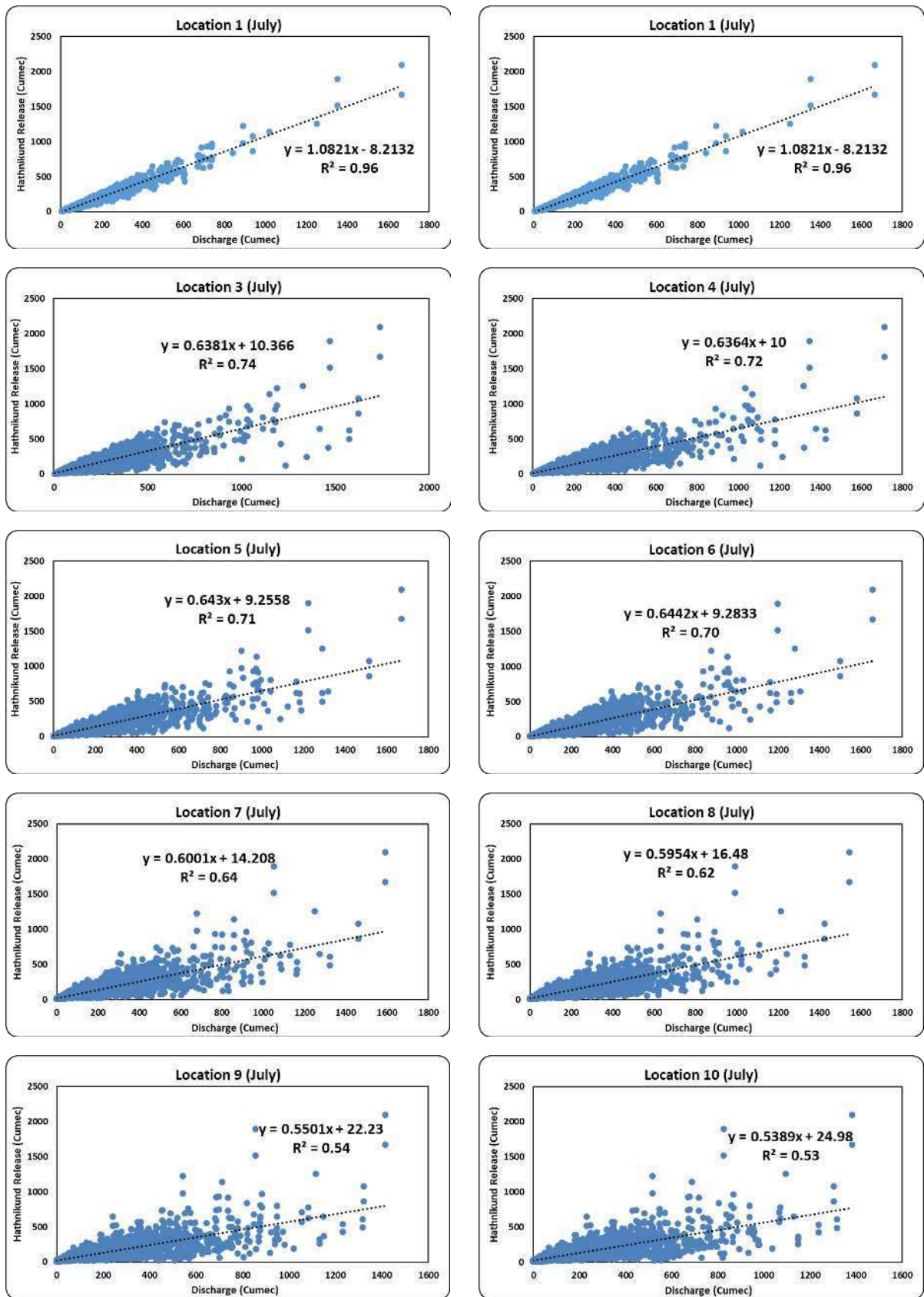


Fig. A2.7 Hathnikund release vs simulated discharge on selected sites for month of July (contd...)

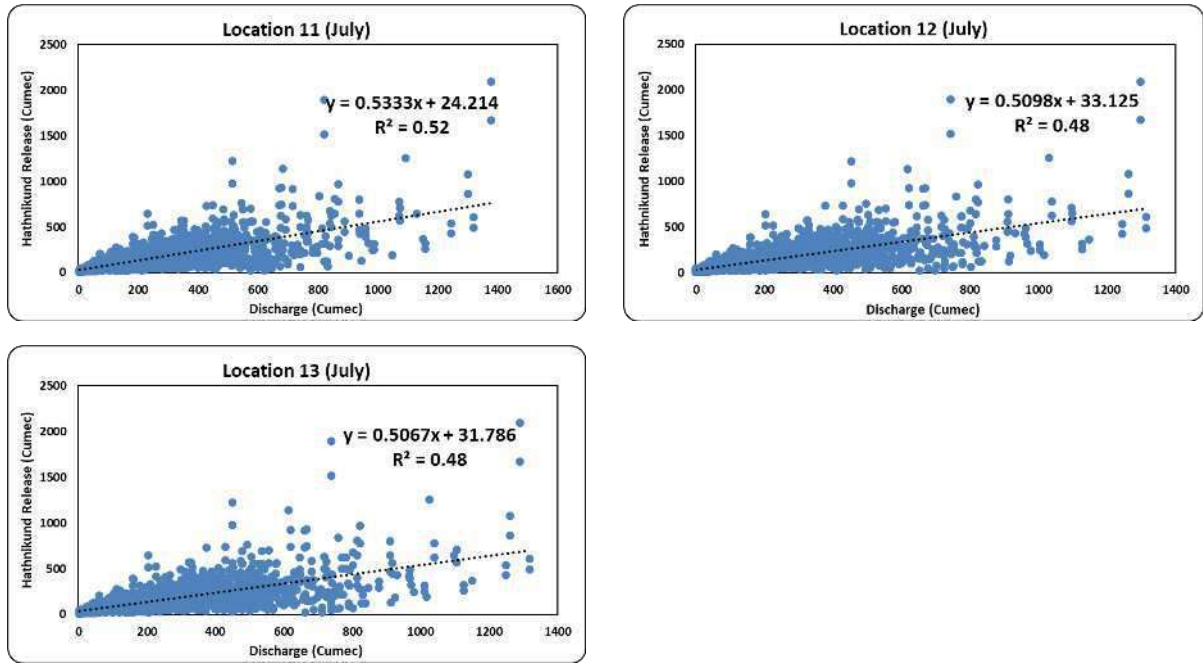


Fig. A2.7 Hathnikund release vs simulated discharge on selected sites for month of July

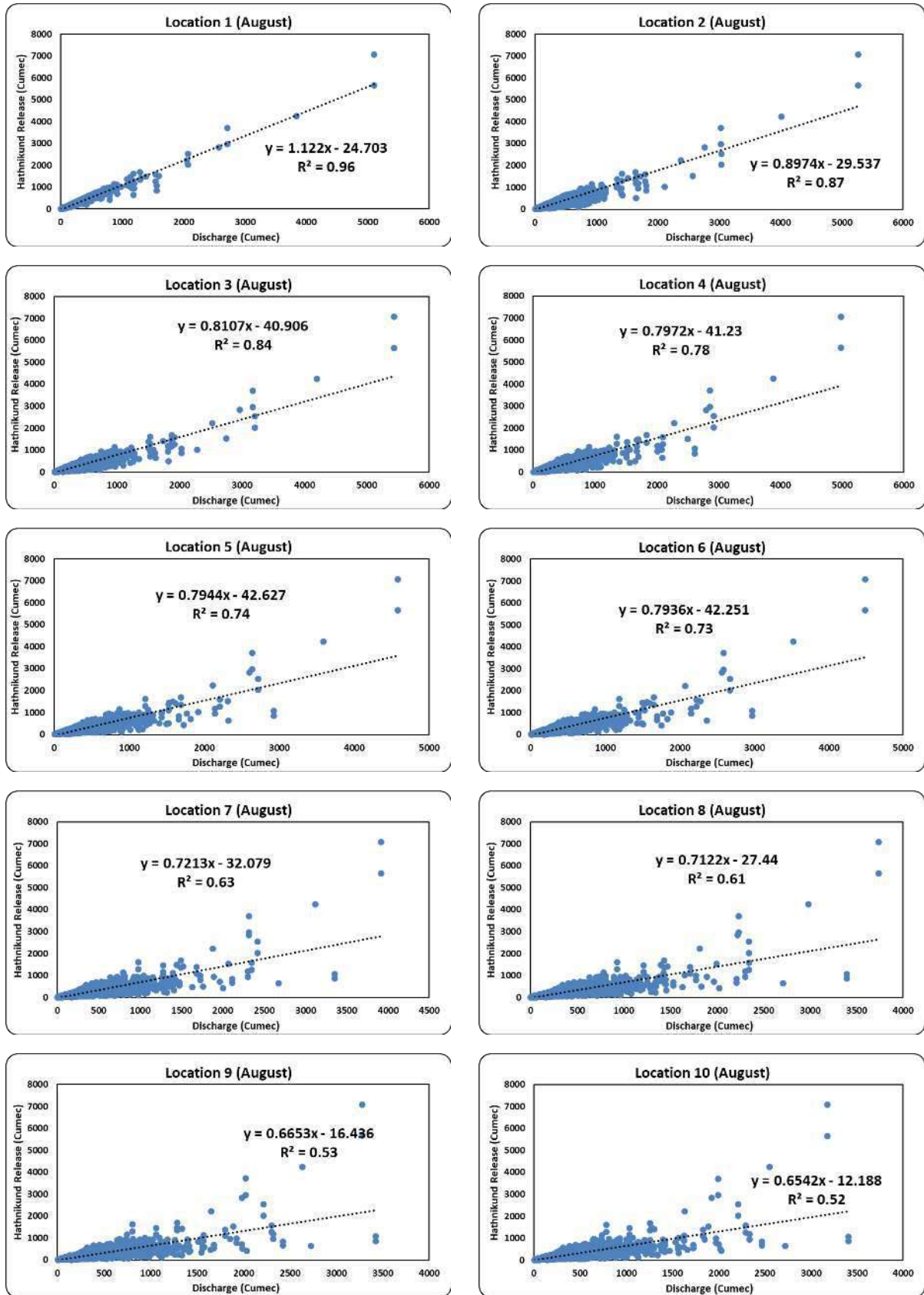


Fig. A2.8 Hathnikund release vs simulated discharge on selected sites for month of August (contd...)

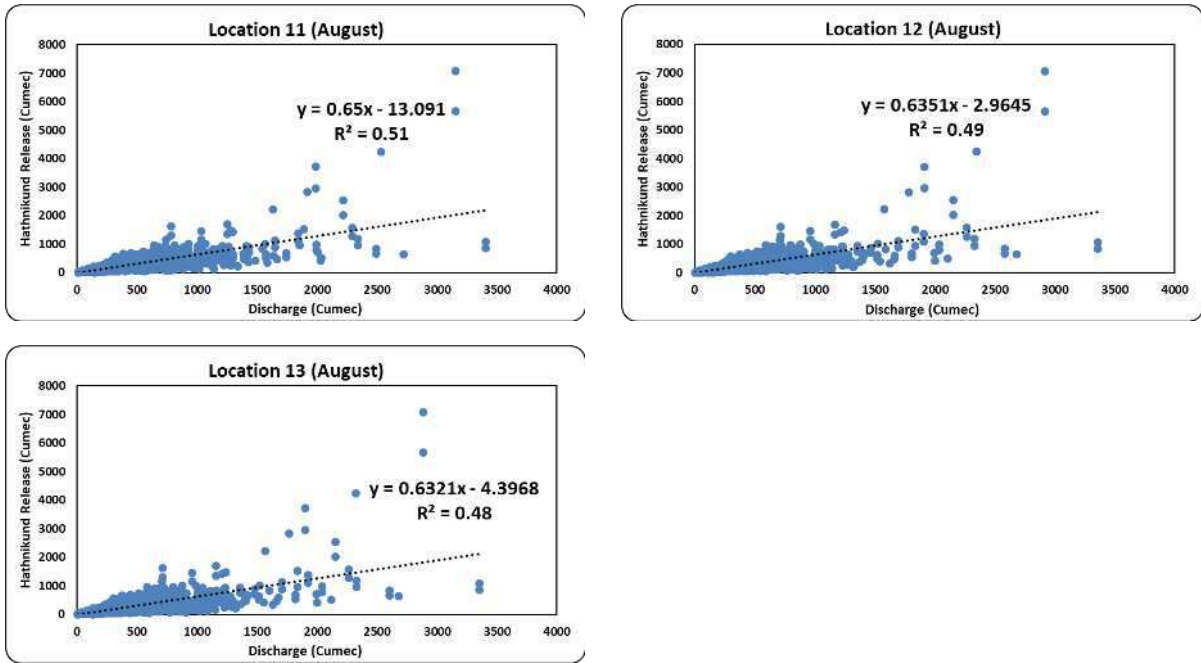


Fig. A2.8 Hathnikund release vs simulated discharge on selected sites for month of August

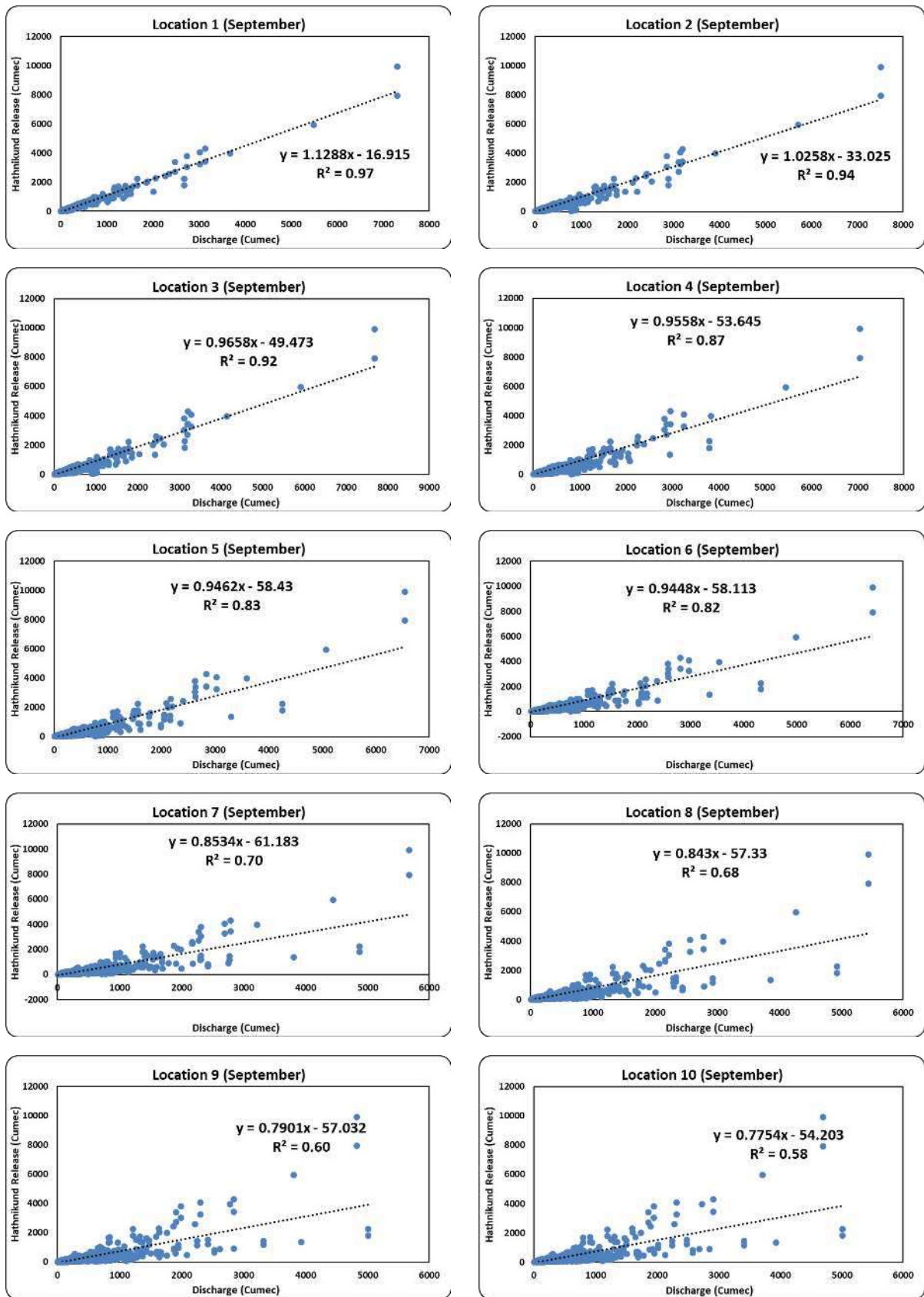


Fig. A2.9 Hathnikund release vs simulated discharge on selected sites for month of September (contd...)

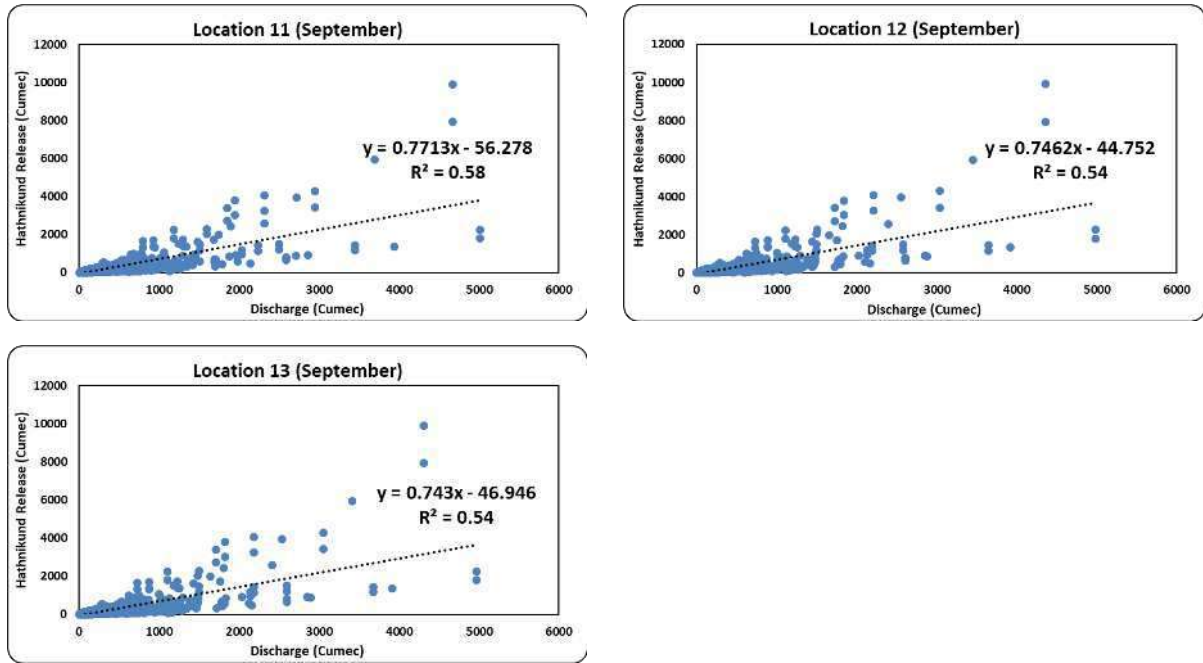


Fig. A2.9 Hathnikund release vs simulated discharge on selected sites for month of September

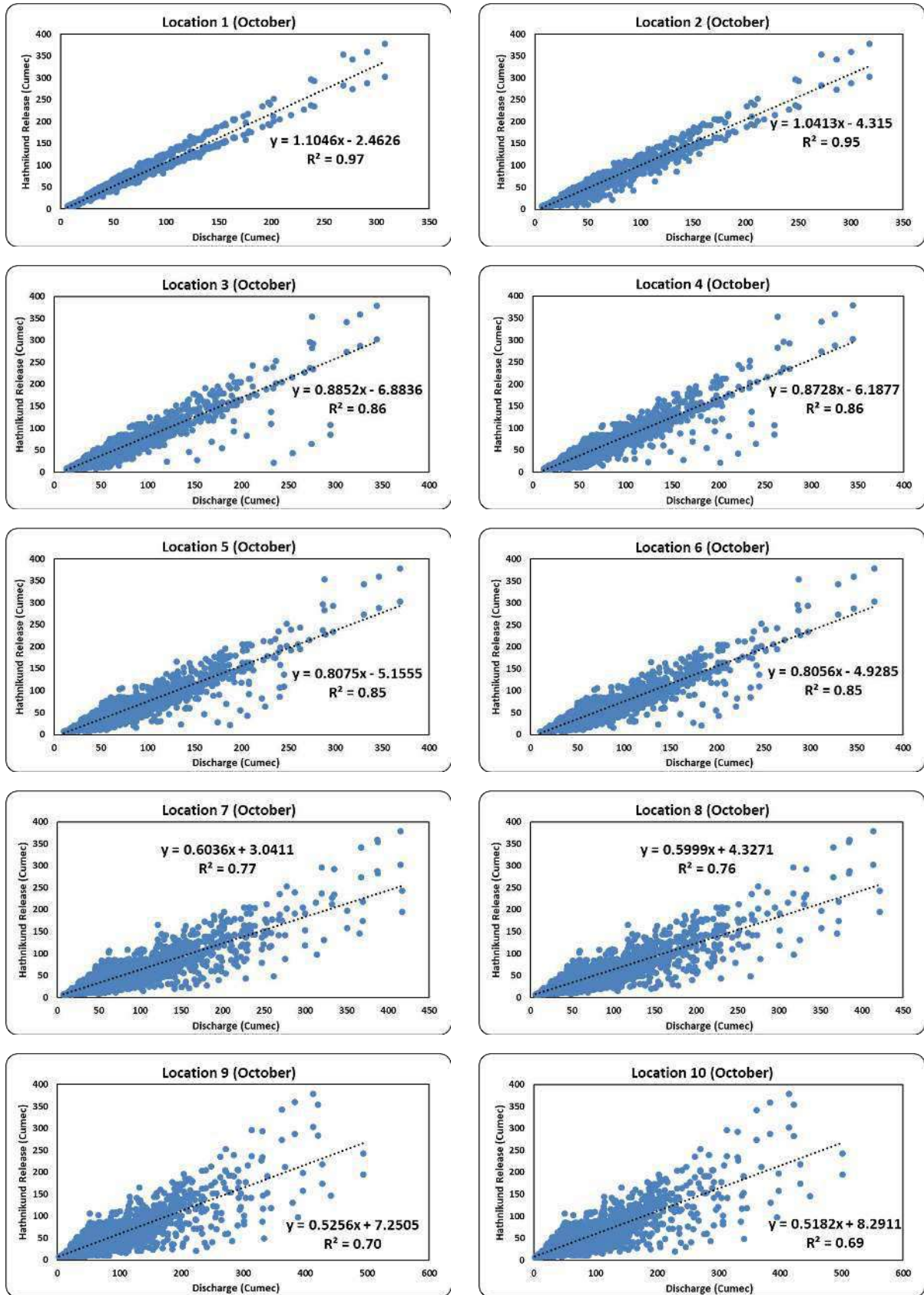


Fig. A2.10 Hathnikund release vs simulated discharge on selected sites for month of October (contd...)

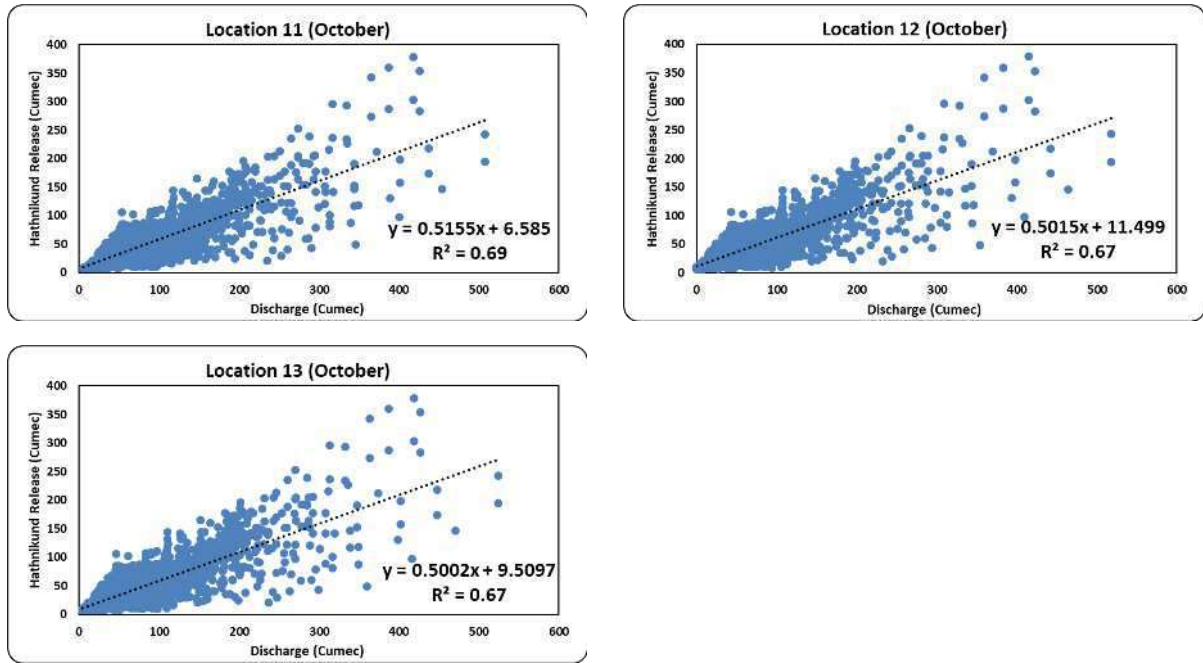


Fig. A2.10 Hathnikund releases vs simulated discharge on selected sites for month of October

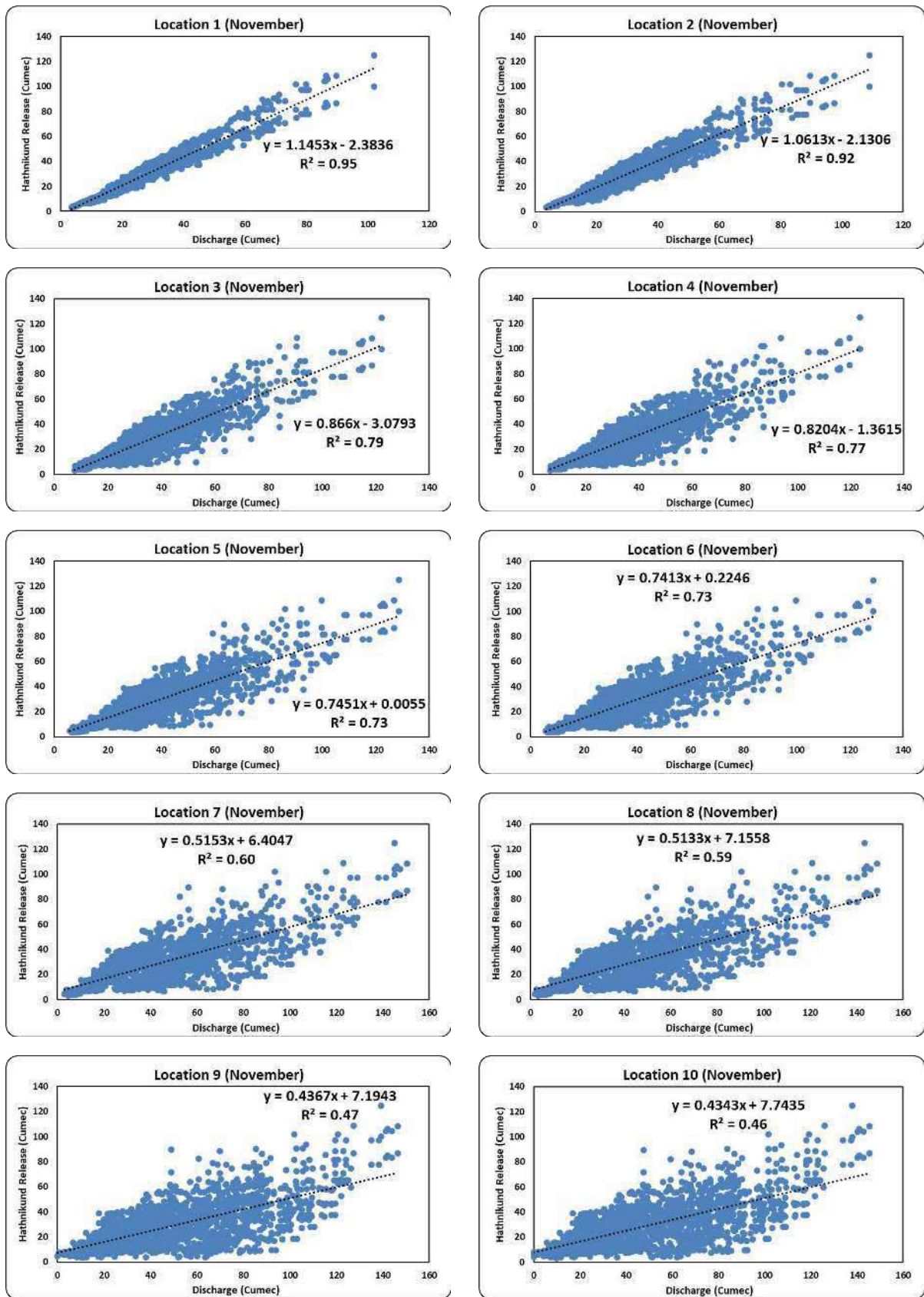


Fig. A2.11 Hathnikund releases vs simulated discharge on selected sites for month of November (contd...)

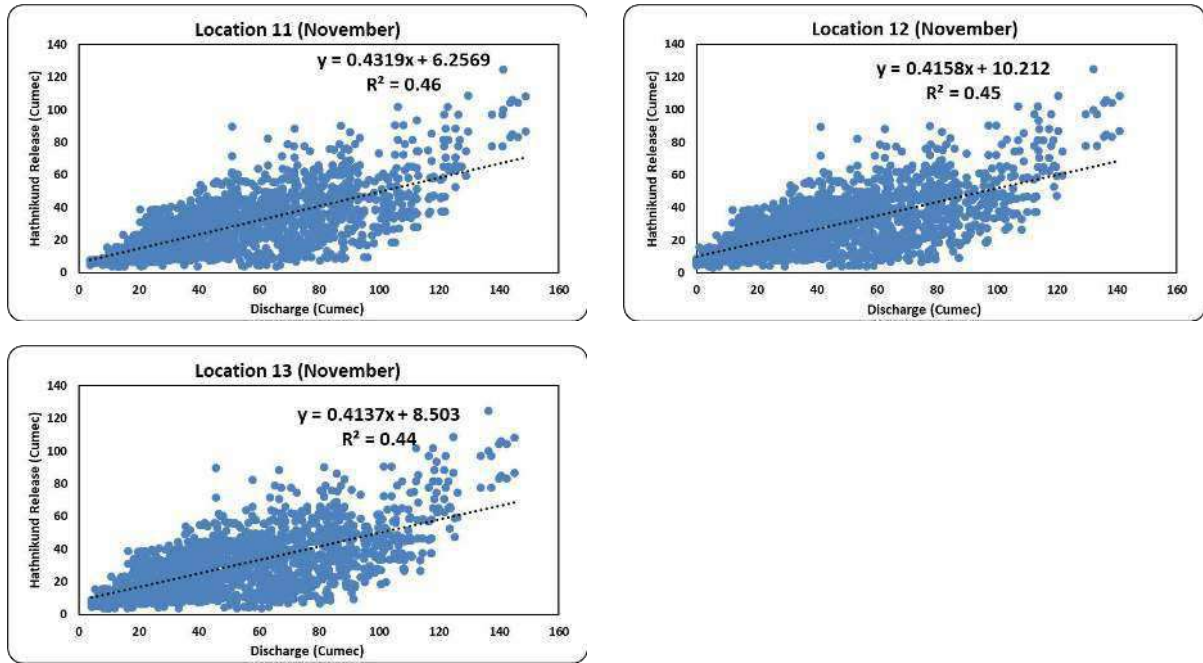


Fig. A2.11 Hathnikund releases vs simulated discharge on selected sites for month of November

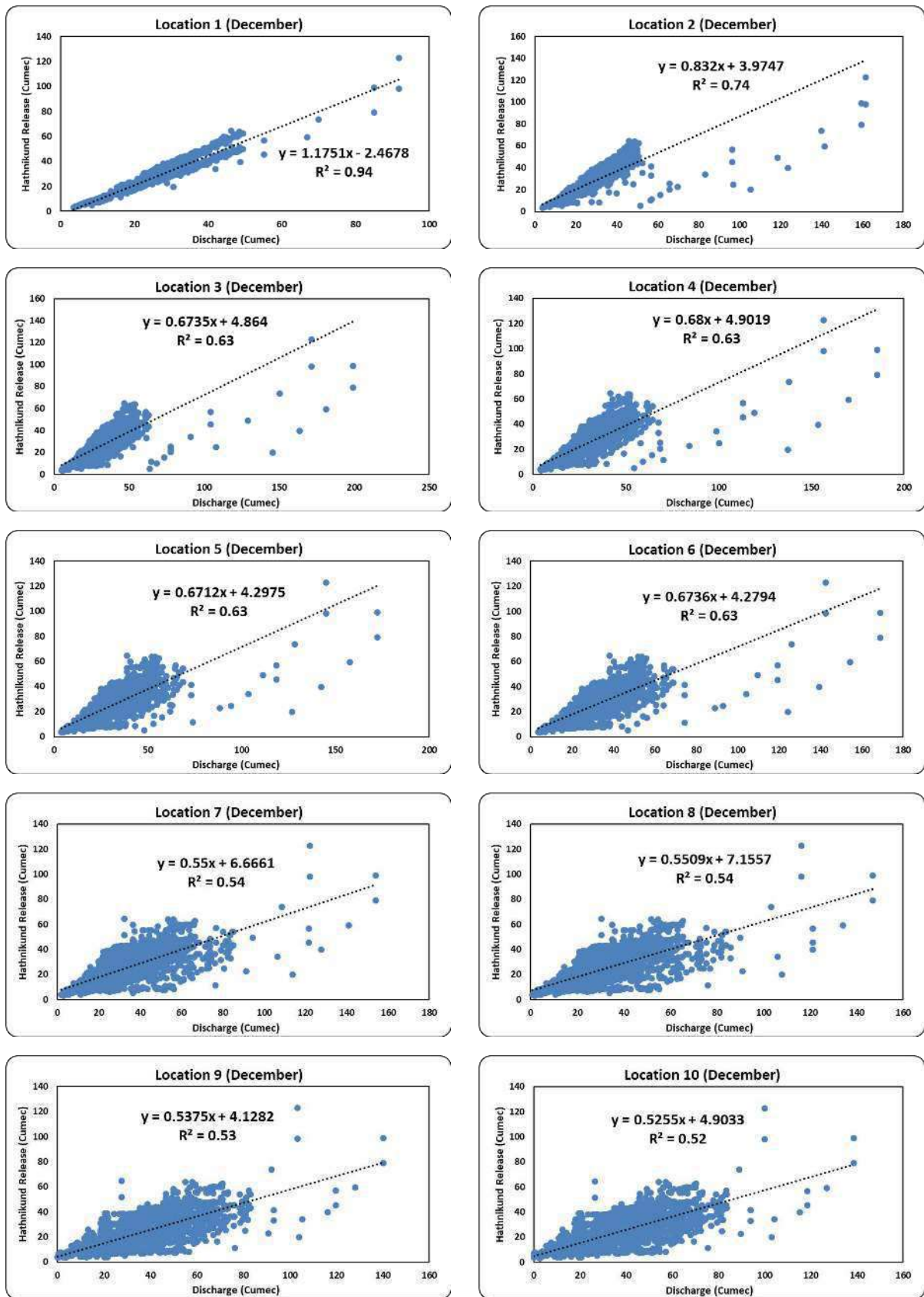


Fig. A2.12 Hathnikund releases vs simulated discharge on selected sites for month of December (contd...)

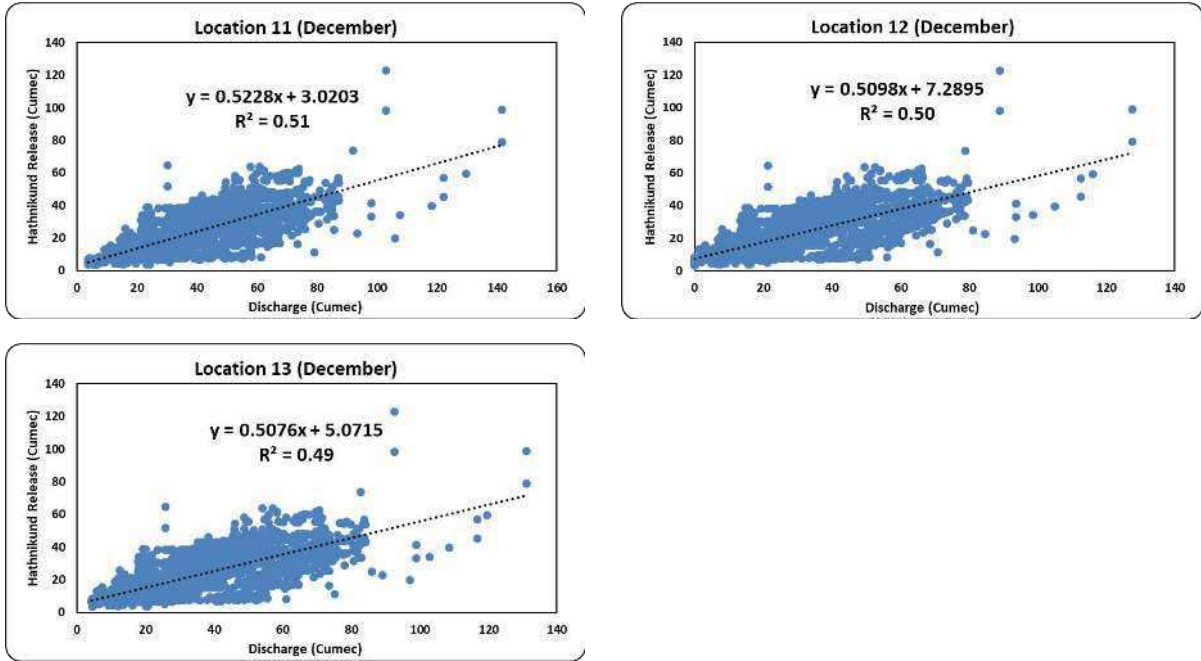


Fig. A2.12 Hathnikund releases vs simulated discharge on selected sites for month of December

Annexure 3

Releases Required from Hathnikund Barrage
for Maintaining Suitable Habitat at
13 Identified Locations

ANNEXURE 3

Table A3.1 Releases required from Hathnikund barrage for maintaining suitable habitat at location 1

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows				Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m	For Depth for Inundating Floodplains		Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 1	31	Confluence of Stream or Drain	$Q (EF) = 23.623X (Depth) ^ (2.8052)$	3.65	5.64	10.54	17.58	892.65	$Qr = 1.0205X Q1 (EF) + 0.6732$	Jan	6.43	11.43	18.61	911.62
									$Qr = 1.0237X Q1 (EF) + 0.893$	Feb	6.66	11.68	18.89	914.69
									$Qr = 1.1575 X Q1 (EF) + 2.1578$	Mar	8.68	14.36	22.50	1035.39
									$Qr = 1.2018 X Q1 (EF) - 1.345$	Apr	5.43	11.32	19.78	1071.44
									$Qr = 1.210 X Q1 (EF) + 1.418$	May	8.24	14.17	22.69	1081.52
									$Qr = 1.1133X Q1 (EF) - 2.4891$	Jun	3.79	9.25	17.08	991.29
									$Qr = 1.082X Q1 (EF) - 8.213$	Jul	14.31	3.19	10.81	957.63
									$Qr = 1.122X Q1 (EF) - 24.70$	Aug	31.02	-12.87	-4.98	976.85
									$Qr = 1.1288X Q1 (EF) - 16.915$	Sep	-10.55	-5.02	2.93	990.70
									$Qr = 1.104X Q1 (EF) - 2.642$	Oct	3.58	8.99	16.76	982.84
									$Qr = 1.1453X Q1 (EF) - 2.3836$	Nov	4.07	14.46	17.75	1019.96
									$Qr = 1.175X Q1 (EF) - 2.467$	Dec	4.16	14.85	18.19	1046.39

Table A3.2 Releases required from Hathnikund barrage for maintaining suitable habitat at location 2

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows				Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m	For Depth for Inundating Floodplains		Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 2	36	Confluence of Stream or Drain	$Q (EF) = 61.269 X (Depth) ^ (2.4948)$	4.37	17.13	29.89	47.11	1479.15	$Qr = 0.3253 X Q2 (EF) + 14.911$	Jan	20.48	24.63	30.23	496.08
									$Qr = 0.5651 X Q2 (EF) + 10.006$	Feb	19.69	26.90	36.63	845.88
									$Qr = 0.9203X Q2 (EF) + 2.2656$	Mar	18.03	29.77	45.62	1363.53
									$Qr = 1.1875 X Q2 (EF) - 0.9629$	Apr	19.38	34.53	54.98	1755.53
									$Qr = 1.211X Q2 (EF) + 1.244$	May	21.99	37.44	58.29	1792.50
									$Qr = 0.9481 X Q2 (EF) - 1.3696$	Jun	14.87	26.97	43.29	1401.02
									$Qr = 0.743X Q2 (EF) + 5.995$	Jul	18.72	28.20	41.00	1105.01
									$Qr = 0.897X Q2 (EF) - 29.53$	Aug	-14.16	-2.72	12.72	1297.27
									$Qr = 1.0258X Q2 (EF) - 33.025$	Sep	-15.45	-2.36	15.30	1484.29
									$Qr = 1.041X Q2 (EF) - 4.315$	Oct	13.52	26.80	44.72	1535.48
									$Qr = 1.0613X Q2 (EF) - 2.1306$	Nov	16.05	29.59	47.86	1567.70
									$Qr = 0.832X Q2 (EF) + 3.974$	Dec	18.23	28.84	43.17	1234.63

Table A3.3 Releases required from Hathnikund barrage for maintaining suitable habitat at location 3

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 3	41	Confluence of Stream or Drain and G&D Site	$Q (EF) = 6.5316 \times (\text{Depth}) ^ (3.5023)$	3.81	1.09	2.38	4.52	1006.81	$Qr = 0.2185 \times Q3 (EF) + 16.955$	Jan	17.19	17.48	17.94	236.94
									$Qr = 0.4745 \times Q3 (EF) + 11.447$	Feb	11.96	12.58	13.59	489.18
									$Qr = 0.8366 \times Q3 (EF) + 4.1332$	Mar	5.05	6.13	7.91	846.43
									$Qr = 1.1549 \times Q3 (EF) - 0.0175$	Apr	1.24	2.74	5.20	1162.74
									$Qr = 1.212 \times Q3 (EF) + 0.716$	May	2.04	3.61	6.19	1220.96
									$Qr = 0.8595 \times Q3 (EF) - 0.257$	Jun	0.68	1.79	3.62	865.09
									$Qr = 0.638 \times Q3 (EF) + 10.36$	Jul	11.06	11.88	13.24	652.70
									$Qr = 0.810 \times Q3 (EF) - 40.90$	Aug	-40.02	-38.97	-37.24	774.61
									$Qr = 0.9658 \times Q3 (EF) - 49.473$	Sep	-48.42	-47.17	-45.11	922.90
									$Qr = 0.885 \times Q3 (EF) - 6.883$	Oct	-5.92	-4.77	-2.89	884.14
									$Qr = 0.866 \times Q3 (EF) - 3.0793$	Nov	-2.13	-1.01	0.83	868.81
									$Qr = 0.673 \times Q3 (EF) + 4.864$	Dec	5.60	6.47	7.90	682.44

Table A3.4 Releases required from Hathnikund barrage for maintaining suitable habitat at location 4

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 4	71	Confluence of Stream or Drain	$Q (EF) = 46.577 \times (\text{Depth}) ^ (2.36)$	3.8	13.95	23.62	36.32	999.41	$Qr = 0.1949 \times Q4 (EF) + 17.614$	Jan	20.33	22.22	24.69	212.40
									$Qr = 0.4459 \times Q4 (EF) + 12.444$	Feb	18.66	22.98	28.64	458.08
									$Qr = 0.844 \times Q4 (EF) + 5.0075$	Mar	16.78	24.94	35.66	848.51
									$Qr = 1.126 \times Q4 (EF) + 3.7152$	Apr	19.42	30.31	44.62	1129.05
									$Qr = 1.220 \times Q4 (EF) + 2.783$	May	19.80	31.60	47.10	1222.06
									$Qr = 0.8756 \times Q4 (EF) + 0.4059$	Jun	12.62	21.09	32.21	875.49
									$Qr = 0.636 \times Q4 (EF) + 10$	Jul	18.87	25.02	33.10	645.63
									$Qr = 0.794 \times Q4 (EF) - 42.62$	Aug	-31.54	-23.86	-13.78	750.91
									$Qr = 0.9558 \times Q4 (EF) - 53.645$	Sep	-40.31	-31.07	-18.93	901.59
									$Qr = 0.872 \times Q4 (EF) - 6.187$	Oct	5.98	14.41	25.49	865.30
									$Qr = 0.8204 \times Q4 (EF) - 1.3615$	Nov	10.08	18.02	28.44	821.28
									$Qr = 0.68 \times Q4 (EF) + 4.901$	Dec	14.39	20.96	29.60	684.50

Table A3.5 Releases required from Hathnikund barrage for maintaining suitable habitat at location 5

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 5	97	Confluence of Stream or Drain	$Q (EF) = 68.254 \times (\text{Depth}) ^ {2.6741}$	3.01	17.41	31.62	51.50	519.77	$Qr = 0.1987 \times Q5 (EF) + 17.273$	Jan	20.73	23.56	27.51	120.55
									$Qr = 0.4503 \times Q5 (EF) + 11.947$	Feb	19.79	26.19	35.14	246.00
									$Qr = 0.8392 \times Q5 (EF) + 5.4131$	Mar	20.03	31.95	48.63	441.60
									$Qr = 1.1102 \times Q5 (EF) + 6.1261$	Apr	25.46	41.24	63.30	583.17
									$Qr = 1.214 \times Q5 (EF) + 6.056$	May	27.20	44.45	68.57	637.05
									$Qr = 0.8808 \times Q5 (EF) + 2.5599$	Jun	17.90	30.42	47.92	460.37
									$Qr = 0.643 \times Q5 (EF) + 9.255$	Jul	20.45	29.59	42.37	343.47
									$Qr = 0.794 \times Q5 (EF) - 42.62$	Aug	-28.79	-17.51	-1.73	370.08
									$Qr = 0.9462 \times Q5 (EF) - 58.43$	Sep	-41.95	-28.51	-9.71	433.37
									$Qr = 0.807 \times Q5 (EF) - 5.155$	Oct	8.90	20.37	36.40	414.30
									$Qr = 0.7451 \times Q5 (EF) + 0.0055$	Nov	12.98	23.57	38.37	387.28
									$Qr = 0.671 \times Q5 (EF) + 4.297$	Dec	15.98	25.52	38.85	353.06

Table A3.6 Releases required from Hathnikund barrage for maintaining suitable habitat at location 6

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 6	103	G&D Site	$Q (EF) = 36.808 \times (\text{Depth}) ^ {3.2364}$	4.1	7.05	14.51	26.17	1236.85	$Qr = 0.1994 \times Q6 (EF) + 17.26$	Jan	18.66	20.15	22.48	263.89
									$Qr = 0.4517 \times Q6 (EF) + 11.96$	Feb	15.14	18.51	23.78	570.64
									$Qr = 0.8378 \times Q6 (EF) + 5.7076$	Mar	11.61	17.86	27.64	1041.94
									$Qr = 1.1097 \times Q6 (EF) + 6.6335$	Apr	14.45	22.73	35.68	1379.16
									$Qr = 1.215 \times Q6 (EF) + 6.682$	May	15.24	24.31	38.48	1509.45
									$Qr = 0.881 \times Q6 (EF) + 3.0475$	Jun	9.26	15.83	26.11	1092.71
									$Qr = 0.644 \times Q6 (EF) + 9.283$	Jul	13.82	18.63	26.14	805.81
									$Qr = 0.793 \times Q6 (EF) - 42.25$	Aug	-36.66	-30.75	-21.49	938.57
									$Qr = 0.9448 \times Q6 (EF) - 58.113$	Sep	-51.46	-44.41	-33.38	1110.46
									$Qr = 0.805 \times Q6 (EF) - 4.928$	Oct	0.74	6.75	16.14	990.73
									$Qr = 0.7413 \times Q6 (EF) + 0.2246$	Nov	5.45	10.98	19.63	917.10
									$Qr = 0.673 \times Q6 (EF) + 4.279$	Dec	9.02	14.04	21.89	836.68

Table A3.7 Releases required from Hathnikund barrage for maintaining suitable habitat at location 7

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 7	146	G&D Site	$Q (EF) = 23.535 X (Depth) ^ (2.8145)$	5.12	5.59	10.47	17.50	2306.64	$Qr = 0.165 X Q7 (EF) + 17.897$	Jan	18.82	19.63	20.78	398.49
									$Qr = 0.3871 X Q7 (EF) + 13.402$	Feb	15.57	17.46	20.17	906.30
									$Qr = 0.744 X Q7 (EF) + 9.8845$	Mar	14.04	17.68	22.90	1726.02
									$Qr = 1.0781 X Q7 (EF) + 12.229$	Apr	18.25	23.52	31.09	2499.01
									$Qr = 1.238X Q7 (EF) +13.15$	May	20.07	26.12	34.81	2868.77
									$Qr = 0.852X Q7 (EF) + 9.658$	Jun	14.42	18.58	24.56	1974.91
									$Qr = 0.600X Q7 (EF) + 14.20$	Jul	17.55	20.48	24.70	1398.18
									$Qr = 0.721X Q7 (EF) - 32.07$	Aug	-28.04	-24.52	-19.46	1631.01
									$Qr = 0.8534X Q7 (EF) - 51.183$	Sep	-46.41	-42.25	-36.25	1917.30
									$Qr = 0.603X Q7 (EF) + 3.341$	Oct	6.71	9.66	13.89	1394.24
									$Qr = 0.5153X Q7 (EF) + 6.4047$	Nov	9.28	11.80	15.42	1195.01
									$Qr = 0.55X Q7 (EF) + 6.666$	Dec	9.74	12.43	16.29	1275.32

Table A3.8 Releases required from Hathnikund barrage for maintaining suitable habitat at location 8

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 8	163	Confluence of Stream or Drain	$Q (EF) = 23.651 X (Depth) ^ (2.9608)$	3.95	5.21	10.09	17.31	1114.06	$Qr = 0.1637 X Q8 (EF) + 18.073$	Jan	18.93	19.72	20.91	200.44
									$Qr = 0.3837 X Q8 (EF) + 13.962$	Feb	15.96	17.83	20.60	441.43
									$Qr = 0.729 X Q8 (EF) + 11.699$	Mar	15.50	19.06	24.32	823.85
									$Qr = 1.0935X Q8 (EF) + 14.349$	Apr	20.05	25.38	33.28	1232.58
									$Qr = 1.269X Q8 (EF) + 15.67$	May	22.28	28.48	37.64	1429.41
									$Qr = 0.8427X Q8 (EF) + 12.599$	Jun	16.99	21.10	27.19	951.42
									$Qr = 0.595X Q8 (EF) + 16.48$	Jul	19.58	22.48	26.78	679.35
									$Qr = 0.712X Q8 (EF) - 27.44$	Aug	-23.73	-20.26	-15.11	765.77
									$Qr = 0.843X Q8 (EF) - 57.33$	Sep	-52.94	-48.82	-42.74	881.82
									$Qr = 0.599X Q8 (EF) + 4.327$	Oct	7.45	10.37	14.70	671.65
									$Qr = 0.5133X Q8 (EF) + 7.1558$	Nov	9.83	12.34	16.04	579.00
									$Qr = 0.550X Q8 (EF) + 7.155$	Dec	10.02	12.71	16.68	619.89

Table A3.9 Releases required from Hathnikund barrage for maintaining suitable habitat at location 9

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 9	203	G&D Site	$Q (EF) = 36.808 \times (\text{Depth}) ^ { (3.2364)}$	4.37	5.64	10.54	17.58	1479.15	$Qr = 0.1423 \times Q9 (EF) + 17.454$	Jan	18.26	18.95	19.96	227.94
									$Qr = 0.3394 \times Q9 (EF) + 12.401$	Feb	14.31	15.98	18.37	514.43
									$Qr = 0.6587 \times Q9 (EF) + 8.6215$	Mar	12.33	15.56	20.20	982.94
									$Qr = 0.7715 \times Q9 (EF) + 14.006$	Apr	18.35	22.14	27.57	1155.17
									$Qr = 1.083 \times Q9 (EF) + 16.43$	May	22.53	27.85	35.47	1618.35
									$Qr = 0.808 \times Q9 (EF) + 14.022$	Jun	18.58	22.54	28.23	1209.18
									$Qr = 0.550 \times Q9 (EF) + 22.23$	Jul	25.33	28.03	31.90	835.77
									$Qr = 0.665 \times Q9 (EF) - 16.43$	Aug	-12.68	-9.42	-4.74	967.21
									$Qr = 0.7901 \times Q9 (EF) - 57.032$	Sep	-52.58	-48.70	-43.14	1111.65
									$Qr = 0.525 \times Q9 (EF) + 7.250$	Oct	10.21	12.78	16.48	783.81
									$Qr = 0.4367 \times Q9 (EF) + 7.1943$	Nov	9.66	11.80	14.87	653.14
									$Qr = 0.537 \times Q9 (EF) + 4.128$	Dec	7.15	9.79	13.57	798.43

Table A3.10 Releases required from Hathnikund barrage for maintaining suitable habitat at location 10

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows			Depth for Inundating Floodplains	Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m			Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 10	219	Confluence of Stream or Drain	$Q (EF) = 18.109 \times (\text{Depth}) ^ { (3.0769)}$	4.15	3.76	7.47	13.09	1279.63	$Qr = 0.1423 \times Q10 (EF) + 17.454$	Jan	17.99	18.52	19.32	199.54
									$Qr = 0.3347 \times Q10 (EF) + 12.889$	Feb	14.15	15.39	17.27	441.18
									$Qr = 0.6373 \times Q10 (EF) + 10.277$	Mar	12.67	15.04	18.62	825.78
									$Qr = 0.7785 \times Q10 (EF) + 15.357$	Apr	18.28	21.17	25.55	1011.55
									$Qr = 1.116 \times Q10 (EF) + 17.94$	May	22.14	26.28	32.55	1446.00
									$Qr = 0.7989 \times Q10 (EF) + 16.272$	Jun	19.28	22.24	26.73	1038.57
									$Qr = 0.538 \times Q10 (EF) + 24.98$	Jul	27.00	29.00	32.03	713.42
									$Qr = 0.654 \times Q10 (EF) - 12.18$	Aug	-9.72	-7.29	-3.62	824.70
									$Qr = 0.7754 \times Q10 (EF) - 54.203$	Sep	-51.29	-48.41	-44.05	938.02
									$Qr = 0.518 \times Q10 (EF) + 8.291$	Oct	10.24	12.16	15.07	671.14
									$Qr = 0.4343 \times Q10 (EF) + 7.7435$	Nov	9.38	10.99	13.43	563.49
									$Qr = 0.525 \times Q10 (EF) + 4.903$	Dec	6.88	8.83	11.78	676.71

Table A3.11 Releases required from Hathnikund barrage for maintaining suitable habitat at location 11

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows				Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m	Depth for Inundating Floodplains		Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 11	222	G&D Site	$Q (EF) = 16.363 \times (\text{Depth}) ^ {2.7447}$	3.95	4.03	7.43	12.25	1114.06	$Qr = 0.1421 \times Q11 (EF) + 16.92$	Jan	17.49	17.98	18.66	175.23
									$Qr = 0.3331 \times Q11 (EF) + 11.726$	Feb	13.07	14.20	15.81	382.82
									$Qr = 0.6343 \times Q11 (EF) + 8.3032$	Mar	10.86	13.02	16.08	714.95
									$Qr = 0.7755 \times Q11 (EF) + 12.99$	Apr	16.11	18.75	22.49	876.94
									$Qr = 1.1151 \times Q11 (EF) + 14.598$	May	19.09	22.88	28.26	1256.89
									$Qr = 0.796 \times Q11 (EF) + 14.05$	Jun	17.26	19.96	23.80	900.84
									$Qr = 0.5333 \times Q11 (EF) + 24.214$	Jul	26.36	28.18	30.75	618.34
									$Qr = 0.65 \times Q11 (EF) - 13.091$	Aug	-10.47	-8.26	-5.13	711.05
									$Qr = 0.7713 \times Q11 (EF) - 56.278$	Sep	-53.17	-50.55	-46.83	803.00
									$Qr = 0.5155 \times Q11 (EF) + 6.585$	Oct	8.66	10.41	12.90	580.88
									$Qr = 0.4319 \times Q11 (EF) + 6.2569$	Nov	8.00	9.47	11.55	487.42
									$Qr = 0.5228 \times Q11 (EF) + 3.0203$	Dec	5.13	6.90	9.43	585.45

Table A3.12: Releases required from Hathnikund barrage for maintaining suitable habitat at location 12

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows				Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m	Depth for Inundating Floodplains		Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 12	243	Confluence of Stream or Drain	$Q (EF) = 32.146 \times (\text{Depth}) ^ {2.388}$	5.25	9.49	16.17	25.00	2474.72	$Qr = 0.1414 \times Q12 (EF) + 17.996$	Jan	19.34	20.28	21.53	367.92
									$Qr = 0.3293 \times Q12 (EF) + 14.487$	Feb	17.61	19.81	22.72	829.41
									$Qr = 0.61 \times Q12 (EF) + 14.603$	Mar	20.39	24.47	29.85	1524.18
									$Qr = 0.8257 \times Q12 (EF) + 18.767$	Apr	26.60	32.12	39.41	2062.14
									$Qr = 1.2579 \times Q12 (EF) + 21.792$	May	33.73	42.14	53.23	3134.74
									$Qr = 0.7718 \times Q12 (EF) + 22.52$	Jun	29.85	35.00	41.81	1932.51
									$Qr = 0.5098 \times Q12 (EF) + 33.125$	Jul	37.96	41.37	45.87	1294.74
									$Qr = 0.6351 \times Q12 (EF) - 2.9645$	Aug	3.06	7.31	12.91	1568.73
									$Qr = 0.7462 \times Q12 (EF) - 44.752$	Sep	-37.67	-32.68	-26.10	1801.88
									$Qr = 0.5015 \times Q12 (EF) + 11.499$	Oct	16.26	19.61	24.03	1252.57
									$Qr = 0.4158 \times Q12 (EF) + 10.212$	Nov	14.16	16.94	20.61	1039.20
									$Qr = 0.5098 \times Q12 (EF) + 7.2895$	Dec	12.13	15.53	20.03	1268.90

Table A3.13 Releases required from Hathnikund barrage for maintaining suitable habitat at location 13

Location No.	Distance from Hathnikund Barrage (km)	Type of Site (G&D Site / Meandering / confluence of Streams or drains)	Relationship between Depth (X) and Discharge (Y)	Depth for Inundating Floodplains (m)	Discharge at different sites required for maintaining E-Flows				Relationship between Simulated Discharge (X) and Hathnikund Releases (Y)	Releases from Hathnikund required for maintaining E-Flows				
					0.60 m	0.75 m	0.90 m	Depth for Inundating Floodplains		Month	0.60 m	0.75 m	0.90 m	For Inundating Floodplains
Location 13	248	G&D Site	$Q (EF) = 21.109 \times (\text{Depth})^2$	4.98	5.55	9.95	16.02	2134.04	$Qr = 0.1412 \times Q13 (EF) + 17.362$	Jan	18.15	18.77	19.62	318.69
									$Qr = 0.3287 \times Q13 (EF) + 13.097$	Feb	14.92	16.37	18.36	714.56
									$Qr = 0.6061 \times Q13 (EF) + 12.349$	Mar	15.71	18.38	22.06	1305.79
									$Qr = 0.8209 \times Q13 (EF) + 15.913$	Apr	20.47	24.08	29.07	1767.75
									$Qr = 1.2544 \times Q13 (EF) + 17.551$	May	24.51	30.03	37.65	2694.49
									$Qr = 0.7675 \times Q13 (EF) + 20.146$	Jun	24.40	27.78	32.44	1658.02
									$Qr = 0.5067 \times Q13 (EF) + 31.786$	Jul	34.60	36.83	39.91	1113.10
									$Qr = 0.6321 \times Q13 (EF) - 4.3968$	Aug	-0.89	1.89	5.73	1344.53
									$Qr = 0.743 \times Q13 (EF) - 46.946$	Sep	-42.82	-39.56	-35.04	1538.65
									$Qr = 0.5002 \times Q13 (EF) + 9.5097$	Oct	12.29	14.49	17.53	1076.96
									$Qr = 0.4137 \times Q13 (EF) + 8.503$	Nov	10.80	12.62	15.13	891.36
									$Qr = 0.5076 \times Q13 (EF) + 5.0715$	Dec	7.89	10.12	13.21	1088.31

Annexure 4

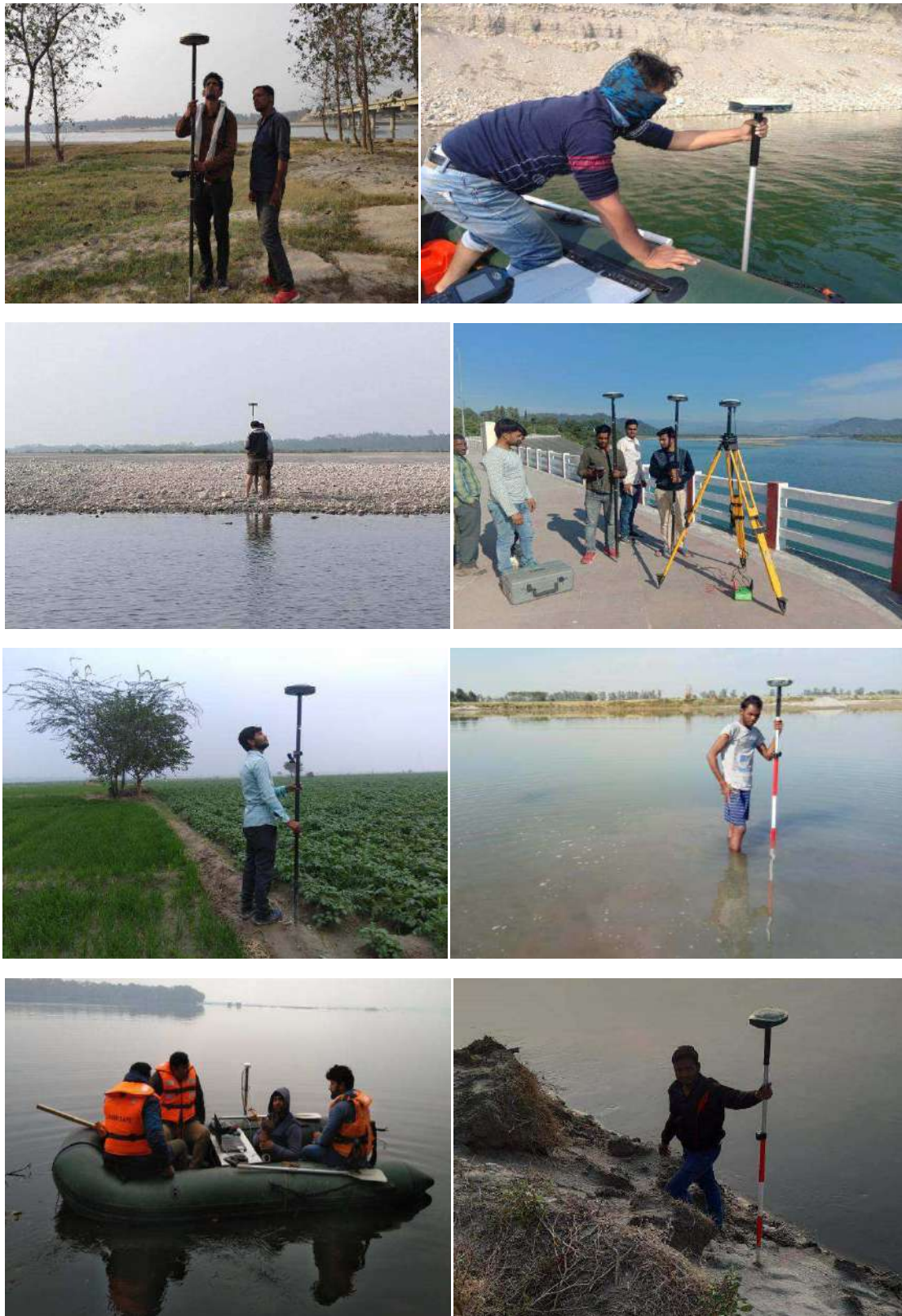
Field Investigations in Yamuna River



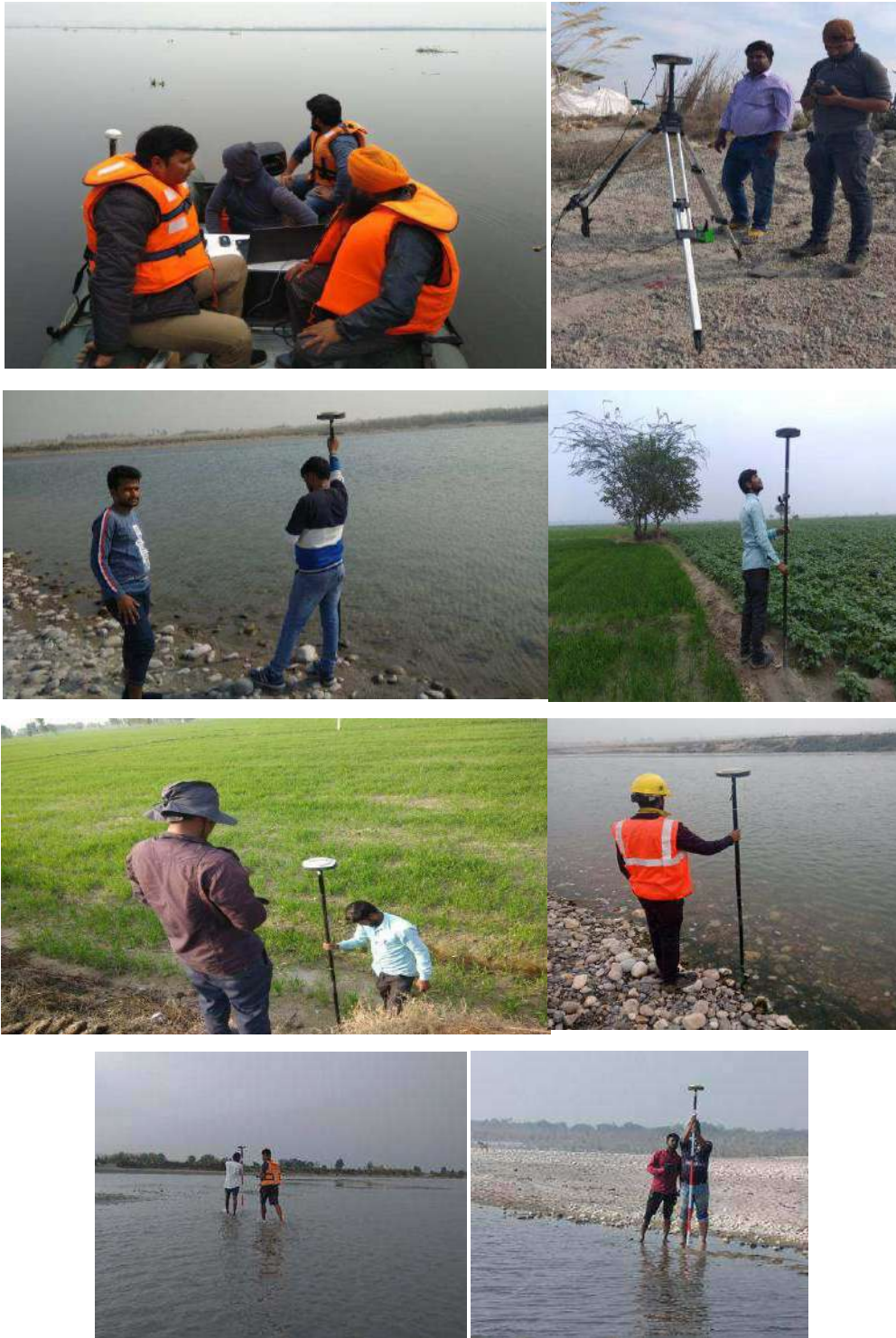
(a) Survey for identification of indicator fish species and for determining the e-flow requirement for maintaining ecological integrity



(b) Water quality survey



(a) River Cross-Section Survey (contd...)



(b) River Cross-Section Survey

Environmental Flow Assessment for Yamuna River from Hathnikund Barrage to Okhla Barrage



Research Study Report

National Institute of Hydrology, Roorkee

Related to Chapter 1: Environmental Flow

B.S Sajwan <sajwanbs@yahoo.com>

To: Rajiv Ranjan Mishra

Cc: UYRB

Bcc: Shailaja Chandra, Monitoring Committee River Yamuna

Fri, May 8 at 4:35 PM

Dear Shri Mishra,

Dr Anupama Sharma of NIH has submitted draft report on E- flow in river Yamuna vide mail dated 1.5.20.

Yamuna Monitoring Committee would like the NMCG, to have the draft report examined and Final Report submitted to the YMC.

In the Provisional Report submitted earlier the minimum E- flow estimated was about 38 cumecs, however in the draft report now received the minimum E flow recommended is about 22 Cumecs. This variance may be examined and a final view taken by the NMCG/Ministry of Jal Shakti.

Most importantly, YMC has been repeatedly emphasizing that the various policy and conservation measures that are required to be taken to achieve the level of recommended E flow may be spelt out together with quantitative estimation from each of such measures. The draft report has not covered this aspect and has only in passing mentioned this in its recommendations.

This being an important aspect of the study, may also be gone in to and a report submitted on this by way of a supplementary report, if required. In the absence of this, the E flow study may remain an academic exercise with little practical utility.

Attached please also find NGT's order dated 6.5.20 in OA no. 06/2012-Manoj Mishra vs UOI and ors. In view of the directions contained in the order of NGT, Ministry's response be furnished to the YMC on or before 31.5.20.

Sincerely,

B S Sajwan
Member

Related to Chapter 1: Environmental Flow

Sub: Minutes of meeting held on 22.05.2020 regarding assessment of environmental flows Yamuna (Hathnikund to Okhla barrage)

A meeting to discuss the recommendations/ results of the draft final report submitted by NIH-Roorkee for project titled "*Environmental flow assessment for Yamuna river from Hathnikund barrage to Okhla barrage*" was held on 22.05.2020 via video conferencing under the Chairmanship of Secretary, D/o Water Resources, River Development & Ganga Rejuvenation (WR, RD &GR) cum Chairman, Principal Committee of Hon'ble NGT (Yamuna).

2. The list of the participants is enclosed herewith as **Annex-I**.
3. At the onset, a brief background of the study and importance of environmental flows was stated by Secretary, D/o WR, RD&GR. Thereafter, a presentation on the draft final report was made by Dr.Anupama Sharma, NIH-Roorkee. The salient points of the presentation are outlined below:
 - I. **Selection of target indication fish species:**
 - i. **Option1:** Maintaining ecosystem based on historical evidences –selected fish species '*Golden Mahseer*'- It was stated that presently Golden Mahseer is not available downstream of Hathnikund barrage. Estimated flows will provide more suitable habitat in terms of volume, but does not guarantee in bringing back the river habitat features such as substrate heterogeneity suitable for Golden.
 - ii. **Option2:** Maintaining ecosystem based on present field survey -*Banganadero* and *Raiamas bola* have been selected as indicator fish species.

It was stated that ensuring minimum water depth of 60 cm and flow of 0.1 m/s at riffle/run habitat in the river will safeguard the fish diversity in Yamuna river.

- iii. **Analysis of Data including Water Quality, GW Levels:** Total 309 river cross-sections at 1 km interval were taken. Out of these 309 locations, 13 locations were identified where surveys for 5 cross-sections were carried out at 250 m interval. These 13 locations were selected based on confluence of tributary/ drain; presence of CWC G&D site and river meandering.

Ground water depletion was observed to be maximum in Mawi-Baghpat reach with maximum depletion of 10 - 20 m.

In the reach of Wazirabad to Okhla barrage, total BOD load discharging into river from the drains was estimated to be 6140 kg/hr. It was stated that to dilute this much pollution load, 390 cumec of water will be required in this reach. Release from Hathnikund barrage during non-monsoon season will be in range of 22.81-43.66 cumecs for maintaining a depth of 0.6m in reach from Hathnikund to Wazirabad.

- II. **Methodology for E-Flow Assessment:** The integrated hydrologic and hydrodynamic modeling approach has been adopted to assess the e-flows between Hathnikund barrage and Okhla barrage and compute the releases required from Hathnikund barrage for maintaining these e-flows.

Hydrological model SWAT has been used to simulate streamflow, overland flow, base-flow, evapotranspiration and total water yield in study reach. **For hydrodynamic analysis of streamflow, 1D model HEC-RAS has been employed.** Hydrodynamic variables such as maximum water depth, hydraulic depth, wetted perimeter, top width and water velocity for the range of discharges as available at Hathnikund barrage have been computed at different river sections.

HEC-RAS is used to derive depth vs discharge curves at different river sections. These curves are utilized to estimate minimum flows, based on SWAT modeling, that are required to be released from Hathnikund barrage for maintaining suitable physical habitat for indicator fish species for study reach.

- III. **Recommended E-flows** regime varies from 22 to 44 cumecs during non-monsoon periods based on releases at Hathnikund (for different months minimum being for January and maximum being for June) and expected flows at Wazirabad being 9.49 cumecs (in May) to 34 cumecs (in January).
- IV. Management Strategies recommended:
- i. Increase in irrigation efficiency and reduction in diversions to Western Yamuna Canal (WYC) /Eastern Yamuna Canal (EYC).
 - ii. Regulate groundwater withdrawal in the basin especially in the Mawi-Baghat stretch and augment groundwater recharge in order to sustain base flows.
 - iii. Augmentation of non-monsoon inflows at Hathnikund barrage by creating storage of monsoon runoff in the upstream reaches.
 - iv. Treatment of effluent coming through various drains meeting river Yamuna.
4. After the presentation, views/ comments from co-basin States viz. Haryana, Uttarakhand, Uttar Pradesh & Delhi and expert members of the Committee were solicited.
5. Sh. Devendra Singh, Addl. Chief Secretary, Irrigation Dept., Govt. of Haryana submitted strong opposition and protest to the recommendations of NIH for increasing environmental flow beyond 10.0 cumecs from Hathnikund Barrage. Following points were raised:
- i. It was stated that every drop of water is critical for the survival and livelihood farmers and residents of Haryana especially in the Southern Haryana. State is facing acute shortage even for drinking water purposes as out of 121 blocks, 78 blocks have been declared over exploited/ dark blocks and the ground water level have gone very deep and supplying canal water for drinking and other uses is priority of the State Government in these blocks.

- ii. MoU for sharing of water among partner states special emphasis was given for maintenance of e-flow in the river Yamuna and 10.0 cumecs e-flow was provided throughout the year for ecological considerations as upstream storages are built up progressively. Though no upstream storage dams have been constructed, yet 10.0 cumecs e-flow is being released from Hathnikund Barrage.
- iii. The matter was also discussed with Hon'ble Chief Minister Haryana who opposed vehemently to the idea of increasing e-flow in Yamuna beyond existing 10.0 cumecs. He believes that in view of the facts and circumstances mentioned above, these recommendations tantamount to signing of Death Warrant for Haryana in view of its tremendous potentially adverse impact on the lives and livelihood of residents and farmers of Haryana.
- iv. The extra e- flow has been recommended by NIH for increasing fish production from Yamuna by proving natural habitat to two species of fish namely, Banganadero and Raiamas bola which are otherwise in good number.
- v. The mandatory releases from Hathnikund Barrage to Delhi including environmental flows, total diversion amounts to 1062 cusecs (330 + 380 + 352). As per NIH report, average available inflow to HKB for the months of December to March is 1676 cusecs (47.47 cumecs) only. Thus, after meeting recommended environmental flow (10 cumecs) and Delhi water needs, availability of water for Haryana and UP at Hathnikund Barrage during four Rabi months of December to March is only 614 cusecs (17.39 cumecs). Out of this Haryana share will be 411.41 cusecs (11.65 cumecs) and rest will be for Uttar Pradesh. Thus, Haryana is receiving almost the same water from Yamuna as being given for e-flow.
- vi. Accordingly, there is hardly any scope to increase e-flow from HKB during these months and Govt is able to supply just 11% canal irrigation to the Rabi crops. Rest of the irrigation demand is met from the ground water. Any further reduction of Yamuna water for Haryana would mean **environmental disaster for ground water**.
- vii. NIH has used SWAT and HEC-RAS models to evaluate releases from Hathnikund Barrage to maintain 60 cm depth at all the 13 locations of River Yamuna. SWAT model is basically to be applied to the river basin for sizable discharge and with full river parameters. Govt. of Haryana is of the view that such a large scale river model cannot accurately be applied for such small discharges and for such shallow water depths.
- viii. Further, it was stated that Govt. of Haryana has already undertaken various initiatives towards water conservation viz. changing cropping pattern, adoption of water efficient irrigation practices and policy for reuse of treated wastewater.

It was stated that NIH failed to study the present uses of water of Yamuna and its existing stress level due to scarcity of water and secondly the suggestions made by NIH to manage the demand side due to reduced availability of water on account of increased e- flow are not workable, these are merely the eye wash. Haryana does not agree to these and strongly object to any increase of e-flow beyond 10.0 cumecs.

The comments from Irrigation Dept., Govt. of Haryana were also received via email. Same are attached as **Annex-II**, for reference.

6. Sh. Anil Kumar, Chief Engineer, Irrigation Dept., Govt. of Uttar Pradesh, stated that mainly three districts viz. Saharanpur, Muzzfarnagar and Shamli will be affected by the recommended environmental flows. Further, it was stated that Govt. of Uttar Pradesh has no objection to the recommended environmental flows. It was also suggested that if the water supply to Delhi is made available through river Yamuna in place of Haryana canal then it would be easier to maintain the recommended environmental flows.
7. Sh. Sanjay Saxena, Chief Engineer, Irrigation & Flood Control Dept., Govt. of Delhi stated that Delhi Jal Board is main stakeholder on this matter from Delhi Govt. So he didn't offer any comments.
8. Sh. Sanjeev Srivastava, SE, Irrigation Dept., Govt. of Uttarakhand stated that after creation of new State of Uttarakhand, certain quantity of water was to be allocated to Uttarakhand. This is yet to be finalised.
9. Smt. Shailja Chandra, Member, Monitoring Committee of NGT (Yamuna), commended D/o WR,RD&GR for conducting this study which provide scientific basis behind quantifying the environmental flows and policy interventions needed to achieve recommended flows.

In response to the Govt. of Haryana's various measures to encourage and practice water efficient measures in irrigation and usage of less water intensive crops, it was said monitoring and outcome of such measures remains in question.

It was stated that Monitoring Committee supports the recommendations made in the draft report. The report may be set as platform/ benchmark on which policy decisions may be taken. In furtherance, it was suggested that in collaboration with Ministry of Agriculture steps shall be taken to increase the usage of water efficient irrigation practices.

10. Prof. A.K. Gosain, IIT-Delhi, raised the point that study has missed the surface water –ground water interaction while estimating the environmental flows. The recommended water released from Hathnikund barrage may never reach downstream owing to ground water extraction. The comments of Prof. A.K. Gosain were also received via email, same are reproduced below:
 - i. I strongly believe that the institution of any scientific study is aimed at creating the evidence using science about the true ground reality so as to help the policy makers or the NGT (in the present case) in taking the appropriate action for mitigating the problem. While commenting on the Interim Report I had given my detailed comments in July, 2019 wherein I had communicated that the issue of environment flow for River Yamuna cannot be addressed without tackling the surface water groundwater interaction. This is more so because along the river stretch between Mawi and Bhagpat where the ground water table is much below the river bed of Yamuna and with the result huge quantities of water are lost from the river because of the differential head between the river and the groundwater table. Therefore, the present assessment of E-flow is meaningless since even if it is decided to release the

proposed quantities during the lean flow season, water is not going to reach Wazirabad as desired and shall be lost on the way.

What is desired from such scientific study is to assess the present hydrological regime, including the surface water groundwater interaction using a combination of hydrological and groundwater modelling simulation and come out with a set of strategies that shall ensure that the prescribed amount of E-flow shall reach Wazirabad. I would also like to convey that such an exercise has already been done for the Ganga River Basin while formulating the Ganga River Basin Management Plan. The Water Resources Management Group of the IIT Consortium, which I was leading, had taken up the hydrological and groundwater modelling of the whole Ganga, of which Yamuna is one of the sub-basins, to understand the surface water groundwater interaction. This scientific study was also published in one of the most reputed international journal and is considered to be one of the classic papers on the topic (reprint attached).

- ii. Response of the authors of the E-flow study that this aspect of surface water groundwater interaction could not be tackled by them because of paucity of time is not acceptable. Because without this aspect being properly addressed, outcome of the study can be misleading since it does not present a solution that is actionable. The study should clearly come out with the following outcomes:
 - How much is the loss of water from the river to the groundwater in identified loosing stretches of the river especially during the non-monsoon period
 - What strategies can be deployed to ensure that there is no loss from the river to the groundwater during the non-monsoon period so that the released E-flow at Hathnikund reaches Wazirabad
 - Identify the timeline for each of such strategies to accomplish the objective that the loosing stretches do not loose water to the groundwater during the lean flow season.
 - iii. Finally, I would like to reiterate that if the issue of environmental flow is to be tackled properly then understanding the surface water groundwater interaction is very important because in majority of the basins large extent of river stretches have become water loosing stretches (which is an un-natural behavior of a river system) on account of over-exploitation of groundwater. Therefore, the problem of environmental flow is required to be solved in conjunction with the groundwater in an integrated manner.
11. Prof. Vinod Tare, Head cGanga, emphasised that at first stage consensus among all stakeholders and co-basin States shall be reached over the quantity of minimum environmental flows necessary for river Yamuna to fulfil its ecological needs. At the next stage, steps/ measures required to achieve these flows can be discussed, as management strategies are more of negotiation strategy.

Further, it was stated that environmental flows shall not be linked with the water required for dilution of pollution.

12. Sh. B.S. Sajwan, former Expert Member (NGT), Member (Monitoring Committee, Yamuna), stated that this study was undertaken in compliance to Hon'ble NGT directions and commended the work done by NIH-Roorkee. However, in line with issues raised by Prof. A.K. Gosain, it was remarked that water availability at downstream locations still remains questionable.

Further, it was stated that initiatives taken by Govt. of Haryana towards water conservation, changing cropping pattern, adoption of water efficient irrigation practices and policy for reuse of treated wastewater is yet to be monitored in terms of their positive impact and acceptability at the ground level.

It was suggested that D/o WR, RD & GR after taking views/ suggestions of all the stakeholders and States shall quantify the environmental flows in river Yamuna. Additionally, steps required to achieve these goals may also be formulated.

13. Sh. Manu Bhatnagar, Director, INTACH, stated that recommended water releases from Hathnikund barrage for monsoon season is less than the present quantity of water being released from the barrage. The ground water recharge is maximum effective during monsoon season, thus reducing the flows releases during this season may adversely impact the ground water recharge capacity during the monsoon season.

Further, it was stated that agriculture area between Western Yamuna Canal and Eastern Yamuna Canal shall be focused and use of new innovative techniques to reduce water usage shall be adopted.

14. Sh. Suresh Babu, Director, WWF-India remarked that environmental flow targets should be progressive. Environmental flows recommend in the study taking *Banganadero* and *Raiamas bolaas* indicator fish species i.e. ensuring a depth of 60 cm may be considered as short term approach for revival of river Yamuna. However, for long term approach *Golden Mahaseer* may be taken as indicator fish species which requires a depth of around 1.5 m.

Further, it was pointed that definition of Environmental flows provided in the draft report may be revised as per the GRBMP document. Additionally, restoration of wetland in this stretch of river shall also be focused as one of the critical activity for revival of river Yamuna.

15. Comments as received from Dr. K. Sivakumar, Sc 'F', WII, via email are as follows:
 - i. As mentioned by Dr Gosain, surface-groundwater interaction should be taken into consideration while estimating the e-flow required for the main stream but unfortunately that was missed here. He agreed with Dr Gosain in this regard that E-flows are always under estimated if surface-groundwater interactions are not considered. He informed that this constraint was also felt by him while estimating e-flows for downstream of Godavari River with respect to Polavaram Project in 2014.
 - ii. Further, two fish species have been used as indicator species for estimating the e-flow by NIH with help of his colleague Dr JA Johnson. He remarked that he and Dr

Johnson have tried to use the fishes and their habitats requirements for estimating the e-flows (probably first time in the country) for the upstream of Ganges but the same method cannot be used everywhere. In this stretch, the Indian soft shell turtle (*Nilssonina gangetica*), which feeds on fishes (at higher trophic level) and several aquatic birds (migratory water birds during winter) have been reported in this stretch of the River. These animals might have been the better indicators than the fishes for estimating the e-flow. However, he was not aware of the current distributional status of freshwater turtles/birds in this stretch. If these animals are not found, then the fishes are the right choice for estimating the e-flows. As mentioned in the report, it is always better to use larger fish such as Golden Mahseer as indicator although this species not abundant in this stretch in bigger numbers.

16. Dr. Anupama Sharma, NIH-Roorkee, in response to the points raised by Prof. Gosain, explained that while carrying out SWAT modelling NIH has accounted for extractions and all inputs into the river, so indirectly modelling is taking care of losses. Further, during different season particular stretch may become gaining or losing eg. Bahgpat stretch becomes gaining stretch during monsoon season while Mawi stretch remains losing stretch for entire year into the river. However, it was stated that given the limited time frame it was not possible to carry out ground water modelling. It was suggested for time being the recommended environmental flows may be accepted and on latter stage with more studies the re-assessment of e-flows may be done.

Further, in reply to objection raised by Govt. of Haryana over use of SWAT model, it was remarked that SWAT is widely acclaimed model worldwide and is being used for different conditions.

17. Secretary, D/o WR, RD & GR, in response to the comments made by Haryana Govt., mentioned that the purpose of environmental flows is not to increase certain fish species production or to dilute the pollution in the river. The Govt. is aware of the various steps undertaken by Govt. of Haryana towards water conservation and adopting water efficient irrigation practices. Efforts for water conservations are also being undertaken by Central Govt. through various schemes. There is need for policy interventions for reviving of rivers in the country.

Further, it was commented that estimating environmental flows and measures required to achieve these flows are separate exercises. With regard to points raised by Prof. Gosain, it was stated that the release from Hathnikund barrage may be augmented or lost in the downstream stretch depending upon whether river is gaining or losing in that particular stretch.

18. Dr. Sharad Jain, former Director-NIH, stated that Yamuna basin is over extracted basin and following options were presented that are being taken worldwide in case of such basins:
 - i. Dam construction.
 - ii. Purchase of water right

iii. Demand side management

In addition, it was suggested that restoration of wetland shall be focussed upon. Also, scale of usage of treated waste water needs to be increased significantly to any impact on reducing fresh water extraction.

It was also cleared that models used for the study viz. HEC-RAS are not dependent on the flows in the river, only parameters need to be estimated correctly. The model works well in either case of high flows or low flows.

In furtherance, it was commented that taking in consideration of ground water loss will substantially increase the estimated environmental flows, which may see more resistance from States. It was suggested that environmental flows need to be re-assessed continuously based on the feedback and monitoring of implemented e flows. At present, environmental flows recommended in the draft report may be accepted.

19. Member, WP&P, CWC cum Chairman, UYRB commented that allocation of Yamuna river water among States was done in 1994, since then the demand for water for irrigation as well as domestic and industrial purposes has increased extensively. To meet these demands and also to have water for environmental flows, storage dams need to be constructed in the upper reaches of river Yamuna.
20. Member Secretary, UYRB cum Executive Director (Tech.), NMCG stated that so far as allocation right of Yamuna river water is concerned, Delhi has been allocated around 495 cusec, which is return flow component from intervening catchment between Hathnikund to Wazirabad. The return flow component built in the model due to flows from intervening drains will therefore be claimed as their share by Delhi. Some safeguard needs to be developed so that environmental flows released from Hathnikund are not utilised for other purposes by the Delhi Govt. And they remain downstream of Wazirabad also. Views of Delhi therefore are important in this respect.
21. At the end following concluding remarks were made by Director General, NMCG:
 - i. The suggestions made by all the Expert Members and State Governments may be taken into consideration while finalising the report.
 - ii. Restoration of wetlands needs to be taken up on large scale.
 - iii. At this stage consensus over the quantity of environmental flows needs to be arrived, at later stage measures required to achieve these flows may be taken up in detail.

Annexure C-2/1

Related to Chapter 2: DDA and the Demarcation of the Flood Plain and Rejuvenation Activities

**PHOTOGRAPHS OF THE INSTALLATION OF BOLLARDS ON THE FLOODPLAINS SITES
FOR THE DEMARCATION OF THE 1 IN 25 YEARS FLOODPLAINS IN COMPLIANCE TO
THE ORDER OF HON'BLE NGT FOR KIND INFORMATION PLEASE**

1. Area around the Sur Ghat



2. PWD Park under Signature Bridge



3. DDA Land Aruna Nagar Tibetan Colony



4. Behind Tibetan Colony



5. Behind MajnuKatillaGurudwara



6. Near Hanuman Akhara Along Ring Road



Akhada



7. Along Ring Road Near DJB Office



8. Along Ring Road adjacent To DJB Pipeline



9. Along the DDA's HD-II Park along Ring Road



10. Along Ring Road



11. Area around the Golden Jubilee Park



12. Area along the QudesiaGhat



13. Area around the Millenium Depot



Annexure C-2/2

Related to Chapter 2: DDA and the Demarcation of the Flood Plain and Rejuvenation Activities

S.No.	Project	Present Status
1.	Wazirabad to Old Railway Bridge (Western Bank) QUDESIA GHAT	When the last report was given to Hon'ble NGT the expected date of completion was June'20. It has now been extended to 30.6.2021 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
2.	Wazirabad Barrage to ISBT Bridge (Eastern Bank) around Garhi Mandu Village & Usmanpur Village	When the last report was given to Hon'ble NGT the expected date of completion was September'20. It has now been extended to 31.7.2021 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
3.	Old Railway Bridge to ITO Barrage (Western Bank)- Asita West	When the last report was given to Hon'ble NGT the expected date of completion was January'21. It has now been extended to 30.6.2021 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
4.	Geeta Colony Bridge to ITO Barrage (Western Bank) Eco-Tourism Bundh	When the last report was given to Hon'ble NGT the expected date of completion was January'22. It has now been extended to 31.7.2022 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
5.	Old Railway Bridge to ITO Barrage (Eastern Bank) - Asita East	When the last report was given to Hon'ble NGT the expected date of completion was March'20. It has now been extended to 15.9.2020 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
6.	ITO to NH-24 (Eastern Bank)- Area south of Commonwealth Games Village	When the last report was given to Hon'ble NGT the expected date of completion was January'21. It has now been extended to 31.7.2021 with the caveat that this would be subject to normalization of existing situation and availability of labor and material
7.	NH-24 to DND Flyway (Eastern Bank) Part Area- II- Hindon Cut Wetlands I&II	When the last report was given to Hon'ble NGT the expected date of completion was July'20. It has now been extended to 30.9.2020 (subject resolve of dispute of ownership of land at chacchilla village) with the caveat that this would be subject to normalization of existing situation and availability of labor and material
8.	NH-24 to DND Flyway (Eastern	When the last report was given to Hon'ble NGT the expected

	Bank) Part Area- I	date of completion was January'21. It has now been extended to 15.6.2021with the caveat that this would be subject to normalization of existing situation and availability of labor and material
9.	DND to proposed Kalindi Bypass (Western Bank) – Khijrabad	When the last report was given to Hon'ble NGT the expected date of completion was December'19. It has now been extended to 31.12.2020with the caveat that this would be subject to normalization of existing situation and availability of labor and material
10.	NH24 to DND Flyway (Western Bank)	When the last report was given to Hon'ble NGT the expected date of completion was May'20. It has now been extended to 30.9.2020 with the caveat that this would be subject to normalization of existing situation and availability of labor and material.

It appears that extension are ranging between 7 and 10 months. The YMC feels that at this moment because there is no certainty, wherever labour is required extension of time would have been given to the DDA. However it would be unfortunate that this work is lying in limbo only because extension has been given. There should be a direction that it should be reviewed every month by the Chief Engineer concerned.

Annexure C-3/1

Related to Chapter 3 – Quality of River Water

Discharge of Waste Water and BOD load/per day into river Yamuna at Delhi

Comparative data for the year 2017, 2018 and 2019

S.No	Name of Drain	Flow (MLD) 2017	Flow (MLD) 2018	Flow (MLD) 2019	BOD load (TPD) 2017	BOD load (TPD) 2018	BOD load (TPD) 2019
1.	Najafgarh Drain	2042.3	2066.7	1938.38	132.55	101.29	133.82
2.	Shahdara Drain	513.9	473.5	500.97	41.26	38.95	61.44
3.	Waste water input into abandoned Agra Canal	260	218	117.93	33.5	30.63	21.54
4	Barapulla Drain	136.3	151.2	151.77	10.3	9.06	10.46
5	Tuglakabad Drain	88.9	45.8	22.10	9.12	3.25	3.42
6	Delhi Gate (Power House) Drain	84.8	47.5	39.02	6.26	3.31	3.43
7	Sen Nursing Home Drain	64.4	41	31.53	9.45	5.29	4.69
8	Abu Fazal Drain	50.9	35	28.94	1.54	1.08	0.88
9	ISBT + Mori Gate Drain	45.2	51	37.94	2.89	3.06	2.67
10	Sarita Vihar Drain	40.8	26	35.68	9.9	6.02	7.73
11	Maharani Bagh Drain	26.5	24.2	30.16	3.03	2.43	3.51
12	Jaitpur Drain	16.6	23.3	19.58	2.28	3.39	3.07
13	Molar Bandh Drain	14	19	22.17	1.98	2.07	2.36
14	Kailash Nagar Drain	11.9	7.8	9	3.15	2.82	2.70
15	Tonga Stand	11.4	7.8	4.46	1.75	1.18	0.59

	Drain						
16	Shastri Park Drain	7.6	4.3	5.76	0.84	0.46	0.75
17	Drain No.14	7.3	4.3	6.54	0.13	0.05	0.07
18	Magazine Road Drain	7.1	6	4.32	0.54	0.44	0.30
19	Civil Mill Drain	6.3	8.6	11.14	0.5	0.57	0.67
20	Metcalf House Drain	6.1	4.3	3.45	0.2	0.12	0.11
21	Sweeper Colony Drain	6	6	5.4	0.16	0.18	0.10
22	Khyber Pass Drain	1.3	-	NF	0.03	-	NF
		3449.6	3271.3	3026.24	271.36	215.65	264.31

Related to Chapter 3: Quality of River Water



CENTRAL POLLUTION CONTROL BOARD (Ministry of Environment, Forests and Climate Change) 'Parivesh Bhawan', East Arjun Nagar, Delhi – 110032

REPORT ON ASSESSMENT OF IMPACT OF LOCK DOWN ON WATER QUALITY OF RIVER YAMUNA – DELHI STRETCH

1. BACKGROUND

Various photographs and videos were circulated among different social media platforms claiming improved water quality of river Yamuna due to lock down of NCT of Delhi in amid crisis of COVID-19. A visit was made to verify the status of water quality of river Yamuna on 06/04/2020 between 9 AM to 1 PM by the CPCB Team comprising following officials: -

- (1). Dr. Yashpal Yadav, Scientist 'B', Bio-Lab, CPCB, Delhi, and
- (2). Shri Anand B Salve, JSA, Bio-Lab, CPCB, Delhi.

Sampling of river Yamuna at 3 locations viz., Palla (Entry point of river Yamuna in Delhi), Nizamuddin bridge (between Wazirabad barrage and Okhla barrage – 14 drains contributing discharges), Okhla barrage Upstream (after discharge of 16 drains) and two major drains (which are contributors of both hydraulic & pollution load in river Yamuna) namely Najafgarh drain and Shahdarad drain following the standard protocols for collection, transportation and further analysis were carried out in CPCB Central Laboratory. Approximately, river Yamuna stretch between collected water sampling locations i.e., between Palla and Wazirabad Barrage is about 22KM, between Wazirabad Barrage to Nizamuddin Road Bridge is about 13.5 KM, Nizamuddin Bridge to Okhla Barrage is about 7.5 KM. At the time of sampling, no human activity such as bathing, washing of clothes at Dhobi Ghats, religious activities, throwing of flowers, garlands and other worship materials, was observed by the monitoring team in the vicinity of the sampling locations. Photographs of river Yamuna and drains taken during the visit is annexed as **Annexure-I**.

2. INTRODUCTION–ABOUT RIVER YAMUNA WITHIN DELHI STRETCH

River Yamuna enter Delhi at village Palla, traverse 22 Km to Wazirabad barragewhere entire water is impounded to meet the drinking water requirement of Delhi.River Yamuna cease to exist downstream of Wazirabad Barrage during major part of the year and gets its flow from Najafgarh drain at Wazirabad downstream.No major fresh water is allowed to flow downstream of Wazirabad barrage except for monsoon season. As the river traverses further downstream the flow is blocked by a barrage at Okhla. The major part of the water is diverted to Agra canal.

2.1 DRAINAGE PATTERN OF RIVER YAMUNA-WITHIN DELHI STRETCH

There are 23 drains discharging wastewater in river Yamuna i.e., 16 drains discharging wastewater in river Yamuna stretch between Wazirabad downstream to Okhla Upstream and 04 drains meet Yamuna in downstream of Okhla Barrage and 03 more drains which discharge their wastewater directly to Agra Canal and Gurgaon Canal. 05 out of 23 drains are having interception and diversion provision of sewage to the nearby STPs for ensuring further treatment. Schematic flow diagram of river Yamuna contributing to pollution in river Yamuna within Delhi stretch is given in **Figure 1**.

Based on the assessment carried out for the year 2019 (**Table 1**), out of all the drains that flow into the river Yamuna, the drains viz., Najafgarh drain (including Supplementary drain), Delhi Gate drain, Sen Nursing Home drain, Barapulla, Tughlakabad and Shahdara drain contribute about 86% of hydraulic load (Volume of Waste Water) and 75 % of organic load (BOD i.e., amount of organic matter).Main causes for pollution in river Yamuna are (i) discharge of treated or untreated sewage, (ii) discharge of treated and untreated industrial effluents, (iii) bathing by the general public, (iv) washing of clothes on the banks, (v) performing poojas, (vi) throwing of worship materials including idols made of Plaster of Paris (PoP) and decorated with toxic paints during festival season,(vii) disposal of solid waste, and (viii) Flood plain farming and other activities etc.,

Table 1: Waste Water Discharges through Drain into River Yamuna (2019)

S.No.	Name of Drain	Avg. Flow (MLD)	Avg. BOD Load (TPD)
1.	Najafgarh Drain	1938.38	133.82

S.No.	Name of Drain	Avg. Flow (MLD)	Avg. BOD Load (TPD)
2.	Shahdara Drain	500.97	61.44
3.	Waste water input into abandoned Agra Canal	117.93	21.54
4	Barapulla Drain	151.77	10.46
5	Tuglakabad Drain	22.10	3.42
6	Delhi Gate (Power House) Drain	39.02	3.43
7	Sen Nursing Home Drain	31.53	4.69
8	Abu Fazal Drain	28.94	0.88
9	ISBT + Mori Gate Drain	37.94	2.67
10	SaritaVihar Drain	35.68	7.73
11	Maharani Bagh Drain	30.16	3.51
12	Jaitpur Drain	19.58	3.07
13	Molar Bandh Drain	22.17	2.36
14	Kailash Nagar Drain	9	2.70
15	Tonga Stand Drain	4.46	0.59
16	Shastri Park Drain	5.76	0.75
17	Drain No.14	6.54	0.07
18	Magazine Road Drain	4.32	0.30
19	Civil Mill Drain	11.14	0.67
20	Metcalf House Drain	3.45	0.11
21	Sweeper Colony Drain	5.4	0.10
22	Khyber Pass Drain	NF	NF
Total		3026.24 MLD	264.31 TPD
Note: NF- No Flow			

2.2 STATUS OF WASTEWATER GENERATION AND TREATMENT CAPACITY

There are 41 STPs and out of which 33 STPs are operational and remaining 08 STPs are observed non-operational. The total installed capacity of wastewater in Delhi is 3149.3 MLD and operational capacity of 33 STPs are 2801.27 MLD and capacity of non-operational 08 STPs is 348.03 MLD. Out of 2801 MLD of operational capacity, actual treatment capacity utilization is 2254 MLD.

Delhi Jal Board (DJB) has initiated Interceptor Sewage Project (ISP) to trap untreated sewage from 108 drains out-falling into Najafgarh, Supplementary and Shahdara drains. Currently, 94% of project work has been completed i.e., out of proposed 916 MLD (242 MGD) drain flow to be trapped under ISP, 476 MLD (125.8 MGD) of sewage flow from drains has been trapped so far and provision of trapping of sewage from drains about 583 MLD (154 MGD) is expected to be completed by October, 2019.

2.3 INDUSTRIAL EFFLUENT

There are 28 Approved Industrial Estates/Areas in Delhi and 28117 industrial units are operating in these industrial estates/areas as per online Delhi Pollution Control Committee (DPCC). Out of 28117 industrial units, 1516 industrial units are water polluting and have installed captive Effluent Treatment Plants (ETPs). Main sources of water by industries in Delhi is groundwater and through tankers. Total waste water generation from these industrial estates/areas is 35.98 MLD. Also, there are 13 CETPs to cater the waste water generated from 17 Approved Industrial Estates/Areas with total treatment capacity of 212.3 MLD.

In view of the lockdown due to COVID-19 pandemic, all the industries are not operational and therefore, at present, there is no discharge (both domestic sewage and industrial effluent) from all the industries located in Delhi State. However, during the lock down period, discharge of partially treated and untreated domestic wastewater continues to be in same proportion as in business as usual days. Shutting down of industrial activity will only result in reduction of 35.9 MLD of industrial effluent and still BOD load about 260 TPD is expected to be discharged through drains.

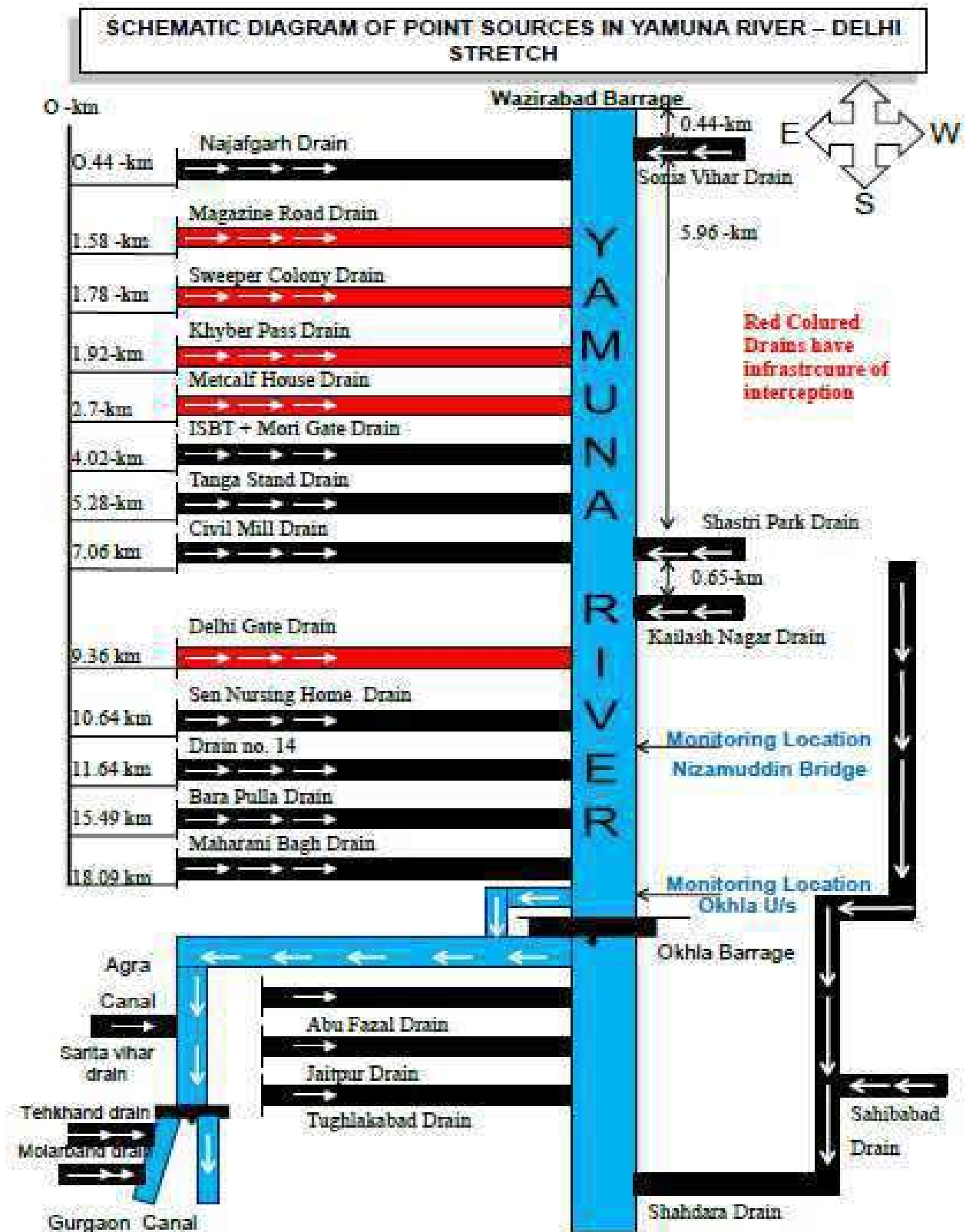


Figure 1: Schematic Flow Diagram of River Yamuna - Delhi Stretch

3. WATER QUALITY OF RIVER YAMUNA AND TWO DRAINS

As stated earlier, sampling of river Yamuna were carried out at 3 locations i.e., Palla, Nizamuddin Bridge, Okhla upstream and major two drains carrying wastewater namely Najafgarh drain and Shahdara drain on 06/04/2020. Also, CPCB has been carrying out monitoring of river Yamuna at these locations on monthly basis. Analytical results of afore mentioned locations are compared with data for the period March 2020 and April 2020 and same are given in **Table 1 and Table 2 below**. Water Quality Trend of river Yamuna as well as Two Drains (Najafgarh and Shahdara drain) with respect to pH, EC, DO, BOD and COD as observed during Pre-lockdown (March 04, 2020) and Lockdown period (April 06, 2020) are depicted in **Figure 2 to Figure 6**.

Table 1: Water Quality of River Yamuna - Delhi Stretch

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria(% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
Palla								
pH	6.5-8.5	8.3	7.8	8.1	8.7	8.7	7.8	Non-Complyingin April 2019 and March 2020
Conductivity, μ S/cm	-	1215	1115	531	440	668	273	Decrease (59.13 %)
DO, mg/l	5.0	7.3	7.1	10.0	8.2	17.1	8.3	Complying (Decrease 51.46 %)
BOD, mg/l	3.0	3	3	1.8	8.8	7.9	2.0	Not complying in April 2019 and March 2020. But complying in April 2020 (Decrease 74.69 %)
COD, mg/l	-	28	15	14	26	28	6	(Decrease

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria(% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
								78.57 %)
Nizamuddin Bridge								
pH	6.5-8.5	7.4	8.0	7.1	7.2	7.3	7.2	Complying (Slight Increase 1.37 %)
Conductivity, $\mu\text{S/cm}$	-	1906	2120	1140	1140	1369	460	Decrease (66.40 %)
DO, mg/l	5.0	1.8	1.2	1.9	1.0	Not Detected	2.4	Not complying during Pre-Lockdown and Lockdown, but improvement in lockdown period
BOD, mg/l	3.0	42	39	21	18	57	5.6	Not complying during 2018, 2019 and in 2020 (Pre-lockdown and Lockdown). But, considerable decrease in BOD Value in April 2020 (Decrease 90.18%)
COD, mg/l	-	140	100	81	71	90	16	(Decrease 82.22 %)
Okhla U/s								
pH	6.5-8.5	7.3	7.5	7.2	7.3	7.2	7.1	Complying (Slight

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria(% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
								Increase 1.39 %)
Conductivity, μ S/cm	-	990	1132	914	1230	861	488	(Decrease 43.32 %)
DO, mg/l	5.0	1.2	1.0	0.9	1.9	Not Detected	1.2	Not Complying
BOD, mg/l	3.0	18	18	20	19	27	6.1	Not Complying But, considerable decrease in BOD value in April 2020 (Decrease 77.41 %)
COD, mg/l	-	81	67	66	67	95	18	Decrease (81.05 %)
Note: *Pre- lockdown (04.03.2020) **Post-lockdown (06.04.2020)								

Table 2: Water Quality of Najafgarh and Shahdara Drain (Sample collected on 06.04.2020)

Parameters	2018		2019		2020		Remarks	
							Comparison between April 2019 and April 2020)	Comparison between March 2020 (Pre-lockdown) and April 2020 (Lockdown Period)
	March	April	March	April	March*	April**		
Najafgarh Drain								
pH	7.3	7.2	7.4	7.3	7.3	7.3		-
SS, mg/l	282	264	201	200	152	106	Decrease	Decrease

Parameters	2018		2019		2020		Remarks	
							Comparison between April 2019 and April 2020)	Comparison between March 2020 (Pre-lockdown) and April 2020 (Lockdown Period)
	March	April	March	April	March*	April**		
							(47 %)	(30.26 %)
BOD, mg/l	50	62	128	90	78	55	(Decrease (38.89 %)	Decrease (29.49 %)
COD, mg/l	319	258	314	316	271	150	Decrease (52.53 %)	Decrease (44.65 %)
Conductivity, μ s/cm	-	-	-	-	-	1501	-	-
Shahdara Drain								
pH	7.1	7.2	7.3	7.1	7.1	7.2	Increase in Alkalinity (9.86 %)	Increase in Alkalinity (9.86%)
SS, mg/l	276	260	481	380	464	305	Decrease (19.74)	Decrease (34.27 %)
BOD, mg/l	46	56	114	128	163	89	Decrease (30.47 %)	Decrease (45.4%)
COD, mg/l	296	311	551	412	574	383	Decrease (7.04 %)	Decrease (33.28 %)
Conductivity, μ s/cm	-	-	-	-	-	1657	-	-
Note: **Pre lockdown(04.03.2020) ***Post lockdown (06.04.2020)								

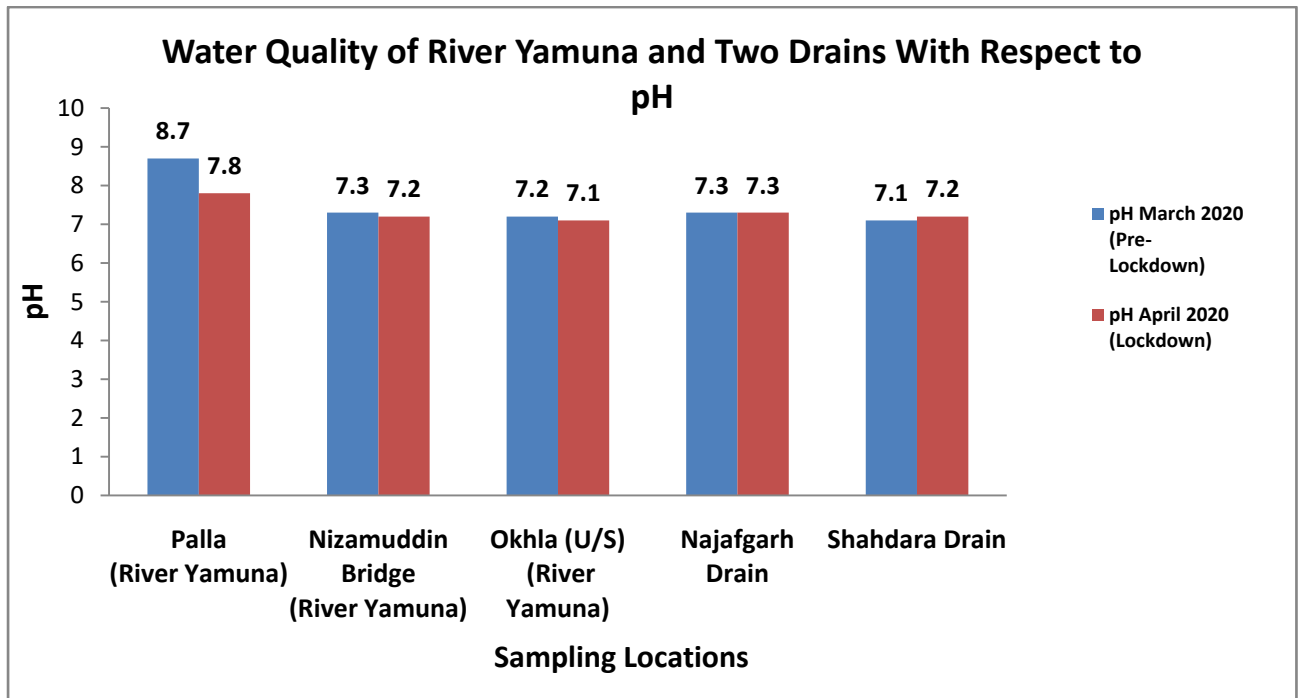


Figure 2: Water Quality of River Yamuna with respect to pH (Pre-Lockdown and During Lockdown)

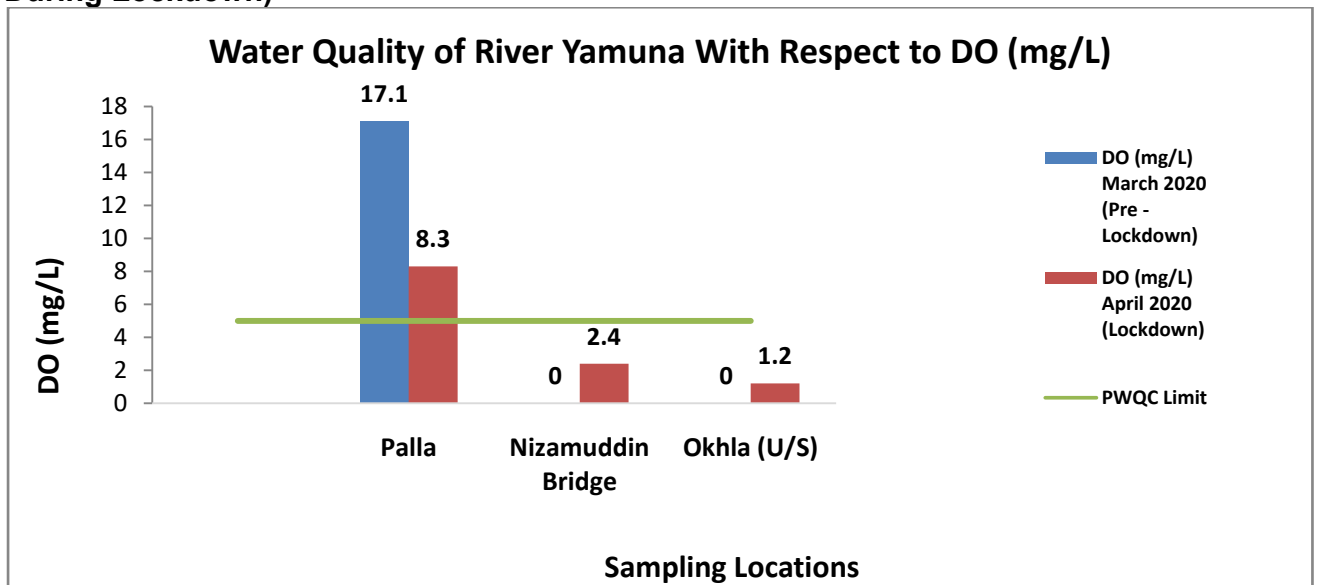


Figure 3: Water Quality of River Yamuna with respect to DO (during Pre-Lockdown and Lockdown)

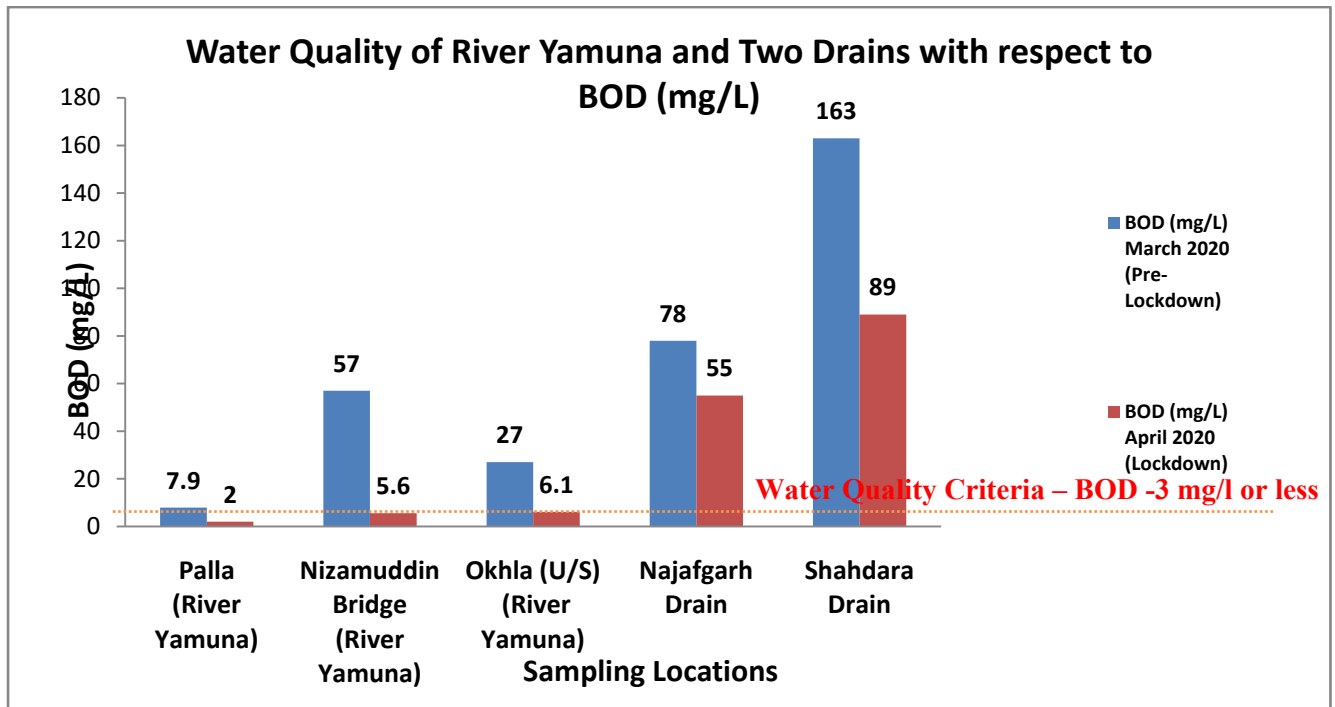


Figure 4: Water Quality Trend of River Yamuna and Two Drains with respect to BOD(during Pre-Lockdown and Lockdown)

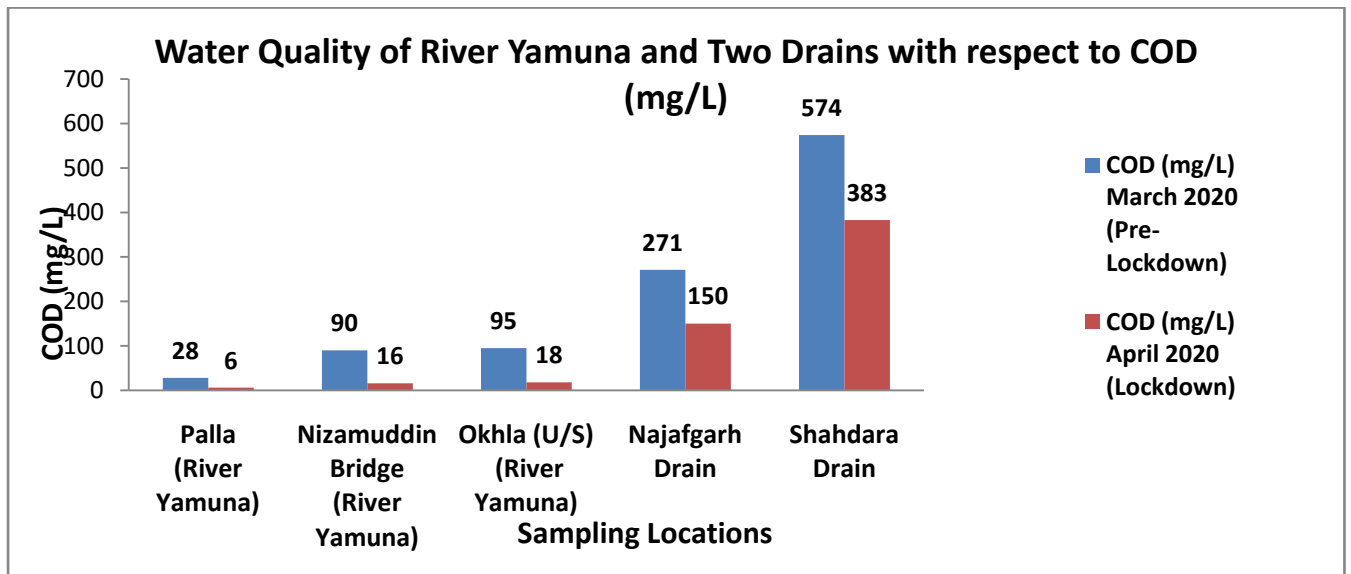


Figure 5: Water Quality Trend of River Yamuna and Two Drains with respect to COD (during Pre-Lockdown and Lockdown)

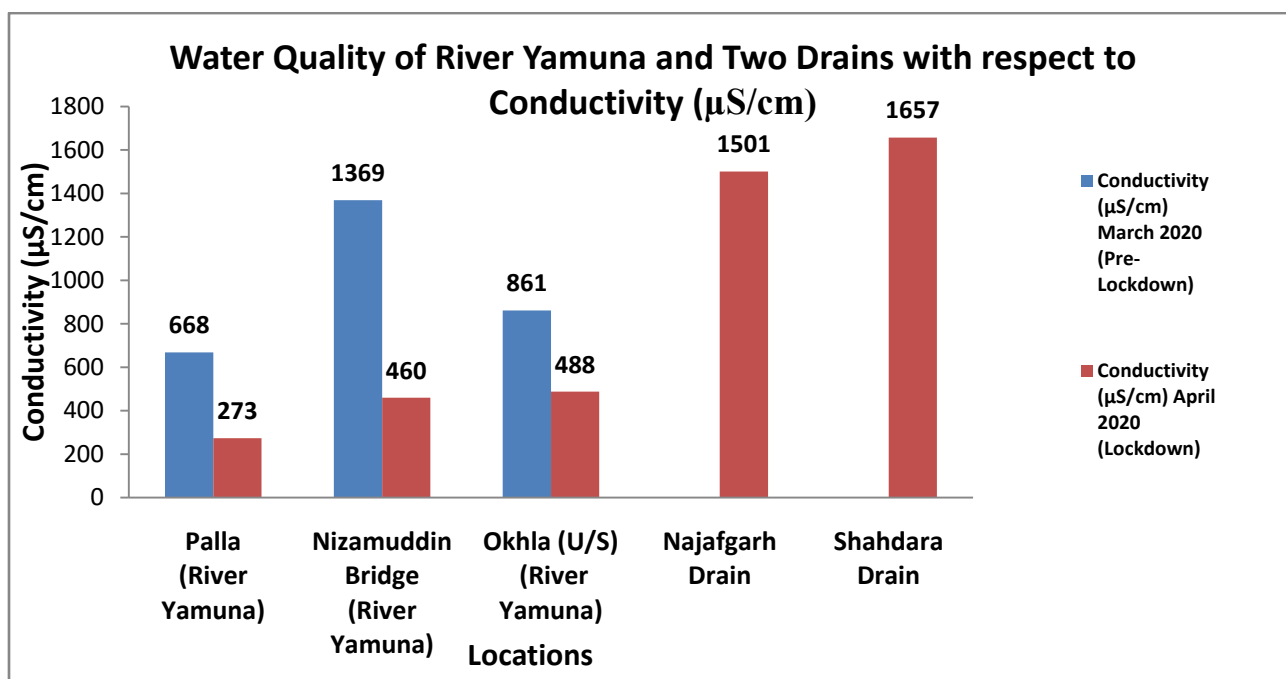


Figure 6: Water Quality Trend of River Yamuna and Two Drains with respect to EC (During Pre-Lockdown and Lockdown)

4. FINDINGS/OBSERVATIONS

Based on the field study and analytical results, following findings/observations are made:

- (i) During the visit on 06/04/2020, as informed by Delhi Jal Board (DJB), about 4145 cusec (hourly average) of fresh water is being released into river Yamuna from Wazirabad barrage, which is mainly due to (i) non-availability of adequate storage capacity at Wazirabad Barrage, (ii) more discharge of fresh water from Hathnikund Barrage, and (iii) unexpected or unseasonal snowfall or rainfall on U/s portion of river Yamuna and monthly average discharge of fresh water from Wazirabad barrage during the month of March, 2020 is 4863 cusecs. Maximum discharge of fresh water of 15,950 cusecs to river Yamuna was recorded on 16.03.2020. It was also observed that during last week of February, 2020 and first week of March, 2020, fresh water release from Wazirabad barrage were less than 1000 cusecs. Details of fresh water discharge from Wazirabad Barrage into river Yamuna for the months of February, March and April, 2020 is annexed (**Annexure-II**).

- (ii) In view of the lockdown due to COVID-19 pandemic, most of the industries located in Delhi are not in operation at present, total waste water discharge (both treated and untreated domestic sewage) from Delhi into river Yamuna is expected to be around 2990 MLD against estimated total wastewater discharge (both domestic and industrial wastewater) of 3026 MLD into river Yamuna during the pre-lockdown period (before 24.03.2020).
- (iii) The analysis results of collected water samples on 06.04.2020 during the lockdown period at Palla, Nizamuddin Bridge, Okhla Barrage U/s as well as Najafgarh Drain and Shahdara Drain are given in subsequent paras:-

Pre-lockdown period (i.e., before 23.03.2020) (in March 2020) and Lockdown Period (06.04.2020):-

At Palla, during pre-lockdown period in March 2020, the analysis results showed pH (8.7), EC (668 $\mu\text{S}/\text{cm}$), BOD (.7.9 mg/L), DO (17.1 mg/L), and COD (28 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.8), EC (273 $\mu\text{S}/\text{cm}$), BOD (2 mg/L), DO (8.3 mg/L) and COD (6 mg/L) and complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters pH, DO and BOD which shows improvement in water quality of river Yamuna at Palla. Also, comparative analysis results during pre-lockdown and lockdown period reveals that there is a considerable decrease in concentration of parameters i.e., EC (59.18 %), DO (51.46 %), BOD (74.69 %) and COD (78.57 %) which may be attributed to fresh water flow from upstream of river Yamuna and no human activity or industrial effluent discharge due to lockdown in view of COVID-19 pandemic.

At Nizamuddin Bridge, during pre-lockdown period in March 2020, the analysis results showed pH (7.3), EC (1369 $\mu\text{S}/\text{cm}$), BOD (.57 mg/L), DO (not detected), and COD (90 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.2), EC (460 $\mu\text{S}/\text{cm}$), BOD (5.6 mg/L), DO (2.4 mg/L) and COD (16 mg/L) and not complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters of DO and BOD. Comparative analysis results during pre-

lockdown and during lockdown reveal that there is a substantial decrease in concentration of parameters particularly w.r.t EC (66.40 %), BOD (90.18 %) and COD (82.22 %) which can be attributed to contribution of mainly from 14 drains discharging both treated and untreated sewage, no industrial effluent discharges from the industrial areas or no other human activities such as bathing, throwing of worship materials or solid waste and fresh water discharges from U/s of river Yamuna.

At U/s of Okhla Barrage, during pre-lockdown period in March 2020, the analysis results showed pH (7.2), EC (861 μ s/cm), BOD (.27 mg/L), DO (not detected), and COD (95 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.1), EC (488 μ s/cm), BOD (6.1 mg/L), DO (1.2 mg/L) and COD (18 mg/L) and not complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters such as DO and BOD. Comparative analysis results (pre-lockdown and lockdown period) reveal that there is considerable decrease in concentration of parameters w.r.t analyzed parameters viz., EC(43.32 %), BOD (77.41 %) and COD (81.05 %) which can be attributed to contribution only from two drains carrying both treated or untreated sewage, no industrial effluent discharges and there is a river Yamuna stretch of about 7.5 KM (after Nizamuddin Bridge) and might be helping in self-purification of river Yamuna.

At Najafgarh Drain (which discharges 1938 MLD of wastewater into river Yamuna), during pre-lockdown period in March 2020, the analysis results showed pH (7.3), SS (152 mg/L), BOD (78 mg/L), COD (271 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.3), SS (106 mg/L), EC (1501 μ s/cm), BOD (55 mg/L), and COD (150 mg/L) Also, comparative analysis results (pre-lockdown and lockdown period) reveal that there is decrease in concentration of analyzed parameters i.e., SS (30.26 %), BOD (29.49 %), and COD (44.65 %) which can be attributed to carrying of untreated and treated sewage.

At Shahdara Drain, during pre-lockdown period in March 2020, the analysis results showed pH (7.1), SS (464 mg/L), BOD (163 mg/L), COD (574 mg/L) whereas the analysis results during the lockdown period (on

06.04.2020) showed pH (7.2), SS (305 mg/L), EC (1657 $\mu\text{S}/\text{cm}$), BOD (89 mg/L) and COD (303 mg/L). Also, comparative analysis results (pre-lockdown and lockdown period) reveal that there is decrease in concentration of analyzed parameters i.e., slight increase in alkalinity, SS (34.27 %), BOD (45.4 %) and COD (33.28 %).

5. Conclusion

Above analysis results indicate there is considerable improvement in water quality of river Yamuna (with respect to DO, BOD and COD when compared with pre-lockdown and lockdown period) at all the three monitored locations of river Yamuna. However, water quality of river Yamuna at Nizamudding and Okhla U/s not meeting the Primary water quality criteria for bathing standards with respect to DO and BOD.

Post –lock down, improvement in water quality can be attributed to (i) release of fresh water from Wazirabad Barrage and availability of dilution in river Yamuna, ii) no industrial effluent discharge (about 35.9 MLD) at present due to lockdown in view of COVID-19 pandemic; (iii) Good penetration of solar radiation in water body can be expected due to washing out of bottom sediments as well as settleable and colloidal form of pollutants in river Yamuna, and (iv) Human activity such as throwing of Pooja materials, solid waste disposal, bathing, washing of clothes etc. minimized due to the ongoing lockdown due to COVID-19 pandemic.

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ANNEXURE-I**PHOTOGRAPHS OF RIVER YAMUNA (06.04.2020)****Figure 1: River Yamuna at Wazirabad Barrage****Figure 2: Najafgarh Drain**

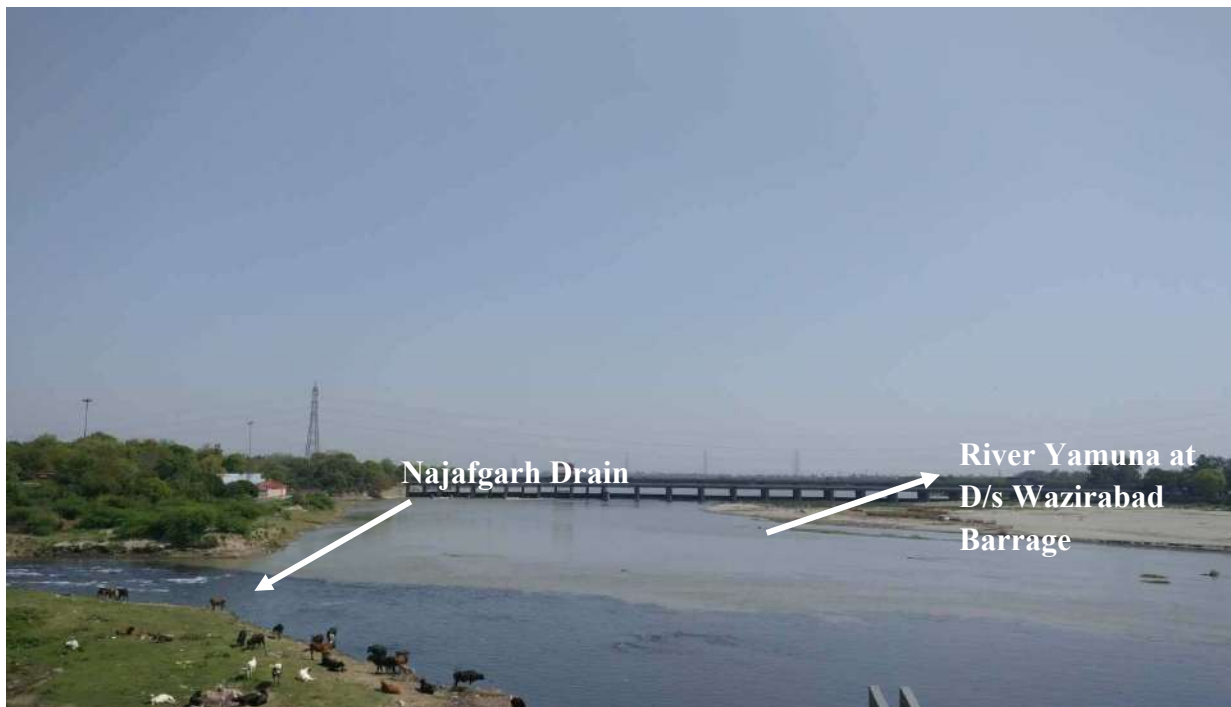


Figure 3: Confluence of Najafgarh Drain with River Yamuna at D/s Wazirabad Barrage



Figure 4: River Yamuna at D/s of ITO Barrage



Figure 5: Hindon Cut Canal



Figure 6: River Yamuna at Kalindi Kunj

ANNEXURE-II

**FRESH WATER DISCHARGE FROM WAZIRABAD BARRAGE INTO RIVER
YAMUNA
(IN CUSEC)**

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.02.2020	26000.00	1083.33
02.02.2020	42400.00	1766.67
03.02.2020	3800.00	158.33
04.02.2020	26600.00	1108.33
05.02.2020	25400.00	1058.33
06.02.2020	22800.00	950.00
07.02.2020	26800.00	1116.67
08.02.2020	30000.00	1250.00
09.02.2020	28000.00	1166.67
10.02.2020	18600.00	775.00
11.02.2020	20600.00	858.33
12.02.2020	21600.00	900.00
13.02.2020	15600.00	650.00
14.02.2020	15200.00	633.33
15.02.2020	10600.00	441.67
16.02.2020	9600.00	400.00
17.02.2020	7800.00	325.00
18.02.2020	7600.00	316.67
19.02.2020	12400.00	516.67
20.02.2020	13800.00	575.00
21.02.2020	9400.00	391.67
22.02.2020	11600.00	483.33
23.02.2020	13400.00	558.33
24.02.2020	25800.00	1075.00
25.02.2020	31400.00	1308.33
26.02.2020	26400.00	1100.00
27.02.2020	21200.00	883.33
28.02.2020	16000.00	666.67
29.02.2020	12200.00	508.33
Total Discharge	552600.00	23025.00
Avg. Discharge	19055.17	793.97

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.03.2020	13600.00	566.67

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
02.03.2020	14400.00	600.00
03.03.2020	12000.00	500.00
04.03.2020	9600.00	400.00
05.03.2020	10000.00	416.67
06.03.2020	18600.00	775.00
07.03.2020	19800.00	825.00
08.03.2020	20000.00	833.33
09.03.2020	23600.00	983.33
10.03.2020	68200.00	2841.67
11.03.2020	115200.00	4800.00
12.03.2020	103600.00	4316.67
13.03.2020	92000.00	3833.33
14.03.2020	74400.00	3100.00
15.03.2020	169600.00	7066.67
16.03.2020	382800.00	15950.00
17.03.2020	324000.00	13500.00
18.03.2020	235600.00	9816.67
19.03.2020	209600.00	8733.33
20.03.2020	178400.00	7433.33
21.03.2020	172800.00	7200.00
22.03.2020	154000.00	6416.67
23.03.2020	116800.00	4866.67
24.03.2020	129200.00	5383.33
25.03.2020	123200.00	5133.33
26.03.2020	106800.00	4450.00
27.03.2020	104400.00	4350.00
28.03.2020	124400.00	5183.33
29.03.2020	142800.00	5950.00
30.03.2020	152400.00	6350.00
31.03.2020	196400.00	8183.33
Total Discharge	3618200.00	150758.33
Monthly Average Discharge Rate	116716.13	4863.17

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.04.2020	178000.00	7416.67
02.04.2020	142000.00	5916.67
03.04.2020	140800.00	5866.67

04.04.2020	136400.00	5683.33
05.04.2020	118800.00	4950.00
06.04.2020	45600.00	4145.45
Total Discharge	761600.00	33978.79
Avg. Discharge*	152320.00	6795.76

Source:- Delhi Jal Board (DJB)

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Parameters (BOD /SS, mg/ l)	Achieved parameters (BOD / SS , mg/ l) (As mentioned in order dated 26.07.2018)	Achieved parameters (BOD / SS , mg/ l) (As per Monitoring in May, 2020)	Prescribed Standards by DPCC [pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]	As mentioned in order dated 26.07.2018	As per Status in May, 2020
1.	Okhla	Phase-I	30	-	-	-	-	-	Plant closed. To be reconstructed under YAP-III.	124 MGD STP at Okhla will be constructed instead of existing Okhla STP (Phase I to IV). The new STP will be constructed at a new location. Till the new plant is constructed & commissioned, the existing plants will remain in operation.
		Phase-II	12	11.05.2020	30 / 50	-	22 / 32.4	Not Meeting the Prescribed standards in respect of TSS (32.4 mg/l), COD (72 mg/l), BOD (22 mg/l) & Faecal Coliform (380 MPN/100 ml)	Under maintenance. To be Rehabilitated under YAP-III.	
		Phase- III	37	11.05.2020	30 / 50	16 / 16	20 / 32	Not Meeting the Prescribed standards in respect of TSS (32 mg/l), COD (60 mg/l), BOD (20 mg/l) & Faecal Coliform (580 MPN/100ml)	To be Rehabilitated under YAP-III.	
		Phase-IV	45	11.05.2020	30 / 50	28/31	12 / 13.8	Not Meeting the Prescribed standards in respect of TSS (13.8 mg/l), COD (52 mg/l), BOD (12 mg/l)		
		Phase-V	16	11.05.2020	30 / 50	26 / 26	14 / 46	Not Meeting the Prescribed standards in	Below capacity	

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

								respect of TSS (46 mg/l), COD (52 mg/l), BOD (14 mg/l) & Faecal Coliform (430 MPN/100ml)		STPs proposed for BOD / TSS (10/10mg/l)
		Phase-VI	30	11.05.2020	20 / 30	8 / 6	2.9 / 2.6	Meeting the Prescribed Standards	Functioning well. DBO plant	
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Parameters (BOD / SS, mg/ l)	Achieved parameters (BOD / SS, mg/ l)	Achieved parameters (BOD / SS, mg/ l)	Prescribed Standards by DPCC	As mentioned in order dated 26.07.2018	As per Status in May, 2020
								[pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]		
2.	Rithala	Phase-I	40	09.05.2020	30 / 50	36 / 70	80 / 98	Not Meeting the Prescribed standards in respect of TSS (98 mg/l), COD (240 mg/l), BOD (80 mg/l), Ammonical Nitrogen (20 mg/l) & Dissolved Phosphate (2.6 mg/l)	To be rehabilitated under YAP-III.	Being Rehabilitated under YAP-III for BOD / TSS (10/10mg/l)
		Phase-II	40	09.05.2020	15 / 20	16 / 22	12 / 13.8	Not Meeting the Prescribed standards in respect of TSS (13.8 mg/l), BOD (12 mg/l) & Ammonical Nitrogen (5.8 mg/l)		Upgradation of STP proposed for BOD / TSS (10/10mg/l)
3.	Kondli	Phase-I	10	-	-	-	-	-	Plant closed. To be rehabilitated under YAP-III.	To be Rehabilitated under YAP-III for BOD / TSS

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

		Phase-II	25	13.05.2020	30 / 50	20 / 42	9 / 20.2	Not Meeting the Prescribed standards in respect of TSS (20.2 mg/l), Ammonical Nitrogen (6.2 mg/l) & Faecal Coliform (260 MPN/100ml)	To be rehabilitated under YAP-III.	(10/10mg/l)
		Phase-III	10	-	-	-	-	-		
		Phase-IV	45	13.05.2020	20 / 30	16 / 23	30 / 28	Not Meeting the Prescribed standards in respect of TSS (28 mg/l), COD (88 mg/l), BOD (30 mg/l), Ammonical Nitrogen (13 mg/l) & Faecal Coliform (380 MPN/100ml)	Functioning Well.DBO plant	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Parameters (BOD / SS, mg/l)	Achieved parameters (BOD / SS, mg/l)	Achieved parameters (BOD / SS, mg/l)	Prescribed Standards by DPCC [pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]	As mentioned in order dated 26.07.2018	As per Status in May, 2020
4.	Keshopur	Phase-I (New)	12	16.05.2020	20 / 30	8 / 30	4.6 / 8.6	Not Meeting the Prescribed standard in respect of Faecal Coliform (330 MPN/100ml)	Functioning well.DBO plant.	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
		Phase-II	20	16.05.2020	30 / 50	26 / 44	90 / 102	Not Meeting the Prescribed standards in respect of TSS (102 mg/l), COD (276 mg/l), BOD (90 mg/l), Ammonical Nitrogen (12.5 mg/l) & Faecal Coliform (410 MPN/100ml)	Below capacity	
		Phase-III	40	16.05.2020	30 / 50	50 / 46	46 / 92.6	Not Meeting the Prescribed standards in	Not meeting	

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

								respect of TSS (92.6 mg/l), COD (120 mg/l), BOD (46 mg/l), Ammonical Nitrogen (11.8 mg/l) & Faecal Coliform (320 MPN/100ml)	the norms.	
5.	Yamuna Vihar	Phase-I	10	14.05.2020	30 / 50	20 / 30	14 / 19	Not Meeting the Prescribed standards in respect of TSS (19 mg/l), BOD (14 mg/l), Ammonical Nitrogen (11.8 mg/l) & Faecal Coliform (270 MPN/100ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
		Phase-II	10	14.05.2020	-	-	12 / 12	Not Meeting the Prescribed standards in respect of TSS (12 mg/l), BOD (12 mg/l), Ammonical Nitrogen (9.5 mg/l) & Faecal Coliform (470 MPN/100ml)	Plant closed as new plant has been commissioned.	To be Rehabilitated/Upgraded for BOD / TSS (10/10mg/l)
		Phase-III	25	14.05.2020	20 / 30	13 / 20	38 / 66	Not Meeting the Prescribed standards in respect of TSS (66 mg/l), COD (120 mg/l), BOD (38 mg/l), Ammonical Nitrogen (21 mg/l) & Faecal Coliform (380 MPN/100ml)	Below capacity DBO plant	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Parameters (BOD / SS, mg/l)	Achieved parameters (BOD / SS, mg/l)	Achieved parameters (BOD / SS, mg/l)	Prescribed Standards by DPCC [pH - 6.5 - 9.0, TSS ≤ 10 mg/l, BOD ≤ 10 mg/l, COD ≤ 50 mg/l, Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l, Fecal Coliform (FC)(MPN/100ml) < 230]	As mentioned in order dated 26.07.2018	As per Status in May, 2020
6.	Vasant Kunj	Phase-I	2.2	01.06.2020	30 / 50	27 / 38	05 / 15	Not Meeting the Prescribed standards in respect of TSS (15 mg/l), Ammonical	Below capacity	Upgradation of STP proposed

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

								Nitrogen (8 mg/l) &Faecal Coliform (480 MPN/100ml)		for BOD / TSS (10/10mg/l)	
		Phase-II	3	01.06.2020	30 / 50	13/ 16	25 / 20.8	Not Meeting the Prescribed standards in respect of TSS(20.8 mg/l), BOD(25 mg/l), COD (80 mg/l) &Faecal Coliform (410 MPN/100ml)	Below capacity		
7.	Mehrauli	-	5	20.05.2020	20 / 30	16/ 18	18 / 30.2	Not Meeting the Prescribed standards in respect of TSS (30.2 mg/l), COD (52 mg/l), BOD (18 mg/l), Ammonical Nitrogen (8.4 mg/l) &Faecal Coliform (260 MPN/100ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)	
8.	Coronati on Pillar	Old	10	-	-	-	-	-	Abandoned.	-	
		Phase-I (Now it is Phase-I & II)	20	12.05.2020	30 / 50	26 / 32	25 / 57.6	Not Meeting the Prescribed standards in respect of TSS (57.6 mg/l), COD (72 mg/l), BOD (25 mg/l), Ammonical Nitrogen (8.6 mg/l) &Faecal Coliform (380 MPN/100ml)	Below capacity	New 70 MGD STP is under construction, thereafter existing 30 MGD will be put out of operation.	
		Phase-II (Now it is Phase-III)	10	12.05.2020	30 / 50	25 / 28	32 / 56.4	Not Meeting the Prescribed standards in respect of TSS (56.4 mg/l), COD (88 mg/l), BOD (32 mg/l), Ammonical Nitrogen (11.8 mg/l) &Faecal Coliform (480 MPN/100ml)	Below capacity DBO plant		
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report		Remarks	
					Designed Paramet ers (BOD /SS, mg/ l)	Achieved parameters (BOD / SS , mg/ l) (As mentio ned in	Achieved parameters (BOD / SS , mg/ l) (As per Monitoring	Prescribed Standards by DPCC [pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) < 10 mg/l,		As mentioned in order dated 26.07.2018	As per Status in May, 2020

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

						order dated 26.07.2018)	in May, 2020)	Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]		
9.	Timarpur	-	6	-	-	-	-	-	Closed. To be redesigned.	Closed.
10.	Narela	-	10	15.05.2020	30 / 50	24 / 27	10 / 15	Not Meeting the Prescribed standards in respect of TSS (15 mg/l) & Faecal Coliform (310 MPN/100ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
11.	Nilothi	Phase-I	40	29.05.2020	30 / 50	16 / 22	34 / 42	Not Meeting the Prescribed standards in respect of TSS (42 mg/l), COD (116 mg/l), BOD (34mg/l), Ammonical Nitrogen (26 mg/l)&Faecal Coliform (410 MPN/100ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
		Phase-II	20	16.05.2020	10 / 10	5 / 7	7 / 5	Not Meeting the Prescribed standard in respect of Faecal Coliform (330 MPN/100ml)	Functioning well DBO plant	
12.	Najafgarh	-	5	21.05.2020	30 / 50	- / 48	12 / 26.5	Not Meeting the Prescribed standards in respect of TSS (26.5 mg/l), BOD (12 mg/l) & Ammonical Nitrogen (12 mg/l)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Paramet	Achieved parameters	Achieved parameters	Prescribed Standards by DPCC	As mentioned in order dated	As per Status in May, 2020

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May,2020

					ers (BOD /SS, mg/ l)	(BOD / SS , mg/ l) (As mentio ned in order dated 26.07.2018)	(BOD / SS , mg/ l) (As per Monitoring in May, 2020)	[pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]	26.07.2018	
13.	Pappan kalan	Phase-I	20	20.05.2020	30 / 50	- / 43	50 / 84.2	Not Meeting the Prescribed standards in respect of TSS (84.2 mg/l), COD (148 mg/l), BOD (50 mg/l), Ammonical Nitrogen (20.2 mg/l) & Faecal Coliform (380 MPN/100 ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
		Phase-II	20	20.05.2020	10 / 10	- / 3	5 / 12.4	Not Meeting the Prescribed standards in respect of TSS (12.4 mg/l), Ammonical Nitrogen (6.2 mg/l) & Faecal Coliform (270 MPN/100 ml)	Functioning well.DBO plant	
14.	Sen Nursing Home Nallah	-	2.2	12.05.2020	10 / 15	9 / 9	3.2 / 13.6	Not Meeting the Prescribed standards in respect of TSS (13.6 mg/l) & Faecal Coliform (310 MPN/100 ml)	Functioning well. DBO plant	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
15	Delhi Gate Nallah	Phase-I	2.2	12.05.2020	10 / 15	8 / 10	3.5 / 6	Not Meeting the Prescribed standards in respect of Ammonical Nitrogen(6.6 mg/l) & Faecal Coliform (400 MPN/100 ml)	Functioning well. DBO plant	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
		Phase-II	15	12.05.2020	10 / 10	8 / 10	10 / 12.4	Not Meeting the Prescribed standards in respect of TSS (12.4 mg/l), Ammonical Nitrogen (5.8 mg/l) & Faecal Coliform (250 MPN/100 ml)	Functioning Well.DBO plant	
16.	Rohini	-	15	09.05.2020	30 / 50	38 / 60	18 / 15.2	Not Meeting the Prescribed standards in respect of TSS (15.2 mg/l), COD (52 mg/l), BOD (18 mg/l), Ammonical Nitrogen (17.3 mg/l) & Faecal Coliform	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May, 2020

S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			(580 MPN/100ml)	Remarks	
					Designed Parameters (BOD / SS, mg/ l)	Achieved parameters (BOD / SS, mg/ l)	Achieved parameters (BOD / SS, mg/ l)	Brief of Analysis Report	As mentioned in order dated 26.07.2018	As per Status in May, 2020
								Prescribed Standards by DPCC [pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Fecal Coliform (FC)(MPN/100ml)< 230]		
17.	Ghitorni	-	5	-	-	-	-	-	Only 0.5 MGD flow is received at the plant.	Monitoring could not be conducted due to Low Flow / Covid – 19 pandemic. Upgradation of STP proposed for BOD / TSS (10/10mg/l)
18.	Kapashera	-	5	20.05.2020	10 / 10	8.6 / 6	15 / 13.8	Not Meeting the Prescribed standards in respect of TSS (13.8 mg/l), COD (56 mg/l), BOD (15 mg/l) & Faecal Coliform (250 MPN/100 ml)	Below capacity	
19	Chilla	-	9	13.05.2020	10 / 10	3.1 / 7	8 / 8	Not Meeting the Prescribed standards in respect of Ammonical Nitrogen(6.8 mg/l) & Faecal Coliform (330 MPN/100 ml)	Functioning well.DBO plant	

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May,2020

20.	Common Wealth Games Village	-	1	13.05.2020	2 / 1	1.5 / 1	3.2 / 3	Not Meeting the Prescribed standard in respect of Faecal Coliform (430 MPN/100ml)	Below capacity	
S. No.	Location of STP	Phase wise break up	Capacity (MGD)	Date of Sampling	Performance			Brief of Analysis Report	Remarks	
					Designed Parameters (BOD / SS, mg/ l)	Achieved parameters (BOD / SS , mg/ l)	Achieved parameters (BOD / SS , mg/ l)	Prescribed Standards by DPCC [pH - 6.5 - 9.0 , TSS ≤ 10 mg/l , BOD ≤ 10 mg/l , COD ≤ 50 mg/l , Ammonical Nitrogen (NH ₄ -N) ≤ 5 mg/l, Total Nitrogen (N -Total) ≤ 10 mg/l, Phosphate (PO ₄ - P) ≤ 2 mg/l , Faecal Coliform (FC)(MPN/100ml)< 230]	As mentioned in order dated 26.07.2018	As per Status in May, 2020
21.	Molar Bandh	-	0.66	11.05.2020	30 /50	28 / 28	9 / 8.2	Not Meeting the Prescribed standards in respect of Ammonical Nitrogen(12.8mg/l) & Faecal Coliform (270 MPN/100 ml)	Below capacity	Upgradation of STP proposed for BOD / TSS (10/10mg/l)
22.	Bakkar wala	-	0.66	-	-	-	-	-	Plant closed as no sewage is received.	Plant Closed.

Note :

(i) DPCC Water Laboratory carries out regular monitoring of the Sewage Treatment Plants (STPs) of Delhi Jal Board on monthly basis and Analysis Reports are placed/ uploaded on the website of DPCC. Analysis Reports of STPs of DJB are briefed in tabular form in respect of the parameters found exceeding the prescribed standards and communicated to Delhi Jal Board through letters from time to time for taking rectification measures to meet the prescribed standards.

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May,2020

(ii) CPCB had issued directions u/s 18 (1) (b) of Water Act, 1974, on 21.04.2015 and further clarified vide letter dated 27.04.2016 to specify stringent standards for STPs to comply within 2 years time. As decided by the Consent Management Committee in its meeting held on 10.05.2016, letters were issued to Delhi Jal Board on 01.06.2019 / in June, 2016, in respect of all the STPs wherein Consent was granted, informing that consent granted earlier stands modified as per the above mentioned decision and DJB was required to comply with the standards by 26.04.2018.

As per the said Directions of CPCB, the compliance was to be done within two years from the date 27.04.2016 i.e by 26.04.2018. MoEF&CC notified the standards for effluent discharge for STPs vide Notification Dated 13.10.2017. An application was filed by Sh. Nitin Shankar Deshpande before the Hon'ble National Green Tribunal against the said notification Dated 13.10.2017 of MoEF&CC [OA No. 1069/2018 in the matter of Nitin Shankar Deshpande Vs. Union of India &Ors.]. After considering the report of the expert Committee constituted by Hon'ble Tribunal and comprising the nominees from IIT Kanpur, IIT Roorkee, NEERI and CPCB the Hon'ble NGT passed following Directions vide order Dated 30.04.2019 in aforementioned case :

“14. Accordingly, we accept the report of the Expert Committee with the modification that the standards recommended for Mega and Metropolitan Cities will also apply to rest of the country. We also direct that the standards will apply not only for new STPs but also for existing / under construction STPs without any delay and giving of sevenyears time stands disapproved. MoEF&CC may issue an appropriate Notification in the matter within one month from today. The Application is disposed of”.

MoEF&CC is yet to issue notification regarding standards for STPs w.r.t. abovementioned order of Hon'ble NGT.

The Committee for II (a) Category cases, headed by Chairman, DPCC and having out side members for deciding Consent under the Air & Water Acts and Authorization under the applicable Rules has decided following Standards for Treated Effluent of Sewage Treatment Plants (STPs) of Delhi Jal Board (for Old as well as New STPs) in its meeting held on 14.10.2019 and the same was communicated to Delhi Jal Board vide letter dated 31.01.2020 to meet the prescribed standards and also to take necessary action for incorporating the prescribed standards in the Online Monitoring System installed at the STPs of DJB.

Standards for Treated Effluent of Sewage Treatment Plants (STPs) of Delhi JalBoard(for Old as well as New STPs)

S.No.	Parameters	Prescribed Standards for Treated Effluent of STPs of DJB
1	pH	6.5 - 9.0
2	Total Suspended Solids (TSS)	≤ 10 mg/l
3	Biochemical Oxygen Demand (BOD)	≤ 10 mg/l

Related to Chapter 4: Sewage Treatment Plants (STPs)

Brief of Analysis Reports in respect of STPs of Delhi Jal Board for the month of May,2020

4	Chemical Oxygen Demand (COD)	≤ 50 mg/l
5	Ammonical Nitrogen (NH_4 - N)	≤ 5 mg/l
6	Total Nitrogen (N -Total)	≤ 10 mg/l
7	Phosphate (PO_4 - P)	≤ 2 mg/l
8	Fecal Coliform (FC) (MPN/100ml)	< 230

MOST IMMEDIATE
NGT MATTER

Government of NCT of Delhi
 Department of Urban Development
 (Water Branch)
 10th Level, "C" Wing, Delhi Secretariat
 I.P. Estate, New Delhi - 110002.
 Phone No. 011-23392343

F.16(483)/UD/W/2020/ 528-530

Dated:- 13/03/2020

To

The Chief Executive Officer,
 Delhi Jal Board,
 Varunalaya Ph-II, Jhandewalan,
 Karol Bagh, New Delhi-110005.

Sub:- Setting up of an 'Integrated Drain Management Cell' (IDMC) under the Chief Secretary, Delhi-reg.

Sir,

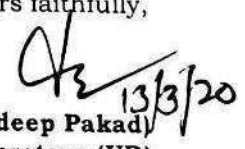
Kindly refer to the order dated 05.03.2020 of Hon'ble NGT in O.A No. 06/2012 in the matter of Manoj Mishra Vs. Union of India & Ors vide which the Hon'ble NGT has directed to set up an 'Integrated Drain Management Cell' (IDMC) under the Chief Secretary for remediation and management of all drains of Delhi with representatives of all agencies/departments/Urban Local Departments owing 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 Hon'ble NGT every two months bt e-mail at judicial-ngt@gov.in. The 'Cell' should be set up within a week.

In view of above, I am directed to request you to kindly set up IDMC (Cell) and seek time from worthy Chief Secretary, Delhi for holding IDMC meeting at the earliest. A copy of members of IDMC may please be forwarded to the undersigned within a week for onward submission to the Hon'ble NGT & YMC.

This may please be treated as **Time Bound**.

This issues with the prior approval of the Pr. Secretary (UD).

Yours faithfully,


 (Kuldeep Pakad)
 Special Secretary (UD)

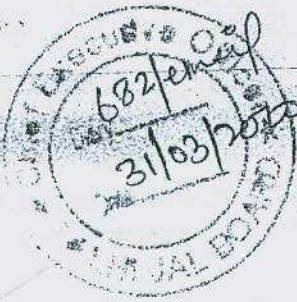
F.16(483)/UD/W/2020/

Dated:- 13/03/2020

Copy forwarded to the following for information please:-

1. S.O. to Chief Secretary, Delhi.
2. Member, Yamuna Monitoring Committee.


 (Kuldeep Pakad)
 Special Secretary (UD)

CHIEF ENG(SDW) S&E
DELHI JAL BOARD

DIARY No. 1097

DATE 17/04/2020

Government of NCT of Delhi
Department of Urban Development
10th Level C-Wing, Delhi Secretariat,
I.P. Estate, New Delhi - 110002.
Ph-011-23392343

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No.F.16(483)/UD/W/2015/Vol.-III/Pt.File/707-718

Dated:- 31/3/2020

Sub:- SOP for collection, transportation and disposal of Septage from
Households of unauthorised /unsewered colonies.

(A) Emptying of septic Tanks/De-sludging procedure (Responsibility- All
ULBs of their area):-

1. As per the Gazette notification No. 219 dated 21/11/2018 on Delhi Water Board Septage Management Regulation 2018 and the SOP thereof, the jurisdiction with respect to the Septage Management has been defined as under:-

S.No.	Area of Working	Authority/Department responsible
1.	Entire sewerage network in sewered areas being maintained by DJB within Delhi Municipal limits.	Delhi Jal Board
2.	Sewer line, private septic tanks/close pits in Delhi Cantonment Area.	Delhi Cantonment Board
3.	Sewer lines/septic tanks if any, maintained in New Delhi Municipal Council Limit	New Delhi Municipal Council
4.	All septic tanks and the House Sewer connections constructed by private entities etc. where sewer lines are not being maintained by DJB.	All Municipal Corporation, Delhi Cantonment Board, New Delhi Municipal Council, Delhi Development Authority etc. and the private entities which is owner of the premises.
5.	Apartments/ Group Housing Societies/Malls/Pvt. Hospitals etc.	Residents Welfare Associations/Owner of the premise
6.	Government Premises	The respective authority i.e. Delhi Development Authority, PWD, CPWD, all Municipal Corporations, Delhi Cantonment Board, Delhi Urban Shelter Improvement Board etc. maintain the premise.

2. All ULBS should ensure safe emptying of septic tanks at regular intervals. The ULBs shall initiate scheduled septic tank desludging services and carry out extensive awareness campaign to ensure that the septic tanks are cleaned at least once in a three years.

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Dr

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3. The Delhi Jal Board will undertake an awareness campaign to make the people aware to engage only the licensed agencies for collection, transportation and disposal of septage.
4. Septic Tank Waste (Septage) shall be collected and transported only by the vendors having a valid licensee for the purpose issued by the DJB.
5. It shall be the duty of each owner/occupier of the building/house to engage the services of valid licensee vendors of DJB.
6. The licensee vendors(s) will engage only trained workers having valid certificate of training from the recognised institution or the department. The vendor will also ensure that required Safety Gadgets as specified in PEMS Rules-2013 are available and used at work place.
7. The fee for collection and transportation of Septic Tanks Waste (Septage) upto notified locations at SPS/STP as well as locations for disposal of septage shall be notified by the Designated Officer of Delhi Jal Board from time to time.
8. The process of collection/desludging of the Septic Tank will be done under the supervision of officials of the respective ULBs.
9. The desludging shall be carried out using appropriate procedures, equipments, safety gear and operating practices which are in compliance with all relevant laws or directions prevailing at the time.
10. The ULB shall ensure that operation and cleaning of septic tanks shall be carried out only by using mechanical devices. The desludging trucks shall be fully equipped with required tools, equipment and spares for the operation.
11. ULBs should either provide the emptying services themselves or enter into service contract with the private agencies. If the private players are providing the services, ULB should monitor their services. In case of any untoward incident, the concerned ULB should be fully responsible.
12. **Desludging Procedure:**
 - a) The sanitary workers, with proper safety tools, shall undertake visual inspection of the interior and exterior of the tanks after opening the access covers and check for:
 - i. Level of water/sludge with respect to the flow line of outlet pipe.
 - ii. Back pressure.
 - iii. Whether inlet pipe and sanitary tee are in place.
 - iv. Cracks in the wall using mirror on a long pole.
 - v. Number of compartments -If more than one compartment, sanitary worker needs to locate and remove lids from all the compartments. Each compartment will need separate pumping.
 - vi. Indication for high ground water, saturated soils.
 - b) The sanitary workers shall use a long handle-rod to determine the sludge level in a septic tanks.



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- c) Workers shall take out the hoses and fitting from the tool box required to complete pumping.
- d) To probe the tank, the hose shall be lowered slowly to the last length of hose, to get an indication on the volume of sludge to be pumped.
- e) Then the hose shall be connected to the truck. Screw on clamp fitting shall be used in case back pressure is required to break up the sludge masses.
- f) Next, the pump or vacuum equipment shall be engaged. The worker must:
 - i. Ensure suction and operation of pump by checking rapid decrease in volume of tank.
 - ii. Monitor the level gauge on the septage cleaning tank. Always ensure there is adequate volume in the cleaning tank to accommodate the load. If only partial load can be pumped, monitor the level closely.
 - iii. Monitor the septic tank as pumping progresses. Also check for blockage at the inflow and outflow pipes.
 - iv. Check the tank for remaining sludge after pumping. Ensure that 1-2 inch of sludge should be left on the tank to facilitate future decomposition.
- g) If accumulated solids are still remaining, the works shall initiate the pump back procedure, which will send the piped septage back to the septic tank under pressure and direct this flow toward the sludge mass. This will break the mass, making it possible to pump out again. As little as 200-300 liters will be enough to break the mass.
- h) After pump-back is completed, pumping out the septic tank shall be done again. The above steps can be repeated if required. Pumping from the tank shall be continued till about 100-200 litres of septage remains in the tank after cleaning.
- i) On the completion of pumping, the hose shall be washed with water by directing water stream back to the tank and the cleaned hoses shall be placed back in the truck tool box.
- j) Before leaving the site, the workers shall ensure that the tank lids/assessment cover is securely placed.

(B) Septage Transportation (Responsibility- Committee headed by District Magistrate):- After desludging of septage from premises, it has to be transported to the approved treatment site designated by the DJB for safe disposal or reuse. The septage transporter is primarily responsible for the safe transport of septage.

The Committee headed by the District Magistrate/Deputy Commissioner (Revenue) constituted under "Delhi Water Board Septage Management Regulation, 2018" shall need to ensure that handling, transport and disposal are in compliance with the Environment Protection Act, The Water Act and the Municipal Solid Waste Management (Handling) and Management Rules. The committee will also ensure for the implementation of the following:-

- (1) Septage shall be transported only in the vehicles approved for this purpose by the designated officer of Delhi Jal Board.



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(2) To ensure safe transportation of septage, the septage transporter in consultation with the DM headed Committee shall prepare a transportation plan which shall include:

- (a) Scheduling and routing for trucks
- (b) Customer services protocols

(3) The septage transporter must ensure that:

(a) The registered septage transport vehicle including all equipments used for the transport of septage shall have a leak-proof body and lock to secure the septage; comply with applicable standards and must be able to withstand a collision with another vehicle or any permanent structure;

(b) The tank and equipments used to transport septage shall not be used for the transportation of any other materials or liquids;

(c) The vehicles used to transport septage shall be equipped, at all times, with spill control or absorbent materials and disinfectant materials such as lime or chlorine bleach;

(d) The company name, contact number, company logo, and body number of the septage transportation vehicle are displayed on both sides of the vehicle. The information shall be marked using permanent and legible lettering at least 3 inches high and of reflective material;

(e) List of emergency contact numbers are pasted at the prominent place in all vehicles involved in septage transport;

(f) Most competent trained drivers are employed for transportation of sludge and septage;

(g) Each worker wears a proper uniform with company logo on dress and hold identity cards;

(h) The vehicle involved in transportation is cleaned and washed inside as well as outside every day; the vehicles and equipment shall be serviced, greasing, oiling, minor repairs, etc. are done at least twice a month;

(4) The septage transporter shall retain the documentation relating to all stages of septage management i.e. desludging and transportation for a minimum period of 5 years.

(5) The septage transporter shall retain registration related documentation permanently and shall present such documentation on request by any authorized official/agency.

(6) All the septage transportation vehicles shall be directed to transport septage to the designated treatment sites. Movement of vehicle without a valid licence by the ULB shall attract fine and / or even seizure of vehicle.

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(7) Prior to starting the journey, the driver shall ensure that the vehicle is well equipped with spill control or absorbent materials and also disinfectant materials like lime and chlorine bleach.

(8) The driver of the vehicle shall take the most convenient and congestion free route considering traffic flows and plan the trip to arrive at the treatment site within the specified operating hours.

(9) While transporting septage, the driver and worker shall ensure that there is no discharge or emptying of septage in to locations other than designated treatment sites.

(10) At the disposal site, the truck must be parked in such a way that the septage may be directed to the inlet chamber with one length of hose, wheels need be checked and parking brakes need be placed properly, then the valves be opened and septage allowed to flow by gravity into the collection chamber.

(C) Disposal of Septage (Responsibility- Delhi Jal Board):-

(1) The Delhi Jal Board will identify and notify the Sewage Pumping Stations and Sewage Treatment Plants where the Septage shall be disposed of by the License vendor(s).

(2) The Licensee shall dispose off Septage only at the locations notified by the Delhi Jal Board from time to time.

(3) The Delhi Jal Board will create necessary infrastructure and provide necessary equipments at the notified locations, to facilitate the disposal of Septage brought by the Licensee Vendor.

(4) Any licensee vendors found dumping septage other than the notified locations shall be liable to pay the penalty of Rs. 50000/- or as notified from time-to-time per default. The license shall be cancelled for two defaults.

(5) The worker deployed by the licensee vendors shall be insured for minimum Rs. 10 lacs towards the compensation to be paid in the eventuality of an accident during the process of cleaning, transportation and disposal of septage as per PEMS ACT 2013 and APEX Courts order dated 27/03/2019 in writ petition no. 583 of 2003.

This issues with the prior approval of the Chief Secretary, Delhi.

(KULDEEP PAKAD, IAS)
SPECIAL SECRETARY (UD)

Contd...6/-

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No.F.16(483)/UD/W/2015/Vol.-III/Pt.File/707-718

Dated:- 31/3/2020 **6**

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

1. The Chairperson, NDMC, Palika Kendra, Sandad Marg, New Delhi - 110001.
2. The Chief Executive Officer, Delhi Jal Board, Varunalaya, Jhandewalan, Karol Bagh, New Delhi - 110005.
3. The Vice Chairman, Delhi Development Authority, Vikas Sadan, INA, New Delhi.
4. The Commissioner, South Delhi Municipal Corporation, Dr. S.P. Mukherjee Civic Centre, J.L.N. Marg, Minto Road, New Delhi.
5. The Commissioner, North Delhi Municipal Corporation, Dr. S.P. Mukherjee Civic Centre, J.L.N. Marg, Minto Road, New Delhi.
6. The Commissioner, East Delhi Municipal Corporation, Patparganj Industrial Area, New Delhi.
7. The Pr. Secretary, Public Works Department, 5th Level, "B" Wing, Delhi Secretariat, I.P. Estate, New Delhi - 110002.
8. The Divisional Commissioner, Revenue Department, Govt. of NCT of Delhi, 5-Sham Nath Marg, Delhi - 110054 with the request to forward the copy of SOP to all the District Magistrate's for compliance.
9. The Managing Director, DSIIDC, N-Block, Bombay Life Building, Connaught Circus, New Delhi - 110001.
10. The Chief Executive Officer, Delhi Urban Shelter Improvement Board, Punarwas Bhawan, I.T.O., New Delhi.
11. The Chief Executive Officer, Delhi Cantonment Board, Delhi Cantt., New Delhi.
12. The Chief Engineer, Irrigation & Flood Control Department, L.M. Bund Office Complex, Shastri Nagar, Delhi.

[Signature]
31/03/2020
(KULDEEP PAKAD, IAS)
SPECIAL SECRETARY (UD)

Annexure - C- 6/1**Related to Chapter 6- Repair and maintenance of Drains****Report and Physical verification of drains trapped by Delhi Jal Board which were directly discharging waste water into River Yamuna:**

In compliance to the directions of the Hon'ble NGT in the matter of Manoj Misra Vs UOI, Delhi Jal was asked to submit compliance report of trapping waste water of drains which are directly out falling into River Yamuna and increasing the water pollution. After concerted effort of Yamuna Monitoring committee, Delhi Jal Board took up the work in hand and submitted the report. As per the directions of the YMC, these drains claimed to be trapped by DJB were physically verified jointly by the Independent Technical Member and the team of DTU and submitted the report to YMC. The drains can be classified as under:

1. 11 drains which have been completely trapped by Delhi Jal Board (Magazine Road Drain, Sweeper Colony drain, Khyber Pass Drain, Metcalf House Drain, Moat Drain(Vijay Ghat), Civil Military Drain, Delhi Gate drain, Drain No 14, Tughlaqabad Drain, Kalkaji Drain and Tehkhand Drain)
 2. 6 drains which are either partially trapped or proposed to be trapped (QudsiaBagh, Morigate, Tonga Stand, Sen Nursing Home, Maharani Bagh and Barapula drain).
 3. 6 drains pointed out by CPCB(Sonia Vihar, Shastri Park, Kailashnagar, AbulFazal, Jaitpur and Agra canal :Old and new)
 4. 2 drains pointed out by YMC (Jahangirouri Drain & Model Town drain)
 5. 109 sub drains of Najafgarh, Supplementary and Shahadra drains into Interceptor sewer.
 6. 204 sub drains other than the Interceptor sewer and came up after 2008, and to be trapped into Interceptor sewer or sewerage network.
- 1. 11 drains:** Factually, these are 10 drains as Kalka Ji drain and Tuglakabad drains are same drain which have been listed separately by DJB at S.No. 10 & 11. Inspection of these drains was carried out on 18th, 19th and 20th June 2020 along with the DJB officers. All the drains were found trapped except some minor issues of maintenance and encroachments. The inspection report is enclosed at Annexure-I.

Hence, by the efforts of YMC, above drains carrying around 150 to 160 MLD waste water (As per CPCB measurement of flow) has been trapped into sewerage system thus decreasing pollution in River and more utilization of STPs. Now, nothing more is required for these drains except proper maintenance of these trappings.

2. **Six drains:** Out of these six drains, Delhi Jal Board has proposed 3 Sewage Treatment Plants at the mouth of Qudsia&Morigate, Tonga Stand and Barapulla drains. DJB has been pursuing with DDA for the land for setting up these plants.

MoriGate &QudsiaBagh drain:since, waste water is coming from sewerage area, Delhi Jal Board was advised by the YMC to find the feasibility of diverting waste water into existing sewerage system of walled city area so that waste water in Morigate drain is reduced thus reducing the capacity of proposed STP at the mouth of Mori Gate drain. DJB informed that since, there is combined sewerage system in walled city area; the waste water cannot be diverted. Hence, there is no other alternative but to set up STP at the mouth of Morigate drain after allotment of land by DDA.

YMC may recommend to NGT for allotment of land to Delhi Jal Board for setting up of the plant at the mouth of Mori Gate Drain

Tonga Stand drain: This drain carries waste water from Old Delhi Rly station area, Lothian bridge and adjoining area. This drain has been partially trapped into Nigam Bodh SPS however; local discharge of Yamuna Bazar is still flowing into this drain. Delhi Jal Board has proposed a small STP at the mouth of this drain for which DDA has been asked to allot the land to DJB for setting up the STP.

YMC may recommend to NGT for allotment of land to Delhi Jal Board for setting up of the plant at the mouth of Mori Gate Drain

Sen Nursing Home drain: Presently, Delhi Jal Board is drawing 2.2 MGD waste water from Sen Nursing Home drain for treatment at existing STP and supplying treated effluent to PPCL for thermal power plant, whereas; remaining sewage is overflowing into Yamuna River. As per the advice of YMC, Delhi Jal Board is constructing a weir across the Sen Nursing Home drain so that excess waste water after drawing at 2.2 MGD waste water into existing STP, is diverted to the Ring Road Trunk Sewer. The work is likely to be completed by 31ST July 2020. Since, this drain is passing through NDMC and DJB area, both of them were asked to divert the sewage of Railway colony and

DeenDayalUpadhyaya Marg Institutional area into sewerage system, which has not yet been done by DJB or NDMC.

Barapulla drain: Delhi Jal Board submitted Action Plan of diverting waste water of Barapulla drain before the Hon'ble NGT around 4 years back which was to be accomplished by June 2015. YMC asked the revised time lines for the action plan. It was advised by YMC that by diverting the flow of Barapulla drain into existing sewerage system, it will also reduce the capacity of proposed STP at the mouth of Barapulla drain. After conducting extensive survey along with the Expert Technical Member, YMC, Delhi Jal Board submitted the action plan for diverting sewage of Kushak drain, one of the tributary of Barapulla drain, into existing sewerage system which will reduce **around 28 to 30 MGD flow from Barapulla drain.**

YMC may recommend to NGT for allotment of land to Delhi Jal Board for setting up of the plant at the mouth of Mori Gate Drain

Delhi Jal Board must decide the capacity of proposed STP after considering the discharge proposed to be trapped from Kushak and SunheriBagh Drain into sewerage system.

SunheriBagh drain is also a major tributary of Barapulla drain and carries huge waste water which comes from New Delhi Municipal council and Delhi Jal Board areas. Accordingly, both of them were asked to divert the waste water of SunheriBagh drain into their respective sewerage system. NDMC has already certified that they have diverted entire waste water into their sewer net work which is yet to be verified. After conducting my intensive survey of the SunheriBagh drain and Delhi Jal Board installation from Pragati Vihar upto Okhla STP on 18th, 19th and 20th March 2020, it was found that sewage from CGO complex under the jurisdiction of Delhi Jal Board is still discharged into SunheriBagh drain which can be diverted to the existing Pragati Vihar SPS. But, due to maintenance issue of entire sewerage infrastructure by Delhi Jal Board, the additional water cannot be conveyed to Okhla STP due to silted up gravity main carrying sewage to Okhla STP (detailed report is enclosed at **Annexure-II**) Delhi Jal Board has been asked by YMC to submit the action plan for trapping of waste water from SunheriBagh drain. But, the action plan has not been submitted by Delhi Jal Board so far.

Delhi Jal Board must take up the work of desilting of Gravity ducts immediately as short term measure and rehabilitate these ducts for carrying more discharge as a long term measure. Hence, DJB must submit action plan accordingly before YMC

Maharani Bagh Drain: this drain has been partially trapped into existing C.V.Raman Marg trunk sewer to the extent of 2 MGD whereas; remaining discharge 4.5 MGD is flowing into River Yamuna. DJB has submitted that for balance flow, the work of sewer network has been awarded in Batla House GOC, Phase-II, which will trap the same and pump to Okhla STP. The revised time lines for the same is April 2022 against original time line of Dec 2021 due to stoppage of work during March to May 2020. The work also got delayed due to ShaheenBagh protest and lock down due to Corona.

Delhi Jal Board must squeeze the time lines for completion of this work. Simultaneously, individual may be provided sewer connection by DJB under the relevant schemes free of cost.

6 drains pointed out by CPCB(Sonia Vihar, Shastri Park, Kailashnagar, AbulFazal, Jaitpur and Agra canal :Old and new): Only Shatri Park drain has been trapped into Sewerage network laid in Buland Masjid colony. However, during inspection, it was observed that sewage is still flowing into this drain. DJB Officer explained that sewage from DMRC colony is being discharged into this drain. They have been asked to issue notice to DMRC to either treat the waste water by setting up small STP before releasing discharge into SW Drain or connect their outfall into nearby sewer line.

In **Soniavihar drain**, DJB proposed enzyme treatment as a short term measure. It has been reported that tenders have been invited two time, only one tender is received which is under evaluation and award.

For **AbulFazal drain**, it has been submitted by DJB that there is no sewerage system in the command area of this drain. The work of P/I internal sewer has been awarded and flow will be trapped by April 2022 subject to lifting of ban on construction and labour movement by May 2020.

Jaitpur Drain:DJB has submitted that Unauthorised colonies of Badarpur area and some discharge from Faridabad. The drain is outfalling into river yamuna on the

downstream side of Okhla barrage. At present no sewerage system in Badarpur area. It is proposed to provide sewerage network in Badarpur area along with construction of decentralized STP of 45.46MLD (10MGD) capacity for which the land is under allocation. The sewer network along with STP will be completed in 3* years time after allotment of land for STP.

DJB has informed that since Agra old and new Canals are meant for irrigation, no action is required. However, no action has been taken so far on remaining drains except submitting long term plan for trapping Sonia Vihar, Jaitpur and AbulFazal drain linking with providing sewerage infrastructures in those areas by 2023 as per the plan submitted by DJB. For Kailashnagar drain, DJB is pursuing DUSIB for trapping of drain. Status report as submitted by DJB is enclosed at **Annexure-III**.

Delhi Jal Board must take up the work of trapping of these drains by providing sewerage system in unsewered areas or directly trap the drain into nearest sewerage system as per the action plan submitted by DJB. These works must be monitored regularly.

3. **Two Drains suggested by YMC as a test case:** Jahangirpuri and Model Town drain are passing through sewerage areas. But, sewage is still flowing into these drains due to malfunctioning of sewerage system. DJB was directed to trap these drains into existing nearby SPS and Coronation STP as a test case. But, nothing has been done so far.

Model Town and Jahangirpuri drains carry a huge discharge despite of the fact that these passes through sewerage areas and can be easily trapped into nearby sewage pump house of Dheerpur and coronation STP respectively. DJB must be asked to take up the work accordingly.

4. **109 sub drains to be trapped into Interceptor Sewer:** It has been reported that 98% Interceptor sewer work has been completed and around 168 MGD against total 242 MGD waste water has been trapped. The revised time lines for completion of balance work are December 2020 due to Covid 19.

Delhi Jal Board may certify that the drains already trapped through I/S are not overflowing.

Entire sewage trapped through Interceptor sewer is not going to be treated till their connected STPs(Coronation, Keshopure, Kondli & Rithala) are constructed/

rehabilitated which may take another two to three years. Hence these works require close monitoring.

5. 204 drains to be trapped other than Interceptor Sewer: the current status of these drains is given by DJB as under:

- Drains already trapped : 34
- Drains proposed to be trapped after laying sewerage system : 157
 - By year 2020: 141
 - By year 2021: 13
 - By year 2025: 3
- Trapping not required as flow is no more : 10
- Drains pertaining to other departments : 3

Majority of the drains will be trapped by 2021. Only 3 drains will be trapped by 2025 as per the DJB action plan submitted before the YMC. However, for three drains pertaining to other department must be pursued by DJB.

Annexure-I

REPORT ON

**TRAPPING OF 11 STORM WATER DRAINS BY DELHI JAL BOARD WHICH ARE DIRECTLY
DISCHARGING INTO RIVER YAMUNA**

Under the aegis of

YAMUNA MONITORING COMMITTEE

NATIONAL GREEN TRIBUNAL, DELHI

JOINT INSPECTION OF INDEPENDENT EXPERT MEMBER & DELHI JAL BOARD

JUNE 20, 2020

SCOPE

The scope was limited to do the physical verification of trapping of drains done by Delhi Jal Board, as reported to the Monitoring Committee. The inspection of drains was carried out on 18th to 20th June 2020 along with the following officers:

TEAM ON BEHALF OF MONITORING COMMITTEE

1. Sh. R. S. Tyagi
Former Member, Delhi Jal Board, Delhi

REPRESENTATIVES FROM DELHI JAL BOARD

1. Mr.PraveshTyagi, SE
2. Mr.GajenderTomar, SE
3. Mr.PankajAtrey, SE

LIST OF DRAINS MONITORED

Sr. No.	Name of Drain
1.	Magazine Road Drain
2.	Sweepers colony Drain
3.	Khyber Pass Drain
4.	Metcalf House Drain
5.	Tonga Stand Drain.
6.	Moat drain-Dry.
7.	Civil military drain
8.	Delhi Gate Drain
9.	Dr Sen Nursing Home
10.	Drain No 14
11.	Kalka Ji Drain
12.	Maharani Bagh Drain
13.	Tehkhand/ Kalka Ji drain

Delhi Jal Board submitted Action Taken Report to Monitoring Committee in compliance to the Hon'ble NGT order dated: 11.09.2019 in which they have claimed that 13 storm water drains carrying sewage and out falling directly into River Yamuna have been

trapped. The M.C. directed Expert Member to conduct physical verification of these drains and verify the statement of DJB. Accordingly, inspection was carried out by the Expert Member on 18th, 19th and 20th June 2020 along with DJB officers.

A.The inspection report is as under:

Magazine Road Drain: Since, there is no outfall sewer line; this drain carries the sewage of Aruna Nagar Resettlement colony on Magazine Road. Delhi Jal Board has fixed a Pen stock gate to obstruct the flow of sewage and divert it to Aruna Nagar Sewage Pumping station through 600 peripheral sewer line.

Observations:

- The entire sewage is being diverted to the Interceptor Sewer line terminating into Arunanagar SPS.
- The employee of the O&M Contractor has encroached upon the entire structure of manhole by constructing jhuggi where he is running a shop as shown in picture. The DJB officer has been asked to remove this unauthorized construction within 24 hours so that maintenance and cleaning of the manhole is regularly done. On 20th June 2020 at 2 pm, it was informed that encroachment has been removed.



Fig. 1

DJB Chamber prior to encroachment

Fig.2

DJB Chamber after encroachment

2. Sweepers Colony Drain:

Since, there is no outfall sewer line, this drain carries the sewage of Balmiki Basti, Chandrawal J.J. Cluster and Old Chandrawal village, Delhi Jal Board has fixed a Pen stock gate to obstruct the flow of sewage and divert it to Aruna Nagar Sewage Pumping station through 600 Interceptor sewer line. The entire sewage is being diverted to Sewer line and pumped to Bela Road Trunk sewer which ultimately goes to Okhla STP. The pictures of the drains are exhibited as under. The representative of O&M Contractor was found at site for cleaning of floating material.

Observation:

- Entire sewage is blocked and being diverted to Aruna Nagar SPS.
- Jhuggi/Jhopribasti of Refugees has been growing at fast pace. Even, the access to the chamber on drain has been encroached upon. In future, a huge faecal discharge is going to be discharged directly into this drain on downstream of trapping which will be difficult for DJB to trap and treat.



Fig.3

Gates are slightly leaking



Fig.4

Encroachments

3. Khyber Pass Drain:

This Drain carries the sewage of Khyber Pass JJC and Khyber Pass Balmiki Basti. The drain passes through DJB land lying vacant between Chandrawal Water Works I & II. It is full of silt and vegetation.

Observations: Drain has been completely trapped into Arunanagar SPS. But due to blockage and poor maintenance of trapping chamber, the sewage was over flowing from the upstream side of pen stock gate, which was later cleaned by the contractor after passing instructions.

The access to the chamber has been blocked by heavy shrubs grown over there:



Fig.5

Trapping



Fig.6

Overflow of waste water

4. Metcalf House Drain: This drain carries the sewage of part of Civil Lines area i.e. Shamnath Marg, Rajniwas Marg, Rajpur & Under Hill Road etc. The drain has been completely trapped by putting Pen stock gate across the drain and sewage is being pumped into Bela Road Trunk Sewer across the Road near Trauma Center.



Observations: Drain has been completely trapped.

Fig. 7

5. **Tonga Stand Drain:** This drain is coming from Old Delhi Railway Station and Lothian Bridge. The drain is partially trapped near Hanuman Temple, Yamuna Bajar. Flow of these drains has been partially diverted into sewerage system into Bela Road Sewer terminating into Nigam Bodh Ghat Sewage Pumping Station. Delhi Jal Board informed that land for setting up of small STP at the mouth of the drain has not yet allotted by DDA.



Observation:

- Sewage generated from Yamuna Bajar colony on the North of Ring Road itself is flowing into river Yamuna as shown in following photograph. **Fig.8**

6. **Moat Drain:** This drain carries very small discharge. There is Penstock gate is installed by Irrigation & Flood Control department at the outfall point.

Observation: Trapping of waste water is completely done

7. **Civil Military Drain:** The waste water comes from walled city area of Kotwali. The drain has been completely trapped near Ring Road.



Fig.9**Fig.10****8. Delhi Gate Drain:**

This drain emanates from walled City area. Since, there is combined sewerage system in entire walled city area, sewage flows into Storm Water drains. Total discharge in this drain is reported to be 16-18 MGD



which is treated at two Sewage Treatment Plants constructed at **Fig.11**

the mouth of drain (2.2 mgd old STP + 15 mgd new STP).

Observations:

- The entire sewage has been blocked on the U/S of the Pen stock Gate installed by Irrigation & Flood Control department, besides one check dam by Delhi Jal Board.
- Treated effluent of quality BOD<5 and SS<7 ppm is partially used by Power plant and remaining is being discharged in to River Yamuna.
- A small quantity of treated water is being supplied through water tankers to PWD.

9. Dr Sen Nursing Home Drain:

This drain Carries discharge of NDMC area, DeenDayalUpadhyay Marg and Railway colony. The drain is partially trapped into Ring Road Trunk Sewer which terminates into Maharani Bagh SPS and partially trapped into Dr Sen Nursing Home STP of 2.2 mgd capacity. Remainingsewage discharges flows into River Yamuna.

Observations:

- The maintenance of this drain being carried out by SDMC is very poor. A lot of solid waste material i.e. floating material is accumulated near the sluice gate as shown in the following photographs in **Fig.12**.
- Delhi Jal Board is constructing Weir across the drain to regulate the flow of waste water into the STP and Sewer line. Due to Covid 19, the work was stopped and now revived

after opening lockdown. DJB officer informed that the work will be completed within one month (**Fig.13**).

- Waste Water Pumping Station set up by South DMC is still pumping waste water of drain coming from AjadBhawan, I.P. Estate into Sen Nursing Home. However, it was learnt that MCD officers are checking feasibility of pumping waste water in Dr Sen Nursing home drain on upstream side of Ring Road.
- The waste water from Power Station is still being discharged into this drain.



Before Trapping



Weir is being constructed

Fig.12Fig.13

10. Drain No. 14:

This drain carries very small discharge, predominantly the ground water being pumped from the PragatiMaidan for construction. Entire flow has been trapped into nearby Ring Road Trunk Sewer line as shown in the following photograph:



Fig. 14

10 & 11. Kalka Ji Drain and Tuglakabad drain are same which has been trapped by DJB into Kalka Ji SPS.

Observation: The drain has been completely trapped.

12. Tehkhand Drain:

DJB has constructed permanent check-dam and also awarded the O&M



work to maintain the trapping point.

Observation:

- The drain has been trapped near Sarita Vihar SPS at Faridabad Road. **Fig. 15. Around 5-6 MGD waste water has been trapped.**
- Since, the work of construction of weir is under finishing stage, a bye pass pipe line has been laid by Delhi Jal Board for discharging waste water on downstream of weir. Delhi Jal Board has been asked to remove Bye pass pipe line permanently which may be misused at later stage to buy pas waste water.

But discharge from the unsewered areas on the downstream of this drain is discharged into this drain and outfalls into River. DJB has been advised to set up small Constructed Wetland System STP at the outfall point of this drain.

13. **Maharani Bagh Drain:** The drain has been partially trapped to the extent of taking 2 MGD sewage, into Peripheral sewer line named as C.V. Raman Marg Peripheral sewer line. Balance discharge of the drain around 4.5 MGD will be trapped after completion and commissioning of sewerage system being laid in the unsewered areas in its command by April 2022 as per the revised time lines submitted by DJB before YMC.

Er. R. S. Tyagi

Former Member (WS/Dr), DJB

Annexure-II

Subject: Inspection of SunheriBagh Drain and Connected DJB Sewerage Installations on 18th, 19th and 20th March 2020.

On the direction of YMC, SunheriBagh drain and the connected installations and sewerage network of Delhi Jal Board was inspected by me on above dates along with the concerned officers of Delhi Jal Board. The following observations were made:

1. Entire CGO complex is a planned area having proper sewerage network, but during construction of Delhi Metro line and Metro station in CGO Complex, the existing sewerage network and storm water drainage system was disrupted by DMRC. After persuasion by the respective departments, they restored the system, but not under the proper supervision of the respective authorities. The sewer lines are connected with storm water system and sewage of entire CGO complex is now flowing into SunheriBagh drain. Some waste water is also pumped from NDMC area through temporary pump constructed within the premise of DTC bus depot at CGO complex. NDMC has to get verified that the sewage from their area is properly connected with DJB trunk sewer line.
2. The sewage of the above areas must be diverted to Pargati Vihar SPS already functioning at CGO complex and can take additional discharge. The peak discharge capacity of this SPS is 40 MGD, whereas; it is running at 17-18 MGD at present.
3. The sewage from the catchment of Okhla STP is pumped through the following Sewage Pumping Stations into a Gravity Duct (three parallel ducts of capacity 45, 55 & 70=170 mgd) starting from Srinivaspurichowk to Okhla STP. The sewage in these ducts flows through gravity and lifted at Okhla STPs. The sewage pumping stations at Maharani Bagh (Peak discharge capacity: 80 MGD), Jal Vihar (PD Capacity: 60 MGD) and Pragati Vihar (PD Capacity: 40 MGD) pump sewage into these gravity mains. But when these pumps are operated at their peak discharge there is overflow in the gravity duct as these are heavily silted up thus reducing the carrying capacities. It is therefore necessary that these ducts are desilted immediately and rehabilitated for carrying more discharge.

4. The Okhla STP has the capacity to treat 140 MGD sewage. But, it is being operated at 110 MGD means it is underutilized. The fact is that it can take 30 MGD additional sewage from its catchment, but due to inadequate carrying capacity of Gravity Ducts, sewage is flowing into drains instead of going to Okhla STP.
5. DJB has submitted action plan to divert 28-30 MGD sewage of Kushak drain into existing sewerage system latest by December 2022. But due to above mentioned deficiencies of the sewerage system of Okhla STP catchment, the action plan submitted by DJB is going to fail.
6. DJB is upgrading and augmenting the capacity of existing Okhla STP from existing 140 MGD to 170 MGD by constructing new 124 MGD capacity STP under YAP-III. But, this plant is already running at 110 MGD. It is therefore necessary for DJB to increase the carrying capacity of all conveyance mains under its command area which can be able to convey 170 MGD sewage at Okhla STP.

Er. R. S. Tyagi

Former Member (WS/Dr), DJB

Annexure-III

B. 7 Drains pointed out by CPCB & Action Plan submitted by Delhi Jal Board:

Name of Drain	Action Plan of DJB
Sonia Vihar Drain	Short Term Measures : A process through Bio-enzymes has been considered. DJB has informed that tenders for enzyme treatment have been invited twice, but only one tender is received which is under evaluation and award. Long Term and Long Term: The work for construction of STP at Sonia Vihar, WWPS at Rajeev Nagar alongwith laying of sewer line in the command of Rajeev Nagar SPS will be taken up under Ph-I for which tender are being invited shortly. Work is likely to be completed by December, 2022.
Kailash Nagar Drain	The discharge in drain is coming mainly from JJ Cluster. Matter is being taken up with DUSIB & EDMC. They have been advised regarding setting up of decentralized STP or extending the rising main up to DJB Geeta Colony SPS.
Shastri Park Drain	- Waste water has been trapped into sewerage system laid in Buland Masjid colony - As per recent directions, proposal has been framed for installation of sewer connections in this colony under “Mukhya Mantri Muft Sewer Connection Sanction Yojna” and it is targeted to install all sewer connections. Sewage is still flowing into this drain. DJB informed that DMRC is discharging sewage of DMRC Campus into this drain. DJB has been asked to issue notice to DMRC to either treat the sewage or connect it

	with nearest DJB sewer line.
AbulFazal Drain	There is no sewerage system on SPS near the drain to trap the waste water. However, the work of providing internal sewer lines in Batla house phase-II has been awarded. The sewerage of the area which is at present going to this drain will be diverted to the sewerage system by proposed 8 MGD SPS at Batla House and will be treated at Okhla STP. The sewerage system will be laid by Dec, 2021.
Jaitpur Drain	In Badarpur area, at present no sewerage system exists. It is proposed to provide sewerage network in Badarpur area along with construction of decentralized STP of 10 MGD capacity for which the land is under allocation. The sewer network along with STP will be completed in 3 years time after allotment of land for STP.
Agra Canal near Okhla	These are irrigation canals which emanate from Okhla Barrage and terminate into UP for irrigating the agriculture fields. Hence, there is low action needs to be taken on these canals. However, if the quality of river water is improved in Delhi stretch, the quality of Agra Canal will also improve.
Old Agra canal near Okhla	

Er. R. S. Tyagi

Former Member (WS/Dr), DJB

nexure-III

**OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI – 110003**

No. YPMC /2020/437

Date: 9/3/20

Subject: Minutes of the meeting on sewage, plastic and other solid waste inside Kushak drain held with representatives of Delhi Jal Board, South DMC, NDMC and the RWAs of Greater Kailash-1, Defence Colony & Nizamuddin West - on 5.3.2020.

The Yamuna Monitoring Committee (YMC) held the above meeting to review the status of the action taken on the following issues:

- i) Release of toxic gases from the Kushak drain adjacent to some House of B-Block (North), Greater Kailash-1.
- ii) Covering of Kushak Drain in Defence Colony – Application filed by Sh. Rajeev Suri.
- iii) Pollution from some houses/Jhuggis/unauthorized buildings at Nizamuddin West discharging into Barahpullah drain.

The Yamuna Monitoring Committee has been monitoring and pursuing the matters raised in these applications over the last more than 12 months and in particular with reference to the following matters.

Prayer of RWA Greater Kailash 1 before Hon'ble High Court, WP(C)4246/2019.

- a. Pass a writ in the nature of mandamus or any other appropriate writ directing the respondents to take all necessary steps, including necessary permissions if any, to cover the remaining about 1/4th of 10.31% of the storm water drain from adjacent to the residences of the petitioners and to cover & develop the same with greenery as done in other parts of Greater Kailash-I and Defence Colony;
- b. Pass a writ in the nature of mandamus or any other appropriate writ directing the respondents to ensure that the storm water drain is sewage and sullage free and no untreated sewage/sullage/any other waste is allowed into the same;
- c. In the alternative pass a writ in the nature of mandamus or any other appropriate writ directing the respondents directing the respondents to dismantle the entire cover/uncover the Storm water Nallah and thereafter conduct timely and periodic cleaning of the same and continue to use the same as a 'Storm water drain' and not as a sewage drain.

- d. Pass such other further order as this Hon'ble Court may deem fit and proper in the facts and circumstances of the present case.

Operative part of the orders of the Hon'ble High Court

Noting the above submissions made by the council for the parties, I direct the Committee constituted by the NGT to look into the representation of the petitioners dated February 19, 2019 and pass appropriate orders as expeditiously as possible, preferably within a period of two months from today.

Prayer of RWA Defence Colony before Hon'ble Supreme Court, Civil Appeal No. 10917 of 2018.

- a. Admit, allow the instant civil appeal and set aside final order dated 26.07.2018 passed by the Hon'ble National Green Tribunal, New Delhi in O.A. No. 164 of 2015.
- b. Pass such further order(s) as this Hon'ble Court may deem fit and proper in the facts and circumstances of the present case.

Operative part of the orders of the Hon'ble Supreme Court

We are of the opinion that the mandate given to the Monitoring Committee would include the problem which is highlighted by the applicant in his O.A. as well in any case, it is made clear that the Monitoring Committee shall look into those aspects.

Prayer of Nizamuddin West before Hon'ble Supreme Court, Vide diary no. 8231 of 2019.

- a. For an order directing the respondents to remove all the debris, sewage, industrial and trade effluent and other municipal solid waste and to restore the ecology of the area along with the drain in the Nizamuddin west area.
- b. For an order directing the respondents to ensure that no fresh debris and other municipal solid waste is thrown into the Drain.
- c. For an order directing the authorities to ensure that both the banks of the drain be planted with trees and other greenery and plantations.
- d. For any other order or directions with the Hon'ble Tribunal deems fit in the facts and circumstances of the present petition.

Operative part of the orders of the Hon'ble Supreme Court

We accordingly, permit the applicant to move the Committee and request the Committee to enquire into the grievances in terms of the directions which were issued by the NGT as expeditiously as possible.

Review of Previous Developments.

The matters have been dealt with by YMC by conducting physical inspections in the presence of the drain owning agencies, namely, south DMC and DJB as responsible for management of sewage and the petitioners before the court along with other members of the RWAs. YMC has held 3 meetings each with RWAs, of GK-I & Nizamuddin West & 5 meetings with the RWA Defence Colony to review what is being done by DJB to target the sewage and grey water and the South DMC to remove the debris and filth in the drain. The last inspection was done in September 2019 and the main decisions taken then are as follows:

- The MC had given clear directions to South DMC to prevent entry of solid waste into the drain through preventive measures and enforcement. The DJB already has a plan which is expected to fructify in the next six months to prevent sewage from going into the drain. Once the effect of this is seen the question of whether to cover or not cover the drain can be addressed.
- MC had recorded that since DDA has no role in the matter any longer, it should expedite handing over the drain to South DMC on an "As is where is" basis after paying deficiency charges, as may be agreed between the Commissioner South DMC and the VC DDA, within one month. The YMC observed that the continuance of "no man's land" syndrome between the civic authorities was unfair to the residents who have been battling this before courts for long years. On the question of dismantling the half/un built portion of the drain it was observed that it was leading to the accumulation of debris and garbage. However, a call on engineering solutions had to be taken by the owner of the drain (South DMC).
- It was informed by RWA that during construction of Barahpullah corridor, a lot of earth and malba was left along the drain which was dumped for construction of temporary road for moving heavy machines. This excess Malba dumped on the drain was

directed to be got removed by the South DMC as it was impeding the natural flow of the drain.

- It was observed that the residents of Nizamuddin Basti were throwing solid waste into the drain. MC requested RWA to motivate residents of Nizamuddin Basti not to throw waste into drains. The RWAs should identify volunteers and assist South DMC in their cleaning efforts. RWA representatives were asked to meet DC, South DMC and work out modalities of citizens involvement in keeping the drain clean and prevent waste being deposited in the drain by casual visitors. South DMC should also tighten enforcement.
- D.C. South DMC informed that the work of fixing grill along the bridge has been awarded and will be taken up shortly. In so far as prevention of solid waste dumping is concerned, J.E. store has been recently set up near Nizamuddin Basti across the bridge. Strict vigilance is now being kept on solid waste dumping.

Despite all these observations having been minuted and directions issued the action taken was apparently unsatisfactory and the residents of the three colonies continued to complain about noxious gases and bad odour emanating from the open portions of the drains presenting health hazards. YMC decided to hold a meeting at site on 27.2.2020. The areas covered were Greater Kailash-1, Defence Colony stretch of Kushak drain and Nizamuddin West at Barahpullah Nalla.

Field Visit Observations:

The following situations which were observed at site were glaring:

1. At Greater Kailash, Andrews Ganj and Nizamuddin portion of the drain the fumes were intolerable.
2. The amount of debris and solid waste/garbage which had accumulated in the concrete boxes which had been constructed to channelize the flow was, if anything, worse than before and the drain had become uncontrollably filthy. The YMC went to the site where the JCB machines had been deployed because of the visit and it was shocking to find the underground situation of the drains in the heart of some of the most organized colonies of Delhi.

The YMC felt that various short term measures like erecting screens, providing CCTV cameras, and desilting would only serve a limited purpose and as long as there was a constant flow of grey and black water the garbage thrown by the people would have every opportunity to accumulate and stagnate.

DJB has been giving assurances over the last few months about trapping and diverting the sewage/ sullage but the ground situation had not improved. Before the meeting YMC had conducted an internal review and asked for proper mapping of the drain, its tributaries and the sewer lines to be done showing the points where the DJB proposed to trap the sewage/sullage which was being discharged both from the unauthorized colonies as well as the sewer areas in which the sewerage/ conveyance systems were not functioning.

The YMC called the meeting with main representatives of the RWAs who are petitioners before the various courts to listen to DJB's presentation. In a nut shell it would appear that if all the efforts being made fructify as claimed by DJB, the expectation is that by June end 2020 maximum number of points of discharge would be diverted or plugged.

DJB's Plans and Current Status of Works for Sewage Containment

The sewage carrying pipes requiring rehabilitation would also be renovated and some work on this had been completed. The presentation made by Chief Engineer DJB Shri Vikram Singh is at **Annexure A** along with the mapping and legends. The target dates of completion of the various works under action plan are given below :

ACTION PLAN OF DJB GIVEN ON 5.3.20 TO YMC

S.No.	Activity	By Date	Quantity of sewage trapped (MGD)
A1	Trapping of unauthorized colonies at Ratia Marg (16 Colonies)	Already achieved 30.6.2019	2
A2	Trapping of unauthorized colonies at Managal Bazar Road.	Already achieved 30.6.2019	1
A3	Trapping of unauthorized colonies (20) of at Tigri Road, Devli and Dr.Ambedkar Nagar	May-20	1.25
A4	Trapping of 25 unauthorized colonies (25) IGNOU Road is to be trapped.	Jun-20	2

A5	Trapping of unauthorized colonies (11) at Deoli Road.	Dec-20	1.25
B1	Rehabilitation of Peripheral trunk sewer at press enclave Road.	Jun-20	4
B2	Rehabilitation of Peripheral trunk sewer at Chirag Delhi Flyover	Jun-20	1
B3	Damage 600 dia. Sewer line at Chirag Delhi Drain.	Jun-20	1
B4	Trapping of drain at Chirag Enclave. SPS.	Jun-20	0.5
C1	Trapping of Nallah at Krishi Vihar (450 mm dia for trapping)	May-20	1.5
C2	Trapping of Nallah at Andrews Ganj (900 mm dia for trapping)	May-20	6.42
C3	Trapping of Nallah at Pant Nagar (900 mm dia for trapping)	May-20	6.42

The YMC was assured that work had been awarded and is in physical progress. Only the work yet to be awarded pertained to B-3 Chirag Delhi which was also under award. In addition, there is one place, namely, Deoli area and where the work would continue till end December 2020. However, it was noted that if the work on downstream trapping is completed by June 2020 one can reasonably expect that all sewage which is emanating from the unauthorized colonies upstream at Sangam Vihar and Chirag Delhi would be stopped which should substantially reduce the problem of sewage flow and consequently the fumes. Grey water would continue to be discharged at places but sewage in the drains will reduce considerably. The RWAs and their representatives/ petitioners in the court cases were shown the exact plans of DJB which are under execution. They requested to be associated so that there is a feeling of satisfaction that the work is actually in progress and the DJB has no objection to collaborating with them.

The members of the RWA appreciated the efforts made by DJB . YMC also feels that it is for the first time that such a satisfactory response had been received .However the actual success would depend on how the situation develops by June and would constantly be kept under review by the RWA who will report to the YMC if they feel that efforts are not being undertaken as promised.

For some of the works to be executed by DJB permission from South DMC may be required and it was assured by the Chief Engineer Sh. M.M Dahiya that there would be no delay in grant of permission and it would be done collaboratory and not through letter writing.

Barapulla Drain Issues :

The only point which stands out and continues to be a matter of serious concern is the enormous amount of water that was flowing upto and into Barapulla Drain from Sunheri Bagh, and branch of Kushak drains coming from AIIMS/INA market side. The discharge of that water is a matter of highest concern because it is ultimately flowing into River Yamuna. The inspection with the former Member Drainage, DJB Sh. R.S Tyagi and the DJB engineers had been undertaken during the last several months but there is no finality about the trapping of sewage water and it continued to be a jurisdictional issue which was not being resolved.

The former Member Drainage, DJB Sh. R.S Tyagi was asked to convene a meeting on the small bridge outside Nizamuddin West Basti, to see that inspection teams identify the points of discharge and give a report of the short term and long term measures which are going to be put in place because all the upstream work will be negated if the flow of dirty water from the storm water drains continues and pollutes the Barapulla drain. The outcome of the inspection and its solution may be reported upon in the next 15 days.

Need to Keep GK Drain Clean because of fumes/ garbage and filth

YMC had found particularly in Greater Kailash that the open drain had allowed accumulation of vast quantities of silt, garbage, plastics and all kinds of filth. This was being removed on the date of inspection of YMC on 27.2.2020 and according to Sh. Anil Tyagi, SE, South DMC about 300 MT silt have been removed. It is a matter of concern that this had been pointed out during the September 2019 visit of YMC. After giving assurances obviously nothing was done. The design of the concrete boxes was extremely faulty and the heavy accumulation of filth was in no small measure the result of faulty design. If sewage / garbage and silt collect and stagnate at different points it will continue to be a health hazard as in due course it will be infested with mosquitoes causing dengue and other vector borne diseases. It is absolutely necessary that filth/silt removal is undertaken in a continuous manner in the open truncated portions of the drains until the outcomes promised by DJB are affected.

Sh. Anil Tyagi S.E, South DMC informed the YMC that tenders had already been notified for erection of screens (which had already been committed in September 19 and was not attended to despite assurances). This time the tenders would be opened within the next 10 days and it is expected that the screens and the grills would be mounted within 3 months. The screens would serve the purpose of barricading the inflow of garbage and other debris into the drain.

YMC directed that plans for executing the barricades/ screens should be shared with the concerned RWAs because it is only if they are satisfied with the work that the strategy would prove to be effective. Accordingly from this month itself, every 15 days the residents may request Sh. Anil Tyagi from South DMC in respect of the problems they face because they were suffering due to the fumes being generated at different points wherever there are openings in the drain.

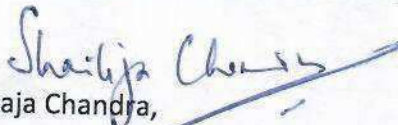
Unfinished Portion of Kushak Drain at Defence Colony

The question of finding an engineering solution to the problem of Kushak Drain both at Greater Kailash where it is covered in a truncated fashion and Defence colony where the drain has been covered almost completely but left unfinished with pillars and steel bars jutting out which was unsightly and gave cause for accumulation of garbage which could not be accessed. The YMC had asked the CE South DMC in charge of the Defence Colony portion Sh. M.M Dahiya to see that the drain is first taken over which action has been completed. DDA had to pay deficiency charges to South DMC after the design features, gradient and safety aspects as well as the benefits and risks of keeping/ removing the pillars were commented upon professionally. Sh. Dahiya Chief Engineer said he had met the IIT professors and requested them for advice and a report would be forthcoming. It was decided that YMC would try to bring this matter to a head and meet the IIT professors in the forthcoming ten days after Holi or if convenient to them YMC can also meet them in their office. The purpose of the meeting would only be to try and expedite getting a report on the engineering solution keeping in mind all considerations. The Chief Engineer Sh. Dahiya undertook to organize such a meeting for the entire area which consists of Kushak drain from Greater Kailash through Andrews Ganj/Defence Colony.

Conclusion:

The problems of the drain needed to be addressed systematically.

- (i) In respect of sewage and grey water the DJB had been pursued and now there was some hope of trapping the sewage which had to be completed on priority.
- (ii) Removal of silt/ garbage and accumulated debris had to be handled through screening/ vigilance/ removal using JCBs and deterring the public . This was being addressed and RWAs would have to work in tandem to see that South DMC does what has been committed.
- (iii) The faulty design issues have to be addressed and YMC would help expedite obtaining professional advice.
- (iv) Nizamuddin West RWA raised the issue of pollution caused by clusters of jhuggies along the drain. YMC decided to hold a meeting on this with DUSIB for containment of sewage going into the drain from these jhuggis.

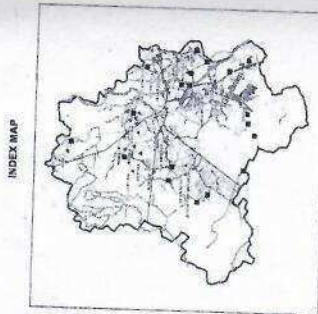

Shailaja Chandra,
Member,
Monitoring Committee for Yamuna
To:


B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

1. VC,DDA
2. CEO, DJB.
3. Commissioner, South DMC.
4. Chairperson, NDMC.
5. Chairman/MS,DPCC.
6. RWA GK-1/Defence Colony/Nizamuddin West.
7. Sh. R. S Tyagi, Expert Member

Address: Room No. 58, India International Centre
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Barapullah Catchment including Kushak Drain & Chirag Dilli Drain



Legend

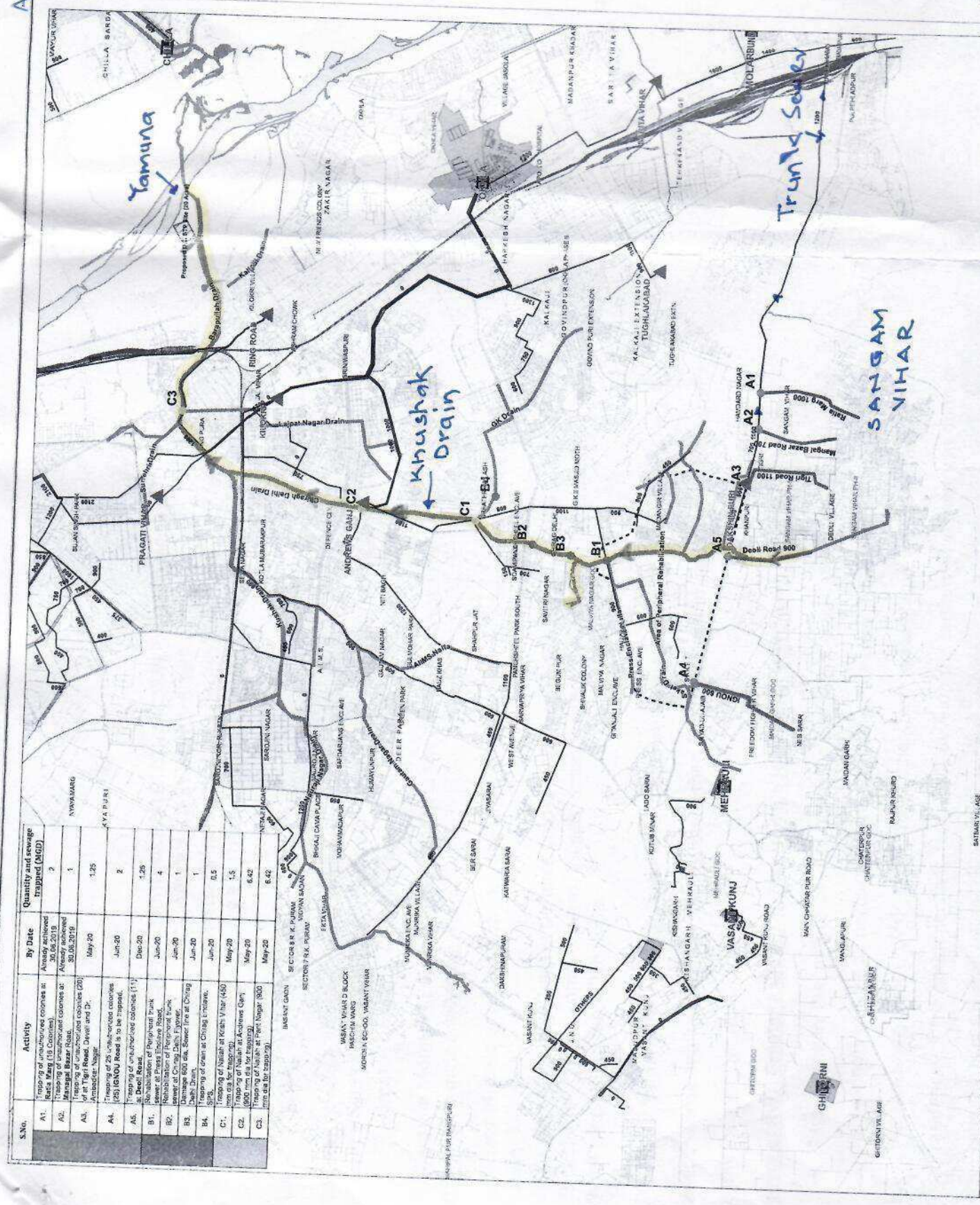
- S.T.P
- SPS
- NG TRAPPING of NALLA
- TRUNKSEWER
- DRAIN
- ROAD CENTER LINE
- RAILWAY LINE
- PROPOSED S.T.P. SITE
- REHABILITATION
- NDMC BOUNDARY
- S.T.P. POLYGON
- SOC
- YAMUNA RIVER

1:25,000

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S.No.	Activity	By Date	Quantity and sewage trapped (MGD)
A1.	Trapping of unauthorized colonies at Barapullah (180 colonies) at 30.06.2018	30.06.2018	2
A2.	Trapping of unauthorized colonies at Mangal Bazar Road.	30.06.2018	1
A3.	Trapping of unauthorized colonies (20) at Tigr Road, Dilli and D.	May-20	1.25
A4.	Trapping of 25 unauthorized colonies (25) (SNOU Road) to be trapped.	Jun-20	2
A5.	Trapping of unauthorized colonies (15) at Tigr Road.	Jun-20	1.25
B1.	Rehabilitation of Ring Road sewer at Press Enclave Road.	Jun-20	4
B2.	Rehabilitation of Ring Road sewer at Chirag Dilli Enclave.	Jun-20	1
B3.	Rehabilitation of Ring Road sewer at Chirag Dilli Enclave.	Jun-20	1
B4.	Trapping of drain at Chirag Enclave.	Jun-20	0.5
C1.	Trapping of Nallah at Kirti Vihar (40)	May-20	1.5
C2.	Trapping of Nallah at Anand Enclave (800)	May-20	6.42
C3.	Trapping of Nallah at Tigr Nagar (800)	May-20	6.42

Related to Chapter 6- Repair and maintenance of Drains**Status of 7 additional drains provided by Monitoring Committee on the report of CPCB**

Sl. No.	Name of Drain	Flow	Source of Discharge	Concerned CE	Action Plan of DJB
1	Sonia Vihar Drain	About 2 MGD	At present there is no sewerage system in Sonia Vihar Group Of Colonies, under the command of Sonia Vihar Drain resulting which discharge from the area is going into the Sonia Vihar Drain. As per the SMP-2031, a scheme of providing sewerage system in Sonia Vihar Group of colonies has been prepared. The present status of the scheme is as under: Sonia Vihar GOC is unsewered area having a population of above 2.34 Lakhs which is proposed with 1 no. STP (7 MGD), 01 nos. WWPS i.e. Rajeev Nagar WWPS (12 MGD) and Sonia Vihar WWPS (4.3 MGD) and 1 no. of lift pumping station (1.5 MGD) near Bedi Gas Agency.	CE(SDW)SE CE(DR)Proj-III	Short Term Measures : The possibility of installation of floating/static aerator at Pond of Sonia Vihar was explored for reduction of pollution load at River Yamuna as per direction of Yamuna Pollution Monitoring Committee appointed by Hon'ble NGT. It has been found that the cost involvement for floating aerators is around Rs.15 Crore excluding the running cost i.e. Electricity charges. In this connection it is to submit that a proposal has also been initiated by the Project Wing for construction of new WWTP including SPSs at Sonia Vihar as a combined scheme of the area. This is expected to be commissioned within 3 to 4 years. After commissioning of WWTP at Sonia Vihar, the floating/static aerators will be scraped which shall not be reusable at new WWTP. Therefore a process through the use of Bio-enzymes has been considered involving much lower cost implication for short term action plan. The tenders for this work are being invited and bids will be received by 31.12.2019. The work will start by 15.01.2020.

					Medium Term and Long Term: The complete scheme of Sonia Vihar GOC comprising of construction of 7 MGD STP at Sonia Vihar, waste water pumping station at Rajiv Nagar, Sonia Vihar, Lift Pumping Station at Bediabad alongwith laying of internal sewerage system has been finalised and approved by the Board on 22.11.2019. As a Medium Term Measures, work for construction of STP at Sonia Vihar, WWPS at Rajeev Nagar alongwith laying of sewer line in the command of Rajeev Nagar SPS will be taken up under Ph-I for which tender are being invited shortly. Work is likely to be completed by December, 2022. As a Long Term Measure, work of construction of WWPS at Sonia Vihar, construction of Bediabad WWPS alongwith laying of internal sewerage system in its command shall be taken up in Ph-II, after allotment of land for construction of WWPS by Police Authority. Completion period will be 30 Months from the date of allotment of land for SPS at Sonia Vihar.
2	Kailash Nagar Drain	About 2 MGD	Discharge is coming this drain through rising main from EDMC's Strom water Pump House near Mahavir Swami Park, Kailash Nagar During dry weather this pum house collects water from Chander Puri JJ Cluster which is un-sewered and is maintained by DUSIB	CE (Dr.) Project-II	The discharge in drain is coming mainly from JJ Cluster. Matter is being taken up with DUSIB & EDMC. They have been advised regarding setting up of decentralized STP or extending the rising main upto DJB Geeta Colony SPS.
3	Shastri	Being	In this drain waste water is	CE(East)	Sewerage system of Buland Masjid U/A Colony has been made

	Park Drain	accessed	coming mainly from Buland Mansjid unauthorized colony and nearby habitations.		functional on 12.10.19. Various camps have been organized in at site for sanction of sewers connections in this colony. As per recent directions, proposal has been framed for installation of sewer connections in this colony under “Mukhya Mantri Muft Sewer Connection Sanction Yojna” and it is targeted to install all sewer connections by 31.03.2020.
4	Abul Fazal Drain	Being assessed	Unauthorised colonies in Batla House Phase-II area.	CE(Dr) Pr-I	There is no sewerage system on SPS near the drain to trap the waste water. However, the work of providing internal sewer lines in Batla house phase-II has been award. The sewerage of the area which is at present going to this drain will be diverted to the sewerage system by proposed 8 MGD SPS at Batla House and will be treated at Okhla STP. The sewerage system will be laid by Dec, 2021.
5	Jaitpur Drain	Being assessed	Unauthorised colonies of Badarpur area and some discharge is also coming from Faridabad. The drain is outfalling into river Yamuna on the downstream side of Okhla barrage.	CE(Dr) Pr-I	In Badarpur area, at present no sewerage system exists. It is proposed to provide sewerage network in Badarpur area along with construction of decentralized STP of 10 MGD capacity for which the land is under allocation. The sewer network along with STP will be completed in 3 years time after allotment of land for STP.
6	Agra Canal near Okhla	These are irrigation canals which emanates from Okhla Barrage and terminates into UP for irrigating the agriculture fields. Hence, there is low action needs to be taken on these canals. However, if the quality of river water is improved in Delhi stretch, the quality of Agra Canal will also improve.			
7	Old Agra canal near Okhla				

Draft Final Report**Characterization of Sludge Deposited on the Yamuna River Bed in the Stretch of Delhi during Pre & Post Monsoon Season 2019**

(Study conducted on the request of Yamuna Pollution Monitoring Committee appointed by Hon'ble NGT)



**CSIR-National Environmental Engineering Research Institute (NEERI),
Delhi Zonal Centre, Naraina, New Delhi - 110 028**

May 21, 2020

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Acknowledgement:

CSIR-NEERI Team is thankful to the concerned officials and staff members of I&FC Department, who assisted in field sampling during pre & post monsoon seasons.

Characterization of Sludge Deposited on the Yamuna River Bed in the Stretch of Delhi during Pre & Post Monsoon Season 2019

(Study conducted on the request of Instructions of Yamuna Pollution Monitoring Committee appointed by Hon'ble NGT)

1.0 Preamble

CSIR-National Environmental Engineering Research Institute (CSIR-NEERI) is of the opinion that the Delhi stretch of the River Yamuna is highly impacted due to high sediments deposit taking place due to storm water run-off and un-treated water coming from urban and industrial areas. CSIR-NEERI prepared a draft project proposal highlighting the sediments/sludge deposit in the Delhi stretch of River Yamuna and recommended dredging of the river bed. This proposal was submitted to the Hon'ble Yamuna Pollution Monitoring Committee (YPMC). This project proposal was discussed in the meeting held on 06.12.2018 at the Office of YPMC at Max Mueller Marg. In this meeting, the representatives of CSIR-NEERI, National Mission for Clean Ganga (NMCG), Central Pollution Control Board (CPCB) and Irrigation and Flood Control (I&FC) department were present.

The agenda 4 of this meeting was related to the "Controlled Dredging of River Yamuna". The representatives of NMCG were of the view that there is no scientific basis to support the view that there is legacy sludge accumulated in the river bed. They were of the opinion that if such an accumulation were to happen year after year then the river bed level would have undergone a change bringing more and more areas within the impact of flooding in and around Delhi. I&FC department was also of the view that there is no perceptible change in the flood level during the past few years and therefore they are unable to say whether the river bed level of Yamuna has been increasing over the years due to deposition of sludge.

The Ministry of water resources while explaining the question of legacy sludge pointed out that whatever sludge gets deposited during the lean season when the volume of water and the velocity of the river are low, gets washed away during the monsoon floods when the river velocity is high and a lot of turbulence and churning takes place due to floods. Therefore, all the sludge that gets deposited during the lean season is transported downstream during the monsoon.

After discussions, however, it was agreed that I&FC department in collaboration with CSIR-NEERI will do a sample test check at 03 to 04 locations along the length of the river within Delhi to assess whether there is legacy sludge getting deposited year after year in the river bed and if so the extent thereof. Once findings from the sample test are

available, a decision on controlled dredging as ordered by the NGT in its judgement dated 13.01.2015 will be taken up.

Accordingly, NEERI along with I&FC Department collected sludge/ sediment samples from different locations in the Yamuna River Bed during pre-monsoon (June 2019) and post monsoon (October 2019). Water samples were also collected from the middle of the river stream. The samples were analysed for various metal contents and some other key parameters at the laboratory of NEERI Zonal Centre, New Delhi. The details of sample collection and results of analysis are presented in this report.

2.0 Sampling Details

A total of 8 important locations were identified for collection of Sediments/ sludge and water samples from the River Yamuna. The sampling locations are shown in **Fig. 1** and details of these locations are given in **Table 1**. Sampling was carried out during June 12-14, 2019 (representing pre-monsoon) and October 17-18, 2019 (representing post-monsoon).

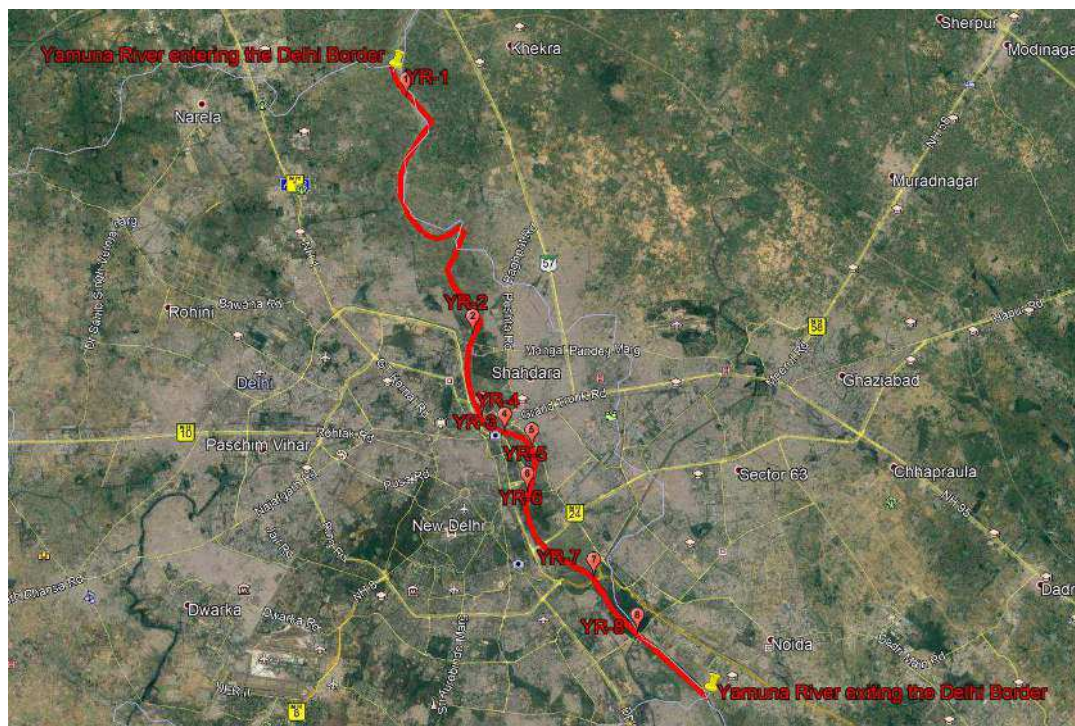


Fig. 1: Sampling locations in River Yamuna (Shown on: Google Earth Map)

Table 1: Details of the Sampling Locations

Sr. No.	Code	Sampling location	Remark/Significance	Latitude Longitude	Distance in between sampling point
1.	YR-1	Palla Village	The village after Yamuna River enters Delhi	28.8442 77.2145	Starting point (0 km)
2.	YR-2	Wazirabad Barrage	Wazirabad Water Treatment Plant (WTP) lifts water from the Wazirabad Barrage.	28.7155 77.2363	14.50 km
3.	YR-3	Kudesia Ghat	Before Kudesia Ghat, Najafgarh drain mix with the Yamuna River	28.6718 77.2354	4.85 km
4.	YR-4	Old Iron Bridge	Nigam Bodh Ghat is upstream to old Iron Bridge	28.6620 77.2480	1.65 km
5.	YR-5	Geeta Colony	-----	28.6519 77.2630	1.85 km
6.	YR-6	Up Stream ITO Bridge	Before ITO bridge, outlet of IP Sewage Treatment Plant (STP) mix with Yamuna River	28.6293 77.2570	2.56 km
7.	YR-7	Up Stream DND Bridge	Before DND bridge, there are IP Extension, STP and Pragati Thermal Power Plant along the banks of the River Yamuna	28.5800 77.2901	6.35 km
8.	YR-8	Up Stream Okhla Bridge	After this point, the Shahdara outfall drain mix with the Yamuna River	28.5480 77.3120	3.66 km

The sludge/sediment samples were collected from the mid, left side (river bed and 1 ft below the river bed) and right side river bed and 1 ft below the river bed) in the flow direction of the River Yamuna at 8 different locations both during pre-monsoon and post-monsoon season wherever possible due to site accessibility constraints. Also during the pre-monsoon season, the volume of water in the river was more, therefore at few locations dry sludge sampling was not possible.

Details of samples collected during pre & post monsoon season are given in **Table 2**, and description of samples code is given in **Table 3**. Sample location code has been used to represent the results in tabular as well as in graphical manner.

Table 2: Details of Sludge/ Sediments Samples Collected during Pre & Post Monsoon

Sr. No.	Location Code	Sampling location	Pre-Monsoon	Post Monsoon
1.	YR-1	Palla Village	LSD, LST, M, RST, RSD	LSD, M, RSD
2.	YR-2	Wazirabad Barrage	LSD, LST, M, RST, RSD	LSD, M, RSD
3.	YR-3	Kudesia Ghat	LSD, LST, M, RST, RSD	LSD, M, RSD
4.	YR-4	Old Iron Bridge	LSD, LST, M, RST	LSD, M, RSD
5.	YR-5	Geeta Colony	LSD, LST, M	LSD, M, RSD
6.	YR-6	Up Stream ITO Bridge	M	LSD, M, RSD
7.	YR-7	Up Stream DND Bridge	M	LSD, M, RSD
8.	YR-8	Up Stream Okhla Bridge	M	M

Table 3: Code used for Sludge/Sediments Samples Collection

Sr. No.	Code	Description
1.	LSD	Sample collected from the left side of the River (in the flow direction), one foot below the river bed
2.	LST	Sample collected from the left side of the River (in the flow direction) from top of the river bed
3.	M	Sample collected from the mid of the River
4.	RST	Sample collected from the right side of the River (in the flow direction) from top of the river bed
5.	RSD	Sample collected from the right side of the River (in the flow direction), one foot below the river bed

Photographs taken during the sampling are shown in **Plate 1**.



1. Palla Village

2. Wazirabad Barrage



3. Kudesia Ghat

4. Old Iron Bridge



5. Geeta Colony

6. Up Stream ITO Bridge



7. Up Stream DND Bridge

8. Up Stream Okhla Bridge

Plate 1: Photographs showing Collection of Sludge/Sediment and Water Samples from the Mid-Stream of River Yamuna

3.0 Results

All the sludge/sediment samples were analysed for different physico-chemical parameters (bulk density, porosity, water holding capacity & organic carbon) and metal contents (Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co & Cd).

Characteristics of the sludge/sediments samples collected from 8 different locations (Palla Village, Wazirabad Barrage, Kudesia Ghat, Old Iron Bridge, Geeta Colony, Up-stream of ITO, Up-stream of DND Bridge and Up-stream of Okhla Barrage) during pre & post monsoon season are summarized in **Tables 4-11**, and also presented graphically through **Figs. 2-9**, respectively.

Table 4: Characteristics of Sludge/Sediments Samples: Palla Village

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	25	8583	3	0	187	9	28	5	0	1.6	41.0	26.1	0.2
LST	34	10192	3	0	283	10	31	7	0	1.7	37.5	21.9	0.5
M	16	5068	4	0	117	7	36	3	0	1.4	43.7	27.9	0.1
RST	38	10221	9	1	237	15	53	8	0	1.3	52.6	39.4	0.3
RSD	11	2858	8	4	122	9	30	4	0	1.2	51.5	42.4	0.5
Post-Monsoon													
LSD	13	8731	7	0	158	7	34	4	0	1.6	43.8	27.7	0.1
M	13	15053	6	0	151	7	20	4	0	1.5	38	23.8	1
RSD	24	12018	13	0	274	11	38	7	0	1.3	51	38.4	0.2

Table 5: Characteristics of Sludge/Sediments Samples: Wazirabad Barrage

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	57	14695	10	0	312	19	54	11	0	1.3	50.6	38.4	0.3
LST	41	11391	5	0	230	14	42	8	0	1.3	44.7	33.3	0.5
M	48	13133	16	6	305	18	54	10	1	1.2	47.4	37.5	0.4
RST	21	7268	4	0	165	10	28	5	0	1.5	39.2	25.7	0.1
RSD	37	12247	7	0	233	15	46	8	0	1.5	45.6	30.8	0.2
Post-Monsoon													
LSD	19	12058	9	0	228	9	25	5	0	1.4	42.7	29.8	0.1
M	23	15314	12	0	261	10	32	6	0	1.4	48.4	35.2	0.2
RSD	21	13659	12	0	243	10	31	6	0	1.4	54.1	34.5	0.1

Table 6: Characteristics of Sludge/Sediments Samples: **Kudesia Ghat**

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	109	25190	32	11	579	32	79	17	1	0.9	55.5	64.3	0.8
LST	175	15766	64	50	337	32	122	11	1	1.0	54.5	54.8	1.3
M	33	7866	3	0	154	13	28	4	0	1.5	43.0	28.3	0.4
RST	41	7261	8	1	134	12	20	4	0	1.4	44.1	31.3	0.3
RSD	32	8358	11	4	165	12	26	5	0	1.4	47.2	33.2	0.1
Post-Monsoon													
LSD	53	26160	33	10	545	19	57	10	0	0.9	55.4	64.8	1.0
M	13	7415	5	0.2	122	6	16	3	0	1.6	39.2	25.1	0.1
RSD	164	17839	56	36	328	27	105	7	0	1.0	53.4	56.4	2.1

Table 7: Characteristics of Sludge/Sediments Samples: **Old Iron Bridge**

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	149	11329	81	68	276	24	160	7	1	0.9	65.3	70.1	3.3
LST	28	7213	4	0	143	10	14	4	0	1.3	46.6	34.7	0.4
M	1082	18392	370	334	398	131	509	13	3	0.8	69.3	92.7	4.1
RST	36	8752	4	0	166	12	22	5	0	1.5	45.3	29.9	0.1
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-
Post-Monsoon													
LSD	8	4740	4	0.1	121	3	22	2	0	1.5	41.4	27.3	0.0
M	12	7486	6	0.9	123	6	33	3	0	1.2	49.9	40.1	0.8
RSD	83	13653	29	17	198	16	54	5	0	1.5	41.0	26.3	0.1

Table 8: Characteristics of Sludge/Sediments Samples: **Geeta Colony**

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	60	14777	12	0	303	18	40	10	0	1.3	51.5	39.5	0.2
LST	55	13780	9	0	266	17	38	9	0	1.3	48.7	36.8	0.1
M	1001	22220	37.8	33.5	425	143	573	16	3	0.8	71.4	94.7	4.1
RST	-	-	-	-	-	-	-	-	-	-	-	-	-
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-
Post-Monsoon													
LSD	27	18125	15	1	287	11	35	7	0	1.3	52.5	41.1	0.3
M	94	19611	38	21	296	20	70	7	0	1.1	53.6	47.2	0.6
RSD	117	23637	46	24.5	390	23	80	9	0	0.9	59.7	49.5	1.1

Table 9: Characteristics of Sludge/Sediments Samples: **Up-stream of ITO Bridge**

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	-	-	-	-	-	-	-	-	-	-	-	-	-
LST	-	-	-	-	-	-	-	-	-	-	-	-	-
M	59	9893	12	4	312	13	42	6	0	1.6	44.1	28.3	0.1
RST	-	-	-	-	-	-	-	-	-	-	-	-	-
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-
Post-Monsoon													
LSD	8	6807	4	0	90	4	12	2	0	1.5	43.2	28.1	0.0
M	13	9170	6	0	124	6	19	4	0	1.5	44.5	29.6	0.0
RSD	14	10541	8	0	161	7	21	4	0	1.4	46.6	32.2	0.1

Table 10: Characteristics of Sludge/Sediments Samples: Up-stream of DND Bridge

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	-	-	-	-	-	-	-	-	-	-	-	-	-
LST	-	-	-	-	-	-	-	-	-	-	-	-	-
M	1809	25810	660	593	506	229	1009	20	6	0.6	72.3	117.1	2.6
RST	-	-	-	-	-	-	-	-	-	-	-	-	-
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-
Post-Monsoon													
LSD	29	18757	16	0.4	292	13	38	7	0	1.2	53.3	45.7	0.3
M	8	7022	4	0	114	5	13	3	0	1.5	40.4	26.4	0.1
RSD	37	16822	22	7.6	274	13	59	6	0	1.2	55.9	47.8	1.1

Table 11: Characteristics of Sludge/Sediments Samples: Up-stream of Okhla Barrage

Sampling Location	Metal Content (mg/kg)									Physico-chemical Parameters			
	Cr	Fe	Cu	Pb	Mn	Ni	Zn	Co	Cd	Bulk Density (gm/cc)	Porosity (%)	WHC (%)	OC (%)
Pre-Monsoon													
LSD	-	-	-	-	-	-	-	-	-	-	-	-	-
LST	-	-	-	-	-	-	-	-	-	-	-	-	-
M	99	20115	22	5	420	26	76	15	1	1.0	54.4	51.9	0.6
RST	-	-	-	-	-	-	-	-	-	-	-	-	-
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-
Post-Monsoon													
LSD	-	-	-	-	-	-	-	-	-	-	-	-	-
M	87	27354	46	24	452	25	83	10	0	0.7	62.1	57.2	1.4
RSD	-	-	-	-	-	-	-	-	-	-	-	-	-

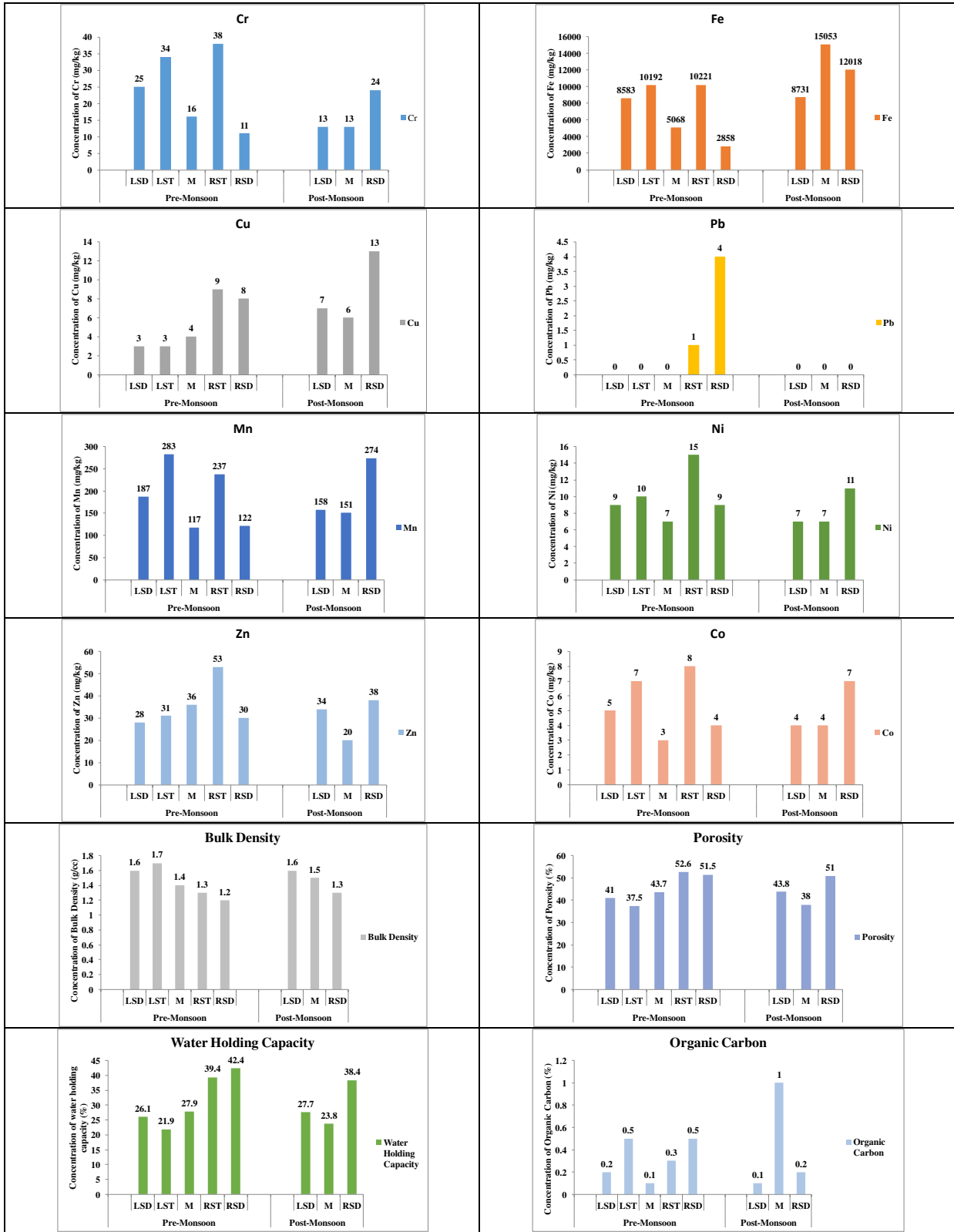


Fig. 2: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at **Palla Village**

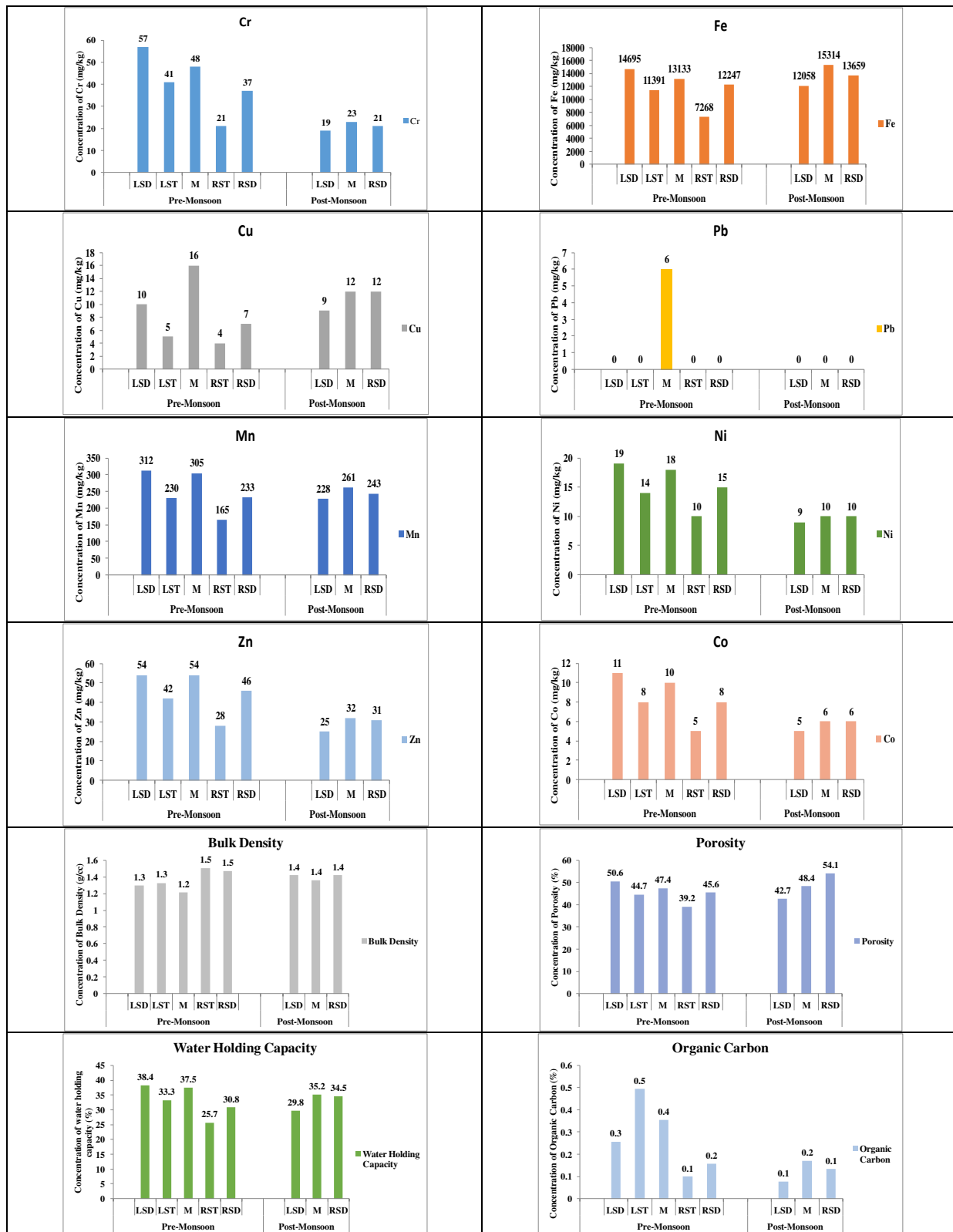


Fig. 3: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at Wazirabad Barrage

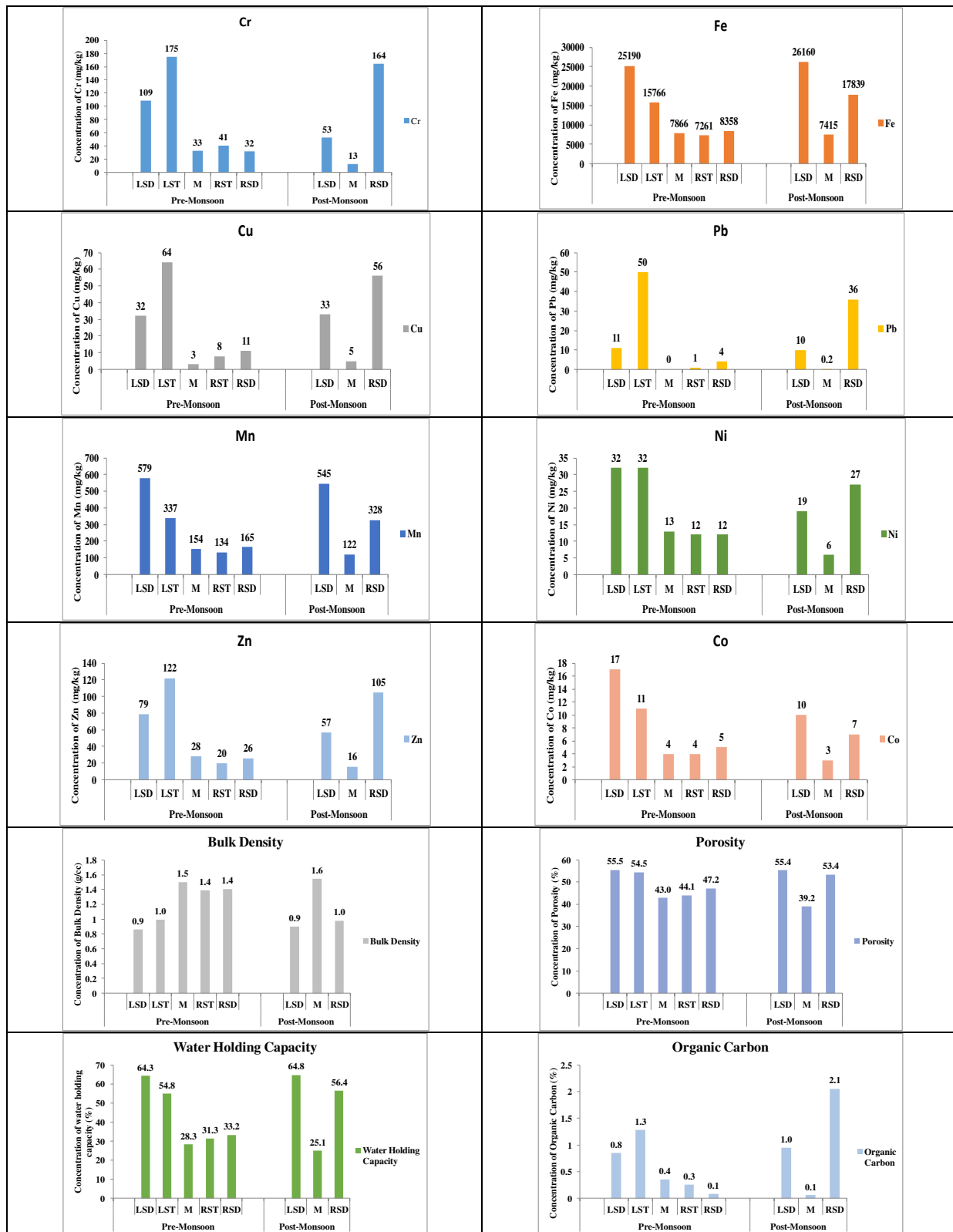


Fig. 3: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at **Kudesia Ghat**

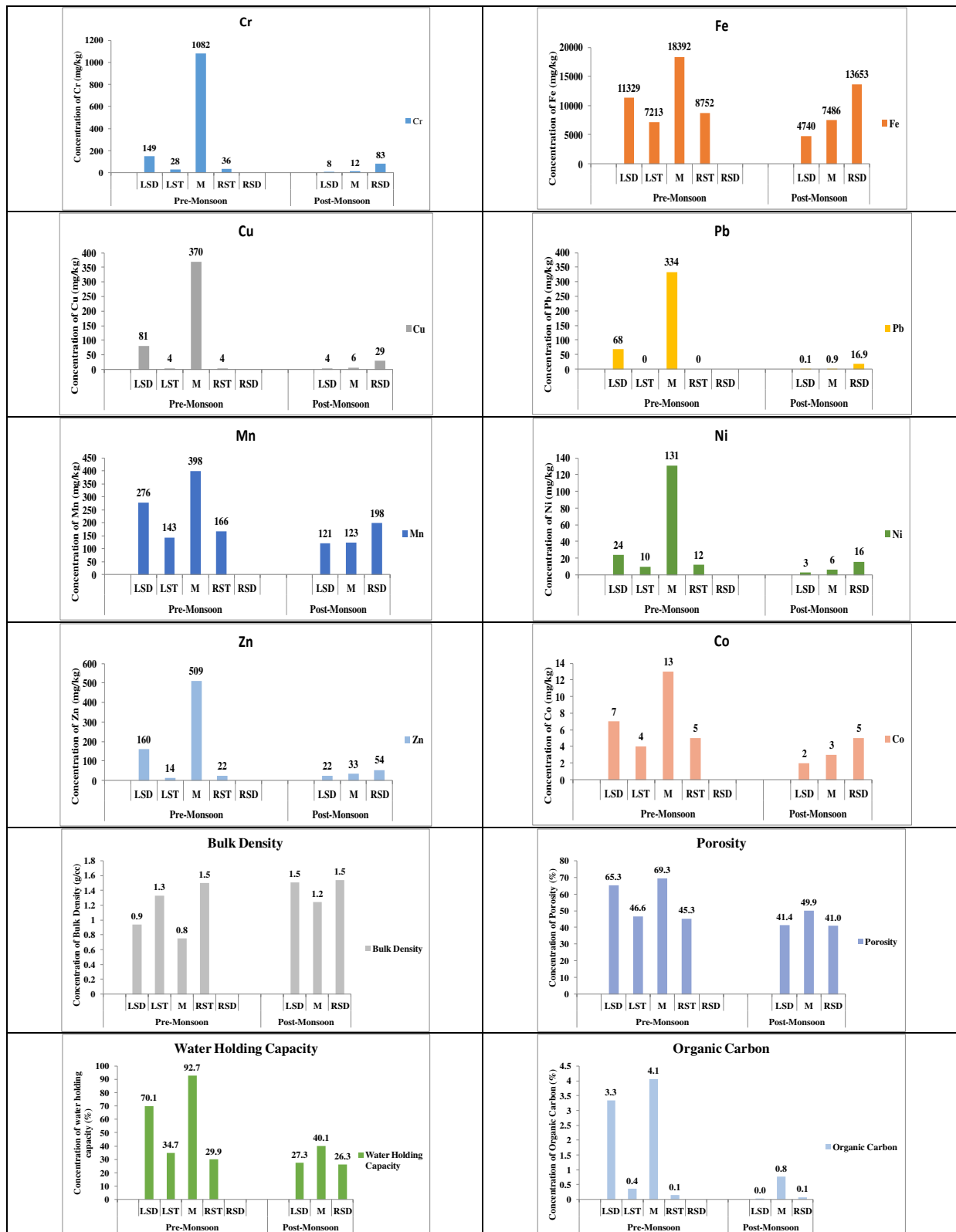


Fig. 4: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at the **Old Iron Bridge**

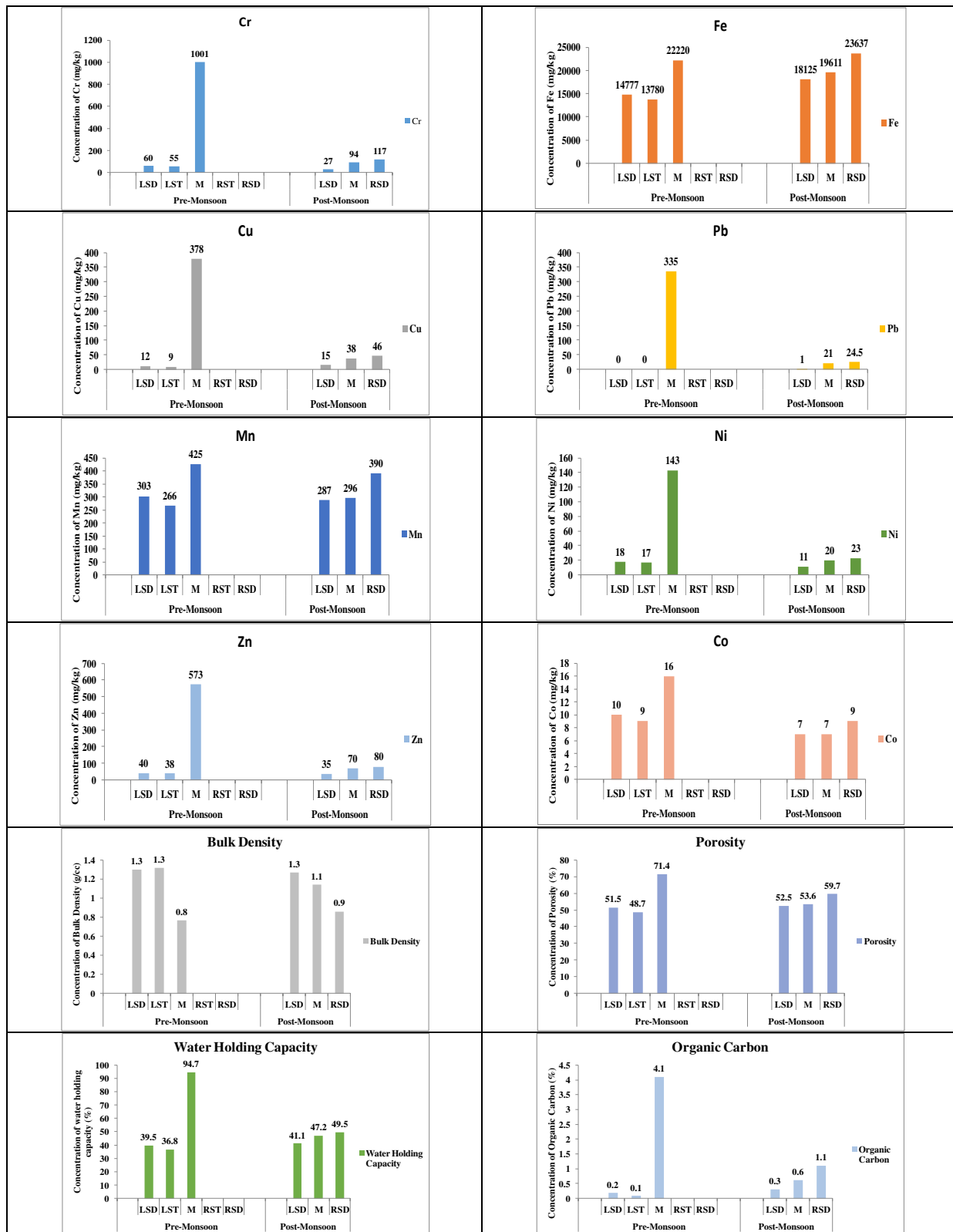


Fig. 6: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at **Geeta Colony**

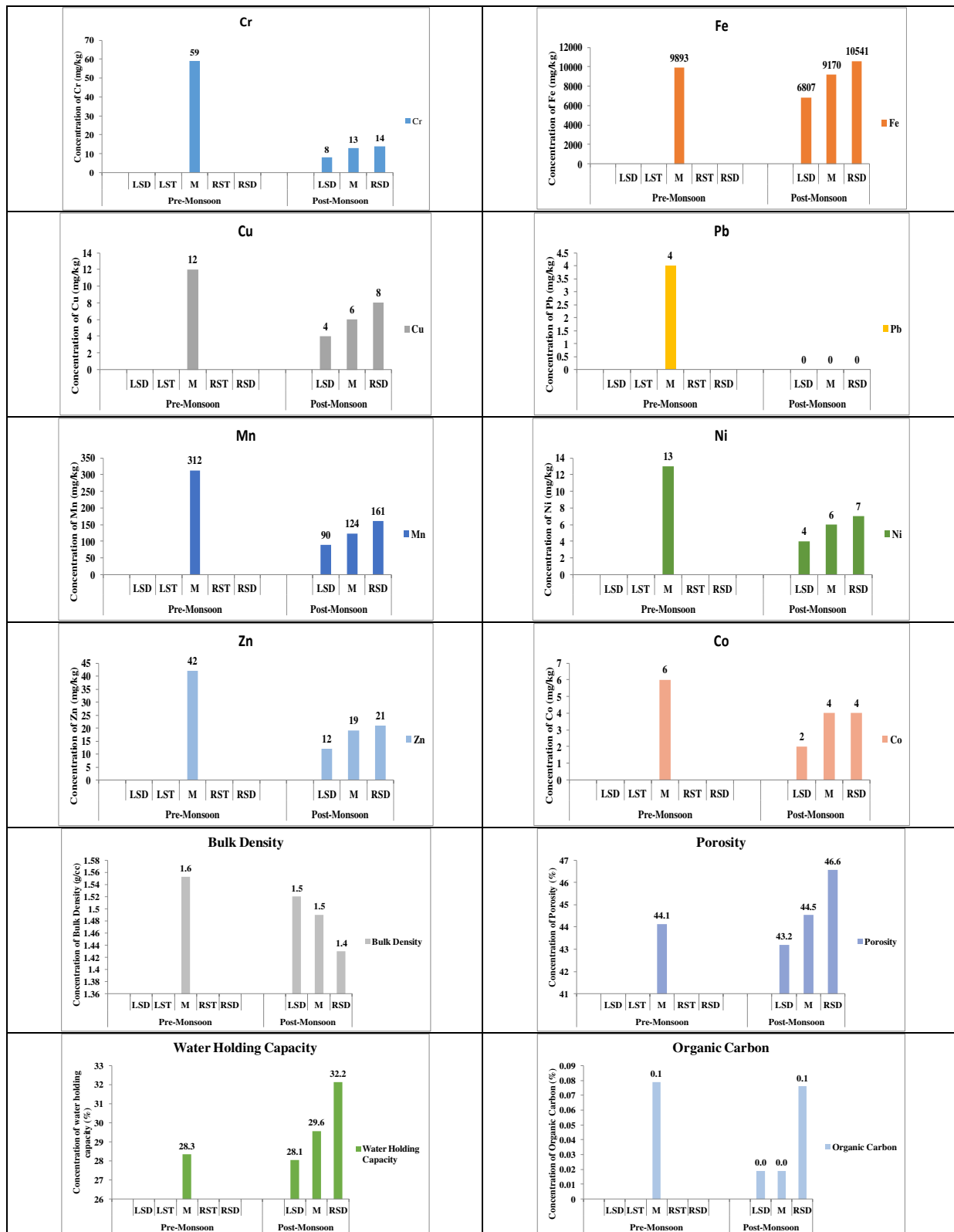


Fig. 7: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at the Up-stream of ITO Bridge

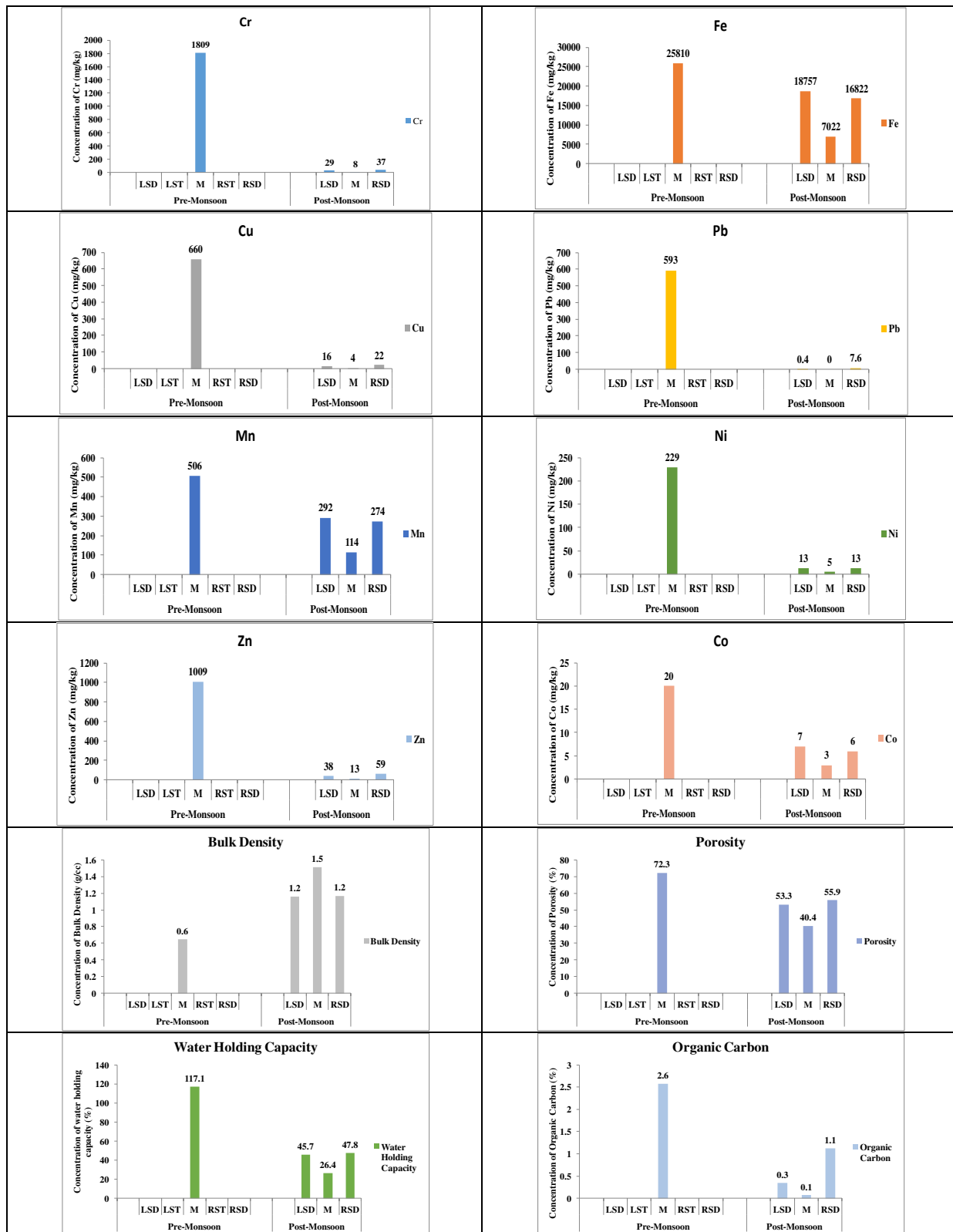


Fig. 8: Characteristics of Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at the Up-stream of the DND Bridge

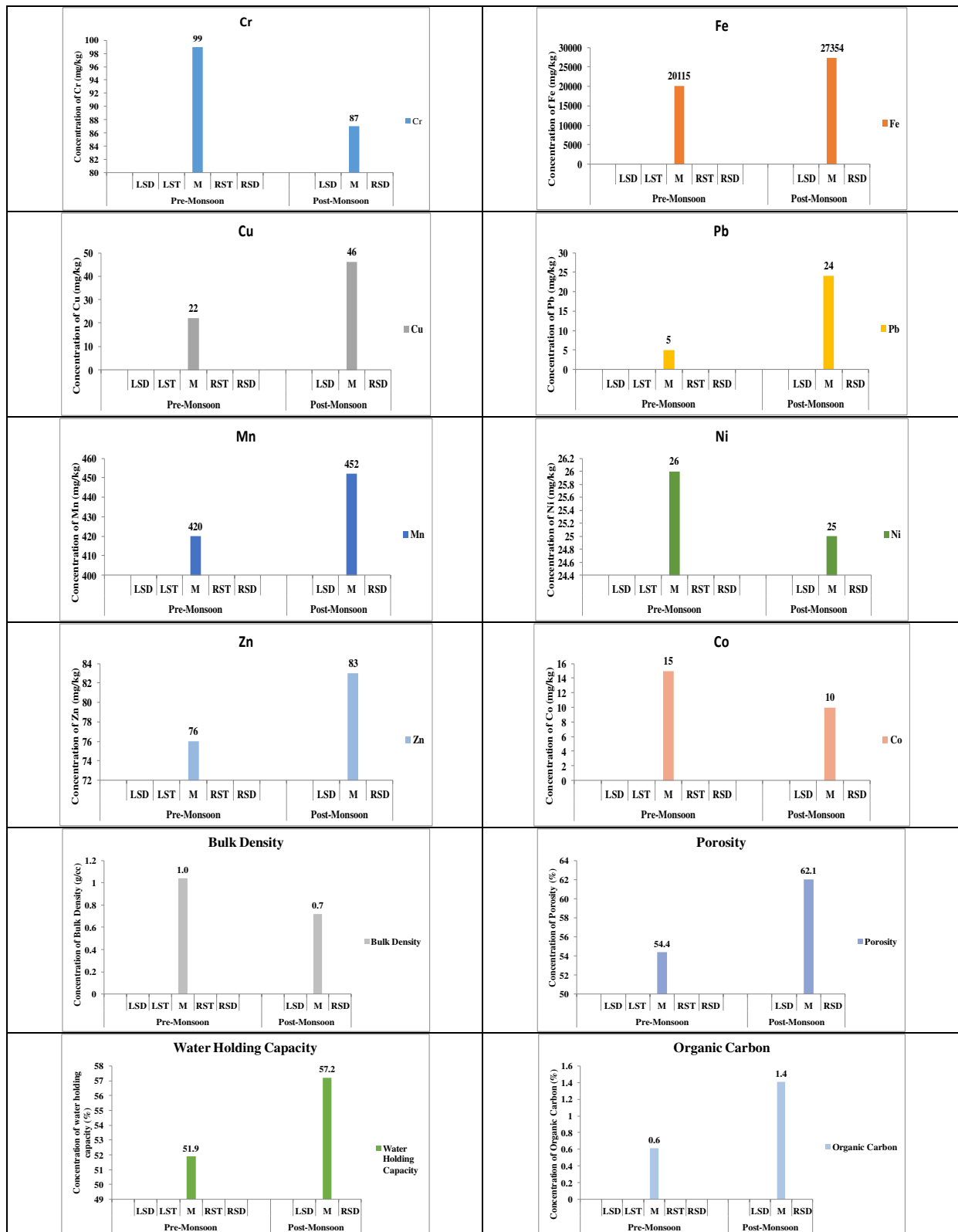


Fig. 9: Characteristics of the Sludge/Sediments Samples collected from the Mid, Left side and Right side (in the flow direction) of the River Yamuna at the Up-stream of Okhla Barrage

4.0 Summary & Conclusion

1. The sludge/sediments samples were collected from the mid, left side (river bed and 1 ft below the river bed) and right side river bed and 1 ft below the river bed) in the flow direction of the River Yamuna at 8 different locations both during pre-monsoon and post-monsoon season wherever possible. The samples were collected from the Palla Village, Up-stream of the Wazirabad Barrage, Kudesia Ghat, Up-stream of the Old Iron Bridge, Geeta Colony, Up-stream of the ITO Bridge, Up-stream of the DND Bridge and Up-stream of the Okhla Barrage.
2. Comparison of the concentration of various heavy metals and other sediments characteristics in the pre-monsoon and post-monsoon season is presented in **Table 12**.

Table 12: Change in the concentration of various heavy metals and other sediments characteristics in the post-monsoon season with respect to the pre-monsoon season.

Sr. No.	Sampling location	Parametric Variation observed								
		Parameters whose values decreased in post monsoon season			Parameters whose values increased in post monsoon season			Parameters whose values did not change in post monsoon season		
		LSD	M	RSD	LSD	M	RSD	LSD	M	RSD
1.	Palla Village	Cr, Mn, Ni, Co, Organic Carbon	Cr, Zn, Porosity, WHC	Pb, Porosity, WHC, OC	Fe, Cu, Zn, Porosity, WHC	Fe, Cu, Mn, Co, Bulk Density, OC	Fe, Cu, Cr, Mn, Ni, Zn, Co, Bulk Density	Pb, Bulk Density	Pb, Ni	
2.	Wazirabad Barrage	Cr, Fe, Cu, Mn, Ni, Zn, Co, Porosity, WHC, OC	Cr, Cu, Pb, Mn, Ni, Zn, Co, WHC, OC	Cr, Ni, Zn, Co, Bulk Density, Organic Carbon	Bulk Density	Fe, Bulk Density, Porosity	Fe, Cu, Mn, Porosity, WHC	Pb	-	Pb
3.	Kudesia Ghat	Cr, Pb, Mn, Ni, Zn, Co,	Cr, Fe, Mn, Ni, Zn, Co, WHC, Porosity, OC	Bulk Density,	Fe, Cu, Organic Carbon,	Cu, Pb, Bulk Density,	Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co, WHC, Porosity, OC	Bulk Density, Porosity	-	-
4.	Old Iron Bridge	Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co, Porosity, WHC, OC	Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co, Porosity, WHC, OC	-	Bulk Density,	Bulk Density,	-	-	-	Co
5.	Geeta Colony	Cr, Mn, Ni, Zn, Co,	Cr, Cu, Pb, Mn, Ni, Zn, Co,	-	Fe, Cu, Pb, Porosity, WHC, OC	Fe, Bulk Density,	-	Bulk Density,	-	-

Sr. No.	Sampling location	Parametric Variation observed								
		Parameters whose values decreased in post monsoon season			Parameters whose values increased in post monsoon season			Parameters whose values did not change in post monsoon season		
		LSD	M	RSD	LSD	M	RSD	LSD	M	RSD
			Porosity, WHC, OC							
6.	Up Stream ITO Bridge	-	Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co, Bulk Density, OC	-	-	Porosity, WHC	-	-	-	-
7.	Up Stream DND Bridge	-	Cr, Fe, Cu, Pb, Mn, Ni, Zn, Co, Porosity, WHC, OC	-	-	Bulk Density	-	-	-	-
8.	Up Stream Okhla Bridge	-	Cr, Ni, Co, Bulk Density	-	-	Fe, Cu, Pb, Mn, Zn, Porosity, WHC, OC	-	-	-	-

- As per **Table 12**, if we focus on the mid of the River Yamuna then it is evident that concentration of most of the heavy metals like Cr, Pb, Mn, Zn, Co, Cu, Cr and Ni are reducing in the sediments samples collected from the River bed in the post monsoon season with few exceptions. This indicates that the flushing of the Yamuna River bed is taking place during the monsoon floods when the river velocity is high and a lot of turbulence and churning takes place due to floods.
- On the other hand, the bulk density of the sediments collected from the mid of the River Yamuna is increasing during post monsoon season. This is due to the deposition of the sand on the Yamuna River bed in post-monsoon season. Due to this sand the water holding capacity, porosity and organic carbon concentration of the sediments is reducing in post-monsoon. The reduction in the organic carbon concentration of the sediments collected from the mid of the River Yamuna also indicates toward flushing of the Yamuna River bed in post-monsoon.
- Levels of certain metals viz. Cr, Fe, Cu, Pb, Ni, Zn were observed to be exceptionally high in the sludge samples collected from mid-stream of Yamuna river at Old Iron Bridge, Geeta Colony and Up-stream of DND Bridge in pre-monsoon. In the upstream of Old Iron Bridge, Najafgarh drain mixes (about 6 km). For example; Cr level at these locations was 1082, 1001 and 1809 mg/kg respectively. However, no such trend was observed in post-monsoon season.

6. Sediment in the Yamuna River stretch from Kudesia Ghat onwards till the Okhla Barrage is found to be heavily polluted wrt metal content (i.e. Cr, Cu, Pb, Ni, Zn, Fe, & Mn) when compared with USEPA Sediment Quality Guideline Values, particularly during the pre-monsoon period. However, there levels decreased considerably during post-monsoon period. Status of metals content in the sediment samples collected from mid-stream of the Yamuna River during Pre and post monsoon season is summarized along with USEPA Guideline values in **Table 13**.

Table 13: Heavy Metals content in sediments samples collected from the **mid-stream** of the Yamuna River during Pre & Post monsoon season

Sr. No.	Metal	Location-wise Parametric Values (mg/kg)								USEPA Sediment Quality Guidelines*		
		YR-1	YR-2	YR-3	YR-4	YR-5	YR-6	YR-7	YR-8	Non-Polluted	Moderately Polluted	Heavily Polluted
	Pre-monsoon											
1.	Cr	16	48	33	1082	1001	59	1809	99	<25	25-75	>75
2.	Fe	5068	13133	7866	18392	22220	9893	25810	20115	-	-	-
3.	Cu	4	16	3	370	378	12	660	22	<25	25-50	>50
4.	Pb	BDL	6	BDL	334	335	4	593	5	<40	40-60	>60
5.	Mn	117	305	154	398	425	312	506	420	--	-	-
6.	Ni	7	18	13	131	143	13	229	26	<20	20-50	>50
7.	Zn	36	54	28	509	578	42	1009	76	<90	90-200	>200
8.	Co	3	10	4	13	16	6	20	15	-	-	-
9.	Cd	BDL	1	BDL	3	3	BDL	6	1	-	-	>6
	Post-monsoon											
1.	Cr	13	23	13	12	94	13	8	87	<25	25-75	>75
2.	Fe	15053	15314	7415	7486	19611	9170	7022	27354	-	-	-
3.	Cu	6	12	5	6	38	6	4	46	<25	25-50	>50
4.	Pb	BDL	BDL	0.2	0.9	21	BDL	BDL	24	<40	40-60	>60
5.	Mn	151	261	122	123	296	124	114	452	--	-	-
6.	Ni	7	10	6	6	20	6	5	25	<20	20-50	>50
7.	Zn	20	32	16	33	70	19	13	83	<90	90-200	>200
8.	Co	4	6	3	3	7	4	3	10	-	-	-
9.	Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	>6

*USEPA, 1991. Sediment Quality Guidelines Draft Report EPA Region, US EPA Office of Science & Technology, Washington, DC. August; Cross-Ref: Swaranlatha, K & A.G. Nair (2017). Assessment of sediment quality of a tropical lake using sediment quality standards. Lakes and Reservoirs: Research and Management 2017; 22:65-73.

7. Though analysis of metals in the sludge/sediment samples collected during pre & post monsoon season do not show any specific trend, as the samples were either collected from surface and 1 ft below the surface, possibility of legacy sludge in deeper section of the River Bed cannot be ruled out. It will be worth considering deep digging of sludge/sediment up to 5-6 ft at few select locations, to further support any conclusion/decision.

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Additional Data Analysis

Table A1: Characteristics of the sludge/sediments samples collected from the **mid-stream** of the Yamuna River during pre & post monsoon season

Sr. No.	Parameters	Location-wise Parametric Values							
		YR-1	YR-2	YR-3	YR-4	YR-5	YR-6	YR-7	YR-8
A.	Pre-monsoon								
1.	Bulk Density (gm/cc)	1.40	1.22	1.50	0.76	0.76	1.55	0.65	1.04
2.	Porosity (%)	43.7	47.4	43.0	69.3	71.4	44.1	72.3	54.4
3.	Water Holding Capacity (%)	27.9	37.5	28.3	92.7	94.7	28.4	117	51.9
4.	Organic Carbon (%)	0.08	0.36	0.36	4.06	4.10	0.08	2.58	0.61
B.	Post-monsoon								
1.	Bulk Density (gm/cc)	1.48	1.36	1.55	1.24	1.14	1.49	1.51	0.72
2.	Porosity (%)	38.0	48.4	39.2	49.9	53.6	44.5	40.4	62.1
3.	Water Holding Capacity (%)	23.8	35.2	25.1	40.1	47.2	29.6	26.4	57.2
4.	Organic Carbon (%)	0.95	0.17	0.06	0.76	0.61	0.02	0.07	1.41

Metal Content in Water Samples

Table A2: **Heavy Metals** content in **water samples** collected from the **mid-stream** of the Yamuna River during Pre & Post Monsoon Season

Sr. No.	Metals	Acceptable/ Permissible Limit*	Location-wise Parametric Values (mg/l)							
			YR-1	YR-2	YR-3	YR-4	YR-5	YR-6	YR-7	YR-8
A.	Pre-monsoon									
1.	Cr	0.05/ 0.05	BDL	BDL	0.001	0.019	0.014	BDL	0.011	0.006
2.	Fe	0.3/ 0.3	0.761	0.109	1.293	1.137	0.782	0.524	0.812	0.560
3.	Cu	0.05/ 1.5	0.006	0.004	0.006	0.010	0.017	0.005	0.007	0.005
4.	Pb	0.01/ 0.01	0.004	0.001	0.003	0.008	0.016	0.002	0.006	0.002
5.	Mn	0.1/ 0.3	0.042	0.014	0.220	0.263	0.270	0.224	0.237	0.171
6.	Ni	0.02/ 0.02	0.002	BDL	0.012	0.019	0.019	0.013	0.012	0.009
7.	Zn	5 / 15	BDL	BDL	0.004	0.022	0.015	BDL	0.012	0.008
8.	Co	-	0.001	BDL	BDL	0.001	0.001	BDL	BDL	0.001
9.	Cd	0.003/0.003	0.002	BDL	0.003	BDL	BDL	BDL	0.003	0.002
B.	Post-monsoon									
1.	Cr	0.05/ 0.05	0.008	0.001	0.030	0.016	0.022	0.019	0.016	0.016
2.	Fe	0.3/ 0.3	0.563	0.322	0.750	0.452	0.667	0.458	0.421	0.591
3.	Cu	0.05 / 1.5	0.003	0.006	0.017	0.001	0.012	0.001	0.009	BDL
4.	Pb	0.01/ 0.01	0.014	0.007	0.021	0.010	0.011	BDL	0.012	BDL
5.	Mn	0.1/0.3	0.022	0.016	0.214	0.168	0.203	0.217	0.189	0.173
6.	Ni	0.02/ 0.02	0.002	BDL	0.015	0.010	0.010	0.013	0.010	0.008
7.	Zn	5/15	0.035	0.013	0.037	0.027	0.043	0.014	0.020	0.008
8.	Co	-	0.001	0.001	BDL	BDL	0.001	BDL	BDL	BDL
9.	Cd	0.003/0.003	0.002	BDL	0.054	BDL	BDL	BDL	BDL	BDL

*IS 10500:2012 Drinking Water Specifications

Metal Content in Soil Samples

Table A3: Summary of Concentration of **Heavy Metals in the Soil Samples** Collected from the Vegetable Fields of the Flood Plains of Yamuna River

Sr. No.	Sample Location (Number of Samples)	Heavy Metal Concentration (mg/kg of Soil)									Hg (µg/kg)
		Cr	Fe	Cu	Zn	Cd	Pb	Co	Mn	Ni	
A.	Reference Site										
1.	Kharkhoda Village (3)	25-34	11297-17531	5-8	21-30	1.0-1.4	1.0-1.3	5.6-7.9	165-233	12.0-17.3	0.31.1
B.	Upstream of Wazirabad Bridge										
2.	Dahestra (4)	43-56	20123-27389	12-18	35-45	2.0-2.6	2.9-5.5	7.8-10.1	277-380	14.3-18.8	5.7-10.8
C.	Yamuna Flood Plain downstream of Wazirabad Bridge										
3.	Usmanpur khadar (4)	43-58	20617-24855	12-20	36-48	1.7-2.1	3.3-8.5	8.3-9.5	358-400	15.7-18.7	6.1-10.8
4.	Geeta Colony (7)	37-77	18279-30699	8-27	30-61	1.5-2.6	0.6-11.6	7.5-10.6	254-384	13.5-21.2	5.6-11.3
5.	Mayur Vihar – Phase I (5)	65-94	18675-24921	23-36	53-76	2.7-3.8	9.8-19.2	8.5-9.9	347-398	15.6-19.7	5.7-22.0
Soil Quality Standard (Awasthi 2000) (mg/kg)		-	-	135-270	300-600	3-6	250-500	-	-	75-150	-

Awasthi SK (Ed.) (2000). Prevention of Food Adulteration Act No. 37 of 1954. Central and State Rules as Amended for 1999, Ashoka Law House, New Delhi.

Annexure – C-7/1**Related to Chapter 7- Industrial Pollution and CETPs**

S.No.	CMC	District	Action taken against Water Polluting Industries/ Units (Nos)			Show Cause Notices (SCN) Issued				Directions for Closure issued				Environmental Compensation (EC) Imposed (in Rs.)			Environmental Compensation (EC) Received (in Rs.)		
			Conforming Area	Non Conforming Area	Total	SCN of Water Act	SCN of Air Act	SCN of EP Act	Total	Water Act	Air Act	EP Act	Total	Conforming Area	Non Conforming Area	Total	Conforming Area	Non Conforming Area	Total
1	I	East, North-East & Shahdara	51	247	298	35	41	0	76	16	138	5	159	9260072	1025461750	1034721822	7529892	736500	8266392
2	II	South, South East & South West	140	47	187	280	274	380	934	118	167	61	346	32116969	113700000	145816969	8966711	2775000	11741711
3	III	North West	107	321	428	109	119	12	240	87	143	0	230	103525000	993118750	202843750	9037500	0	9037500
4	IV	New Delhi	291	64	355	164	143	7	314	134	159	0	293	60080400	0	60080400	4122500	NIL	4122500
5	V	North	1489	221	1710	904	217	45	1166	735	478	96	1309	3195355	25788	57742	48064	4920	529

														00	5000	0500	500	000	845 00
6	VI	West	95	787	882	70	710	5	785	12	232	7	251	4652000 0	72126 0250	76778 0250	80000	4010 750	481 075 0
7	VII	Central	8	532	540	96	95	2	193	38	43	5	86	10000	12325 560	12425 560	0	2650 0	265 00
		Total	2181	2155	4400	1658	1599	451	3708	1140	1360	174	2674	5711379 41	22299 51310	28010 89251	11562 1103	1270 7250	128 328 353

Annexure – C - 8/1**Related to Chapter 8- Sewage and Fecal Sludge Management and Levy of Environmental Compensation****Action Plan for providing sewerage network in colonies presently un-sewered.**

S. No.	Status	No. of U/A Colonies	Timelines
1	Sewer line laid, Commissioned and notified	561	Completed. The sewage is being treated at existing STPs.
2	Work of sewer network is in progress	467	The action plan for completion of work in these colonies is as follows: By June 2020 – 59 colonies By Dec-2020 – 166 colonies By Dec 2021 – 352 colonies By Dec 2022 - 467 colonies The sewage from the above colonies will be conveyed and treated at existing STPs.
3.	Balance Colony where sewer network is to be laid	771	
	a. Work of sewer network in tender stage	115	The works in these colonies are likely to be awarded by July/August 2020 and the target date of completion is July, 2024. The sewage will be treated at Proposed STPs at Rohini & Sonia Vihar.
	b. Colonies where NOC is awaited/O-Zone	154	NOC is awaited due to Forest/ASI- 112 No Feasibility/ "O" Zone - 42
	c. Colonies where works of sewer line are at estimate	502	Colonies under existing STPs – 109 Colonies envisaged under DSTPs – 393 For laying sewerage network in these colonies

	stage including where sewerage network is to be laid along with decentralized STPs		consultants are being appointed for preparation of DPRs and estimates. The works are expected to be awarded by December, 2020 and will be completed by December, 2023 subjected to availability of land for DSTPs and required funds.
	Total	1799	

Annexure-C-8/2

Related to Chapter 8- Sewage and Fecal Sludge Management and Levy of Environmental Compensation

Colonies with population and number of households which will be covered under ISP and their sewage intercepted, conveyed and treated.

S.No.	District	Colonies under the command of ISP		
		No. of UCs	Household (Plot/Building)	Population (@4.5)
1	Central	67	77177	347297
2	East	85	41240	185580
3	New Delhi	2	721	3245
4	North	178	106837	480767
5	North East	118	131880	593460
6	North West	193	189896	854532
7	Shahdara	51	33387	150242
8	South	0	0	0
9	South East	1	641	2885
10	South West	165	90768	408456
11	West	313	220014	990063
Total		1173	892561	4016525

Colonies with populations and households which are neither covered under sewerage network, nor connected to ISP and are releasing their sewage directly in to drains.

S.No.	District	Non ISP		
		No. of UCs	Household (Plot/Building)	Population (@4.5)
1	Central	4	402	1809
2	East	1	805	3623
3	New Delhi	25	12531	56390
4	North	2	912	4104
5	North East	5	27686	124587

6	North West	3	2676	12042
7	Shahdara	0	0	0
8	South	178	101530	456885
9	South East	153	127977	575897
10	South West	251	79416	357372
11	West	4	1024	4608
Total		626	354959	1597316

Related to Chapter 8- Sewage and Fecal Sludge Management and Levy of Environmental Compensation

Status of consumers who have not taken sewer connections in the notified area as per revenue record

S. No.	CE Circle	No. of consumers who have not taken sewer connections in notified area as per revenue record	No. of consumers surveyed	No. of Consumers regularised for sewer connections	No. of consumers who have not taken sewer connections in notified area	Remarks/ Timeline
1.	CE(East)	82,224	45,561	32,847	12,714 plus 36,663 consumer is yet to be surveyed	The work of survey and identification and preparation of estimate have been adversely affected due to assembly election in Delhi in January and February, 2020. The activities were restarted from Mid February upto mid March and again had to be suspended due to Corona Virus Pandemic since last three months. This has cast a shadow on the timelines for return of labour force at the work sites. Further, there are budgetary constraints also and as such the work will be completed in phased manner by March, 2021.
2.	CE(South)	8613	8,545	7,430	1,115 plus 68 consumers is yet to be surveyed.	Same reasons as above. Timeline: December, 2020.
3.	CE(C&N)	3059	3,059	3,059	Nil	---
4.	CE(West)	20176	20,030	18,958	1,072 plus 146 consumers are yet to be surveyed	Same reasons as above. Timelines: December, 2020.
	TOTAL	1,14,072	77,195	62,294		

Annexure - C- 9/1**Related to Chapter 9- Online Monitoring of STPs, CETPs and Yamuna**

**OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI – 110003**

No. YPMC /2019/271

Date: _22 .7.2019

**Subject: Minutes of the meeting held on 18.7.2019 at 11.30 AM to review the functioning of
Online Monitoring System on STPs and CETPs.**

The list of the participants who attended the meeting is attached.

The MC had called the meeting to review the following:

- i. Installation and commissioning of Online Monitoring System (OLMS) in all the CETPs/STPs and their connectivity with DPCC & CPCB servers.
 - ii. Whether alerts are being generated as and when the standards are exceeded and whether there is a Standard Operating Procedure (SOP) for attending to such alerts?
 - iii. Whether the data generated through OLMS correspondent with the laboratory results or not and what corrective steps are being taken in the case of variance between laboratory results & OLMS?
 - iv. Progress of public access to the OLMS data.
 - v. Installation of flow meters.
1. Shri Vikas Anand who has recently taken over as the MD, DSIIDC informed that all the 13 CETPs are connected online with DPCC & CPCB servers now. The Naraina CETP which was earlier not connected has since been provided connectivity. On inquiry the MD informed that at present the data generated at CETP which gets transmitted online to DPCC & CPCB servers is not connected to DSIIDC website. The DSIIDC was reminded that even in the earlier meetings they were asked to ensure that all the data generated

at the CETP is also available on a real time basis on DSIIDC server so that the DSIIDC as an organization responsible for implementing CETP Act is able to intervene and take action against the defaulting CETPs. Besides sending alerts to each CETP societies, alerts should also be transmitted to the concerned officers in DSIIDC for intervention.

2. The DJB informed that as against 33 STPs which were connected online earlier, two more STPs at Ghitorni and Yamuna Vihar Phase II have also been provided OLMS, making a total of 35 STPs which have a functional OLMS. Formal request has been made to DPCC and CPCB for registration of 2 new STPs on their server. Once that is done all the 35 STPs will on a real time basis be connected to CPCB & DPCC servers. The CPCB & DPCC were asked to provide this connectivity within a week since formal request has already been made by the DJB in this behalf. A compliance report be sent by the DJB by 31.7.19.
3. On the question of generation of alerts and finalization of SOPs, DJB has already prepared the SOPs and alerts are presently being sent to the Plants- in-charges and other senior officers including CEO. As far as CETPs are concerned, alerts are only going to CETPs societies but not to the officers of DSIIDC since they are not online with the CETPs. The MD was asked to get this operationalized at the earliest and submit a compliance report. While preparing SOPs for handling the alerts, the officers who can take corrective actions and issue directions under CETP Act should necessarily be part of the network receiving alerts, both online and through SMSs. A compliance report be submitted by the DSIIDC on 31.7.19.
4. In the last meeting held in DPCC office on 12.6.19 it was brought out that although data generated by OLMS for the CETPs suggests that the CETPs are functioning properly and meeting the prescribed standards, the laboratory results carried out by DPCC every month show that most of the CETPs are exceeding parameters. The DPCC further informed that there is a variation of 110% in COD, 89% in TSS and 29% in BOD in the CETP at Narela. Situation is not very different at other CETPs. It thus clearly shows that OLMS is not functioning properly. On further inquiry it transpired that there is no system of periodic calibration of OLMS sensors. The CETPs have neither proper

laboratories nor technical manpower to carry out analytical tests. This being the position, the main purposes of OLMS gets defeated. The MD was, therefore, asked to immediately attend to this problem and if the proper testing laboratories are not available with the CETPs, samples should be got tested at the DPCC or CPCB laboratory, subject to DPCC and CPCB agreeing to this. Else, the DSIIDC may arrange for a system being put in place under which the samples are tested at any NAB laboratory. It must be ensured that calibration of all the sensors is done once in 15 days as per the CPCB guidelines and DSIIDC should confirm by 31.7.19 that arrangements for testing of samples in CPCB/DPCC/NABL and calibration of sensors once in 15 days have been put in place.

5. The DJB representative informed that their data generated online in respect of STPs is available online for free public access. The CE, DJB informed that they are in the process of installing display boards in each of the STPs for public information. This will be completed by 15.9.19. The DSIIDC informed that the public access to information on CETPs through their Website will be given once the data from CETPs is received on their Website or their Website linked with DPCC. This is expected to be completed by 31.7.19. Work on putting up display boards have been started and installed at 5 out of 13 CETPS. The remaining work should also be completed expeditiously.
6. Installation of tamper-proof electro-magnetic flow meters is essential to monitor online the quantum of waste water received and treated at the STP/CETPs. Presently only 3 CETPs and 13 STPs have flow meters installed and connected online and transmitting the data on quantum of waste water received and treated at the CETPs/STPS. DSIIDC and the DJB should complete installation of Flow meters at each CETPs/STPs and submit compliance report by 31.8.19.
7. DSIIDC has been carrying out survey of Industries located in 28 clusters and have made substantial progress as reported earlier. Enforcement action has also been taken against CETPs and industries for failing to comply with the directions of DSIIDC or to adhere to the timelines for OLMS. Present status of the survey and enforcement action be submitted to the MC for inclusion in the next Report of the MC to the Tribunal.

8. DSIIDC had earlier reported that they have decided to engage NEERI to upgrade their CETPs with a view to achieving ZLD and also to explore if some of the CETPs can be retrofitted to be used as STPs due to excess capacity. The MD informed that the MOU for this between the NEERI and DSIIDC is expected to be signed before the end of this month.

Encl.: as above

B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

To:

1. CMD, DSIIDC.
2. Member (Dr.), DJB.
3. MS, CPCB.
4. MS, DPCC.

Address: Room No. 58, India International Centre
40, Max Mueller Marg, New Delhi – 110003
Telephone No: 011- 24609270
Email id: rymonitoringcommittee@gmail.com

Annexure - C- 9/2**Related to Chapter 9- Online Monitoring of STPs, CETPs and Yamuna****Vishal Gandhi** <vishalpcb@gmail.com>**To:**Monitoring Committee River Yamuna,B.S Sajwan**Cc:**SudhakarCPCB, prashant.cpcb@gov.in, J Chandra

Babu,sunitiparashar@gmail.com

Fri, May 22 at 11:07 AM

Sir

In reference to your letter dated 20.4.2020 and 11.5.2020, enclosed please find Standard Operating Procedure for Verification of Installation and Calibration of OCEMS system for your kind perusal please.

It is to further informed that compilation of compliance status made by State Government (Delhi and Haryana Government) is in process.

Regards

Vishal Gandhi

Scientist 'D'

Central Pollution Control Board

Ministry of Environment & Forests (Govt of India)

PariveshBhawan

East Arjun Nagar

Delhi-110032

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protocol.pdf

283kB



Standard Operating Protocol for Verification of Installation and Calibration of UV-Vis Dual Beam Scanning & Multipoint calibration mechanism technology based OCEMS (Effluent) used in Sewage Treatment Plants (STPs)

Version 1.0

This protocol provides general guidance for verification of Online Continuous Effluent Monitoring System (OCEMS) installed at Sewage Treatment Plants (STPs) with step-wise approach for verification of installation and initial calibration by instrument installer, later validation of calibration by operator and performance check by the State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs), so as to ensure that reliable data is generated by OCEMS.

1. Verification of OCEMS Installation

- (i) **Pre-requisites**-OCEMS installation should be planned w.r.t. availability of location, uninterrupted stabilized power supply, protection from harsh environmental conditions, security, accessibility, safety of access to sensors and data display board, data transmission with remote or manual calibration procedure etc. These are pre-requisites before installation of OCEMS.
- (ii) **Continuous Operation**: The purpose of installation of online analyser is to get continuous effluent monitoring data, hence, in no case the system shall be switched off without prior intimation to the concerned regulators.
- (iii) **In-Situ location**: OCEMS must be installed at the Final Outlet/stable outlet channel with least water turbulence. It should always be placed at the treated water chamber overflowing in to final outlet.
- (iv) The sensor must always remain submerged in effluent and whenever (during maintenance and calibration) sensor is taken out from the effluent, alarm should be generated and communicated to SPCB/CPCB server automatically.
- (v) **Extractive location**: The sample must be drawn through a pump from the same location as mentioned above with little over pressure to maintain the sample supply continuously. In case the sample is not available, system should generate automated alarm communicated to CPCB/SPCB server.

2. Calibration of OCEMS:

STP Operators may deploy different makes of instruments based on different technologies measuring effluent quality in terms of pH, BOD, COD, and TSS, therefore, operation and calibration mechanism of such instruments will differ. This document covers calibration procedure for

commonly used technologies for effluent monitoring, available as on date, that is UV-Vis principle based system for BOD, COD & TSS measurement having dual beam scanning and Multipoint calibration mechanism.

Complete calibration of OCEMS requires following checks, calibrations & validations:

- (i) Function Check
- (ii) Basic Installation & Calibration
- (iii) Continuous Validation
- (iv) Performance Check

The calibration shall be considered complete, when process no. (i), (ii), (iii) and (iv) have been completed successfully and all the conditions of protocol are found to be within permissible ranges/limits mentioned in this document.

Function checks, Installation & calibration check is the responsibility of the firm or its authorized representative installing OCEMS. Ensuring continuous validation of OCEMS is the responsibility of the operator of STPs (to be verified by SPCBs/PCCs). Performance check of OCEMS is the responsibility of SPCBs/PCCs to verify the performance of plants against stipulated standards.

2.1 OCEMS Function check

The purpose of this exercise is to cross verify the operation of basic electronics involved in the system. When required, this data should be shared through email to SPCBs/PCCs. Records of this function check should be available in the plant.

Parameter-wise function check process is below:

- pH: Calibrate pH meter with Certified (having international traceability) Buffer solutions of pH 4, 7, 9.2 & 10. Perform at-least two point calibration within the expected range of the pH in the plant. For example, if pH is expected to be 7.8 then perform two points calibration with pH 7 and 9.2.
- BOD: Not possible
- COD: Use KHP Certified Reference Material (CRM)

Step 1: Prepare different dilutions using Potassium Hydrogen Phthalate (KHP) with stock solution 1000ppm and check performance of instrument in respective dilutions. Calibrate optics of the system with the procedure detailed below.

Step 2: Prepare stock standard (1000ppm equivalent COD) in laboratory and store it in refrigerator. Stock is stable upto six months, if stored in refrigerator. Hence, as a safety margin, do not use stock older than five months in calibration and also do not use stocks, if exposed in environment because of any reason.

Step 3: Prepare working solution of nearly $1/3^{\text{rd}}$, $1/2$, $2/3^{\text{rd}}$ and 2 times of working range (i.e. COD levels expected in a plant) and perform the functional test on site within 24 hours.

Step 4: Verify the results and if not found within 5% of the range, perform functional check again

Step 5: Submit middle dilution (of the range in use at plant) as sample for parallel COD measurements in lab along-with the samples.

TSS: Use Formazine solution. Care to be taken in handling solution.

Frequency of function test is every 15 days. STPs may engage the firms providing services of O & M.

2.2 Basic Installation and Calibration of OCEMS

The purpose of this exercise is to ensure installation of the system in a plant and collect calibration data points for better matrix matching and to authenticate the range of measurement coverage. The data collected should be shared through email to SPCBs/PCCs or CPCB. Copy of this basic or initial calibration should be available at any point of time in the plant. If such exercise was not done earlier, the same should be completed and records be maintained. Basic calibration test should be repeated when two consecutive validation tests or performance tests fail and results fall beyond the “criteria of outliers” given in this document.

Step 1: Conduct Grab Sampling of effluent for 24 hours at an interval of 02 (Two) hours.

Step 2: Conduct flow based composite sampling for every 24 hours. All measurements shall be reported in metric SI units. For Example, the flow shall be reported in m³/hr after conversion factor of 4.546 is applied to the readings in MGD

Step 3: Follow standard sampling procedure for

- i. flow based composite preparation.
- ii. sample collection
- iii. sample preservation
- iv. sample storage with ice
- v. samples deposition

Step 4: Send samples for testing to a EPA recognized laboratory, which has participated in AQC, within last one year and has passed the AQC criteria successfully.

Step 5: Collect sample results within maximum seven days from the date of sampling.

Step 6: Collect copy of certificate of Lab’s participation in AQC (as prescribed by CPCB) and its performance results in AQC, along-with the sample’s results each time either physically or electronically (email etc.).

- Step 7: Enter data of 12 (Twelve) Grab samples lab results of every parameter (pH, BOD, COD, TSS) into the OCEMS within seven days of sampling and maintain a record of calibration results entered in the OCEMS.
- Step 8: Ensure that there are no previous calibration results entries in the system. If there are entries, remove all entries from the system. These entries have to be removed only at the first time calibration.
- Step 9: While making calibration results entries, ensure that outliers (data points) as per given “Criteria of outliers” in this document, are not entered into the OCEMS.
- Step 10: within next seven days from the first sampling date, Repeat the exercise again following steps 1 to 7 again.
- Step 12: This time system should hold at-least total 15 valid calibration points (out of 24 data points) after calibration points entries.
- Step 13: Compare results of composite sampling with average of continuous 15 minute values received through OCEMS for both days. The composite sample results should not be an outlier.
- Step 14: If the system does not show Standard Error Mean (SEM) within prescribed criteria for any of the parameters, that particular parameter should be recalibrated, as per above procedure.
- Step 15: As COD is the principal component of measurement of these instruments, cross check results of COD of the middle dilution, as sample. If not within 5% range of prepared working solution, perform function check again for COD parameter.
- Step 16: Only (01) sample out of 24 samples (12 samples per day for two calibration days) shall be sent to SPCBs/PCCs or CPCB lab for cross check, while doing initial calibration of OCEMS in any industry. Sample should again be sent to SPCBs/PCCs or CPCB lab, when system fails in performance and is recommended for re-calibration. The SPCBs/PCCs or CPCB may accept sample only if it is preserved and transported following standard procedure. Report on basic installation and calibration of OCEMS at STPs should be sent to SPCBs/PCCs and CPCB.
- Step 17: SPCBs/PCCs or CPCB will check the results of STPs sample received with online data and may ask for repeat of basic calibration, if found to be deviating more than acceptable error in standard laboratory method.

2.3 Continuous Validation of OCEMS

The purpose of this exercise is to check the validity of earlier calibration and collection of validated calibration data points for better matrix matching and to authenticate the range of measurement coverage. Frequency of continuous validation by plant operators should be once in 15 (Fifteen) days. The data collected should also be shared through email to CPCB, SPCB/PCCs.

Function 1: OCEMS Function check as above (as per technology used) to be performed once in fifteen days or fortnightly basis.

Function 2: OCEMS Validation through routine calibration library generation, to be performed once in fifteen days or fortnightly basis.

Process of Routine Calibration Library Generation

- Step 1: Pick up one sample of effluent (treated water) from the OCEMS location.
- Step 2: Create data entry point in OCEMS and note down exact date and time along-with Global calibration value at this point of time.
- Step 3: Follow standard sampling procedure for:
- i. sample collection
 - ii. sample preservation
 - iii. sample storage with ice
 - iv. samples deposition
- Step 4: Sample should be given for testing to a EPA recognized laboratory only, which has participated in AQC - proficiency test, within last one year and has passed the criteria successfully.
- Step 4: Collect result from laboratory within maximum seven days from the date of sampling.
- Step 5: Collect copy of certificate of Lab's participation in AQC (as prescribed by CPCB) and its performance results in AQC, with the sample results each time either physically or electronically (email etc.).
- Step 6: Visit OCEMS and enter data point in the library- ensuring that outliers are not entered into the system. Now the system will have one entry added to library. These data points of calibration along-with global calibration value should be available at central portals of respective SPCB/PCC and CPCB.
- Step 7: If data point is an outlier, data entry should not be made in OCEMS, instead repeat the process from step 1 to step 7 again on the same day by picking up the sample again.
- Step 8: If two consecutive validation check samples fall out of range and remains outliers, recommend basic OCEMS calibration again through the supplier.

2.4 OCEMS Performance Check by SPCBs/PCCs

The purpose of this exercise is to check the validity of earlier calibration and collection of validated calibration data points for better matrix matching and to authenticate the range of measurement coverage. OCEMS Performance check may be conducted by authorities like SPCBs/PCCs or by any authorized agency engaged by them once in 30 days or more depending on local requirement. Performance check data may be used to verify the performance of plants w.r.t. prescribed standards.

The data collected may be shared with plant operator. Data points within the ranges, should be made part of library of the OCEMS. More number of points shall provide better results. Efforts should be made to keep information available on web portals of CPCB and SPCB transparently, updated automatically.

- Step 1: Perform function check as above, as per technology used, and routine calibration verification data Library.
- Step 2: Pick up one sample of effluent from the OCEMS location.
- Step 3: Create data entry point in OCEMS and note down exact date and time along-with Global calibration value at this point of time.
- Step 4: Follow standard sampling procedure for
 - i. sample collection
 - ii. sample preservation
 - iii. sample storage with ice
 - iv. samples deposition
- Step 5: Sample should be given for testing in own laboratory or a EPA recognized laboratory only, which has participated in AQC- Proficiency Test, within last one year and has passed the criteria successfully.
- Step 6: Collect result within maximum seven days from the date of sampling.
- Step 7: Collect copy of certificate of Lab's participation in AQC (as prescribed by CPCB) and its performance results in AQC, with the sample results each time either physically or electronically (email etc.).
- Step 8: Visit OCEMS and enter data point in the library- ensuring that outliers are not entered into the system. Now the system will have more than 16 calibration points entries.
- Step 9: If data point is an outlier data entry should not be made in OCEMS, instead repeat the process from step 1 to step 7 again on the same day by picking up the sample again.
- Step 10: If two consecutive performance check samples fall out of range and remains outliers recommend basic OCEMS calibration again through the supplier.

3.0 Other Calibration Requirements

- a. Sampling procedure
 - Precaution should be taken while taking the sample for OCEMS validation and performance verification. The water sample pick up point should be same, where OCEMS is operating.
 - Sample should be collected from the outlet of final treatment water storage tank from the instrument measuring-window location.

- Standard sampling procedure should be followed to pick up/storage/transport/preserve the samples. The samples collected should be submitted to the lab within maximum 24 hours.
- Since, exact sampling time plays significant role in the validation of data, sample pick up date and time should be endorsed in the instrument.
- Snapshot of the instrument at sample pick up time should be taken for results entry into the system later.
- Calibration status of OCEMS should be recorded by means of recording number of calibration data points available in the system. Here, data points means the results of lab against data of instrument and Global Calibration values entered in the system. Snapshot can be taken to collect these three data sets.

b. Calibration procedure:

To get better results through OCEMS, adaptation of water matrix/Pollution load is a key point which should be done through sampling as mentioned above and finally based on result multipoint Calibration should be done.

- Results of water samples given to a laboratory, during initial installation or validation or performance verification of OCEMS, for testing must be obtained within five days of sampling.
- Lab result entry must be made in the software of OCEMS within seven days against the same calibration point created at the time of sample pickup. date and time with the template snapshot taken during sampling should be used for data matching and records entry.
- Lab results can be entered in the system, only if results do not fall in criteria of outliers.
- In case results do not fall in the above criteria for two times consecutively, the system Basic installation calibration should be recommended.

4.0 Recommended Outliers:

Outliers have to be calculated on the basis of calculation of SEM (Standard error mean) in the lab results obtained during initial calibrations, continuous validation and performance verification. The SEM can be calculated through excel sheets as per formula applied: $STDEV.S(G1:Gn)/SQRT(COUNT(G1:Gn))$

The recommended Criteria of outliers derived from standard error mean limits for different parameters is as below:

- pH: SEM(Standard error mean) should not be more than 5
- BOD: SEM(Standard error mean) should not be more than 20
- COD: SEM(Standard error mean) should not be more than 10

- TSS: SEM(Standard error mean) should not be more than 10

Protocols of other technologies used in field will be developed in the next version of protocol.

ANNEXURE - C- 10/1**Related to Chapter 10- Use of treated Waste water**

**OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA 8 INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI – 110003**

No. YPMC/2019/395

Dated: 31/12/19

**Subject: Minutes of the meeting held on 19.12.19, 26.12.19 and 30.12.19
regarding sealing of bore-wells in parks**

Lists of those who attended the meetings are attached.

All District Magistrates had been called to attend the meeting in connection with sealing of bore-wells in parks. However their presence was also used to review enforcement action under the Septage Management Regulations 2018. YMC took up both matters with the District Magistrates and representatives of New Delhi Municipal Council, Delhi Development Authority, Delhi Municipal Corporations, Public Works Department and Delhi Jal Board.

Enforcement action related to Septage Management Regulations

District wise position of impounding vehicles and imposition of penalty was not readily available and DM North said he would co-ordinate and provide a consolidated response. The response has been received and shows that only two districts have initiated any action and the officers are according low or no priority to this as the table below bears out:

S. No.	District	Details of challans
1.	New Delhi	During inspection two numbers of tankers at NH 8 near Mahipal Pur petrol pump were found discharging Septic Wastage in the sewer line. Two challans of both vehicles were issued by the inspector, SDMC. Two Challans of Rs. 50,000/- each were also issued.

2.	South	12 unauthorised septage tanks seized and penalty imposed.

During the meeting the following issues came up:-

- That the involvement of the traffic police is essential for ensuring that enforcement action is effective. For this purpose YMC would take up with Special Commissioner of Police (Traffic) and bring to his notice that it is necessary for DCP Traffic to coordinate with the District Magistrates. The requirement was that the representative of traffic police should attend the monthly meetings on septage management chaired by the DMs.
- The DJB representative placed on record that there are already 86 notified Sewage Pumping Stations (SPS's) and the requirement is for septage to be deposited at the designated points only. A suggestion was made that although the Septage Management Regulations only refer to registered tractors/trollies carrying Septage to the SPS, in the interest of depositing the septage only as designated sites, unregistered contractors who have not been registered so far could be given access to SPS' to enable them to deposit the septage which is otherwise going into the storm water drains, water bodies and forest areas. This ultimately flows into the larger drains or into the river or alternately seeps into the ground and pollutes the ground water. Sh. D.K Vaishya Chief Engineer DJB said that there will not be any problem in accepting septage from unregistered vehicles.
- Connected with this suggestion it was highlighted that the objective of the Septage Management Regulations was not confined to collection of septage alone but to also to see that the unregistered operators who were employing casual labourers without any safety equipment, masks, gloves etc. and subjecting the labour to hazardous conditions had to be eliminated. Therefore the operation of such unregistered vehicles carrying septage is a public health hazard and risky for those who undertake the job. To give them licence to deposit the septage in the SPSs' would give legitimacy to their operations and would derail enforcement action. Now that the Regulations have issued It was essential that DJB expedites the scheme of Government contracted Trucks/vehicles to pick up the septage which had already received wide publicity. If unregistered collectors are to be in the interregnum

permitted it should have approval of the competent agency even as a temporary measure. The Chief Engineer DJB said that the scheme of trucks collecting the septage was to become operational in December 2019 but has now been postponed to January 2020. This requires to be fast-tracked to prevent environmental damage and risk to contract labourers operating the unregistered tractor trolleys as apart from being an environmental hazard it was a hazard for human health.

- The District Magistrates also brought out that although monthly meeting are being held, no representative from DJB attends. The DJB representative is the Member Secretary of the committee but there is no ownership for the work of septage collection or enforcement. The result is that the District Magistrates are unable to take necessary measures as expected of them. In the last meeting held with CEO DJB he had stated that District Magistrates were not holding the meetings. CE DJB Mr Vaishya present in the meeting was not able to explain as to why the DJB Engineers were not attending the meeting called by the DMs. The YMC directed the CE to ensure that the DJB officers attend the meetings convened by the District Magistrates and also directed that the meetings must be held without fail.

Whereas the DM of South East District had held 5 monthly meetings, some like New Delhi, South West, West District held 4 monthly meetings, North East, Central District held 3 monthly meeting, North East Shahdara and South District held 2 monthly meeting and North West District held only 1 monthly meeting. The absence of the Member Secretary (from DJB) in several cases showed poor ownership for implementing the regulations. In future if there is no representative from DJB joins fully prepared or the representation is inadequate, the DMs should inform the CEO DJB and the name of the Member Secretary who absented may also be communicated to the YMC.

- Data received from DJB also shows that there are districts like East, South, Central, Shahdara and North where the collection of septage has been zero. There is clearly a need for better co-ordination, review and analysis within DJB and only blaming the DMs does not represent the full story.

Use of Treated waste Water in Parks owned by Government Agencies:

The progress on using treated waste water showed that the progress on NGT's order to see that parks in within a radius of 5 Kms of an STP was very slow. Action on this direction of NGT had only progressed partially. It was only in respect of the parks of East DMC and North DMC that some movement at all has taken place as follows.

East DMC

Sh. R.K Singh Director of Horticulture informed that they will use treated waste water in 444 parks from January 2020 onwards. This will result in a closure of 430 tube-wells. 43 tube-wells had already been closed after switching over to treated waste water from tankers making a total of 473 closed tube-wells. A scheme had been prepared for covering 1338 parks by laying pipelines up-to DJB's STPs located at Kondli and Yamuna Vihar but due to non-availability of funds, East DMC was not in a position to lay pipelines. However a request has already been sent by Commissioner East DMC to DDA for approval of scheme and providing funds under UDF.

South DMC

South DMC informed that they will use treated waste water in 626 parks out of 6400 parks, which will result in 153 tubewells getting closed. They had already closed 28 tube-wells.

North DMC

Sh. D.N. Sharma Deputy Director (HORT) informed that they are going to close 99 tube-wells in 401 parks, (out of 6095 total number of parks) from January 2020 onwards by hiring water tanks.

New Delhi Municipal Committee

NDMC representative informed that they had acute shortage of water and were unable to use the treated waste water of DJB. They were willing to take water from any location in the vicinity of Sarojini Nagar, Panchkuiyan Road, Mandir Marg, Chankyapuri and Shankar Road. The DJB responded by saying that they already have an STP with good quality

surplus treated waste water near Delhi Secretariat. The NDMC representative was asked to meet the DJB representative in this regard and report to the YMC. The Chief Engineer informed the MC that 36 parks are within the 5 Km radius of STP and work can start from there. He also informed that they have surveyed all the land owning institutions within NDMC area and are making a plan for either seeing that they lift treated waste water or setup their own STP.

DDA

DDA representative informed that they have already closed 35 borewells in Dwarka and West Delhi and are undertaking to close 30 more borewells in another 3 months time all over Delhi. Principal Commissioner Horticulture DDA stated that there are 780 parks under DDA out of which 129 parks fall within the 5 KM radius of STP. Further, considering the size of DDA parks which are quite large these would require 100 if not 1000 tankers per day to ply to supply treated waste of STP through this method. The Principal Commissioner DDA said that they are taking up this issue and he would review it and get back with their action plan for lifting/using treated waste water at present:

- (i) First priority is being given to 20 parks out of 129 parks. The YMC stated that if they are not going to use treated waste water using tankers, and in the absence of making any alternative arrangement, this will be deemed as a violation of NGT's orders which the YMC will have to report to the NGT in its next report. The Principal Commissioner, who has joined only recently, promised that the DDA would reexamine this and inform the YMC soon. He was asked to do it by 31.12.19.
- (ii) DDA was asked to consider setting up smaller STPs for different individual parks by tapping drains. Being much smaller STPs it could be executed as a turnkey project within 4 months. The Principal Commissioner said that he will relook at this issue and come up in a month with an appropriate plan for the entire parks of DDA. This must be done by January 15th so that the status is reported to the NGT in the next report of the YMC.

Forests

The YMC realised that the forest areas were huge and the requirement which the DJB has put forward for providing pipelines for supply of treated waste water had been budgeted by WAPCOS at Rs. 512 Crores. In a separate meeting held with the Forest Department on 30.12.19, Shri Nisheet Saxena, Conservator of Forests informed that there are in all 52 functional borewells presently being operated by the Forest Department of which 17 are in the South, 23 in the West and 12 in the North Divisions. Each borewell draws about 30 lac litres to 300 lac litres of ground water per annum depending upon the requirement in a particular area. In addition 154 tankers are being used by the FD in South Division alone which transport borewell water but the location of such bore wells and whether they are authorized is not known. He also assured that it should be possible to switch over to use of treated waste transported through these tankers within one month. Similar steps can be taken in other Divisions too. He was asked to have matter discussed with the DJB and also internally within the Department and prepare a blue print for use of treated waste water with timelines within a week and submit to the MC by 10.1.20 positively.

It was brought up in the meeting that the DMRC and Railways are also bulk consumers and they are using their own treated water. It is for DJB to verify actual sources of supply and give a redo which would be placed before NGT. This inspection and correlation with DJB's own and other water sources should also be done in December 2019 as this was told to DJB on earlier occasions only.

Enforcement by DMs

Ms Tanvi Garg, District Magistrate, New Delhi District said that the DMs could only start sealing action after alternative arrangements were made for supply of treated water. Only a list of private bore wells which were illegal had been received but no such list had been received for Government agencies and parks. As such no enforcement against Government agencies was possible until the supply of treated waste water was first in place as there would be an outcry.

YMC is of the view that notices could be sent to agencies /Departments using borewell water as a starting point asking them to switch over to the use of treated water within certain timeframe so as to compel them to take action and create infrastructure for

using treated waste water. Else the response is likely to remain lackadaisical. More than letters, one – on- one meeting should be held agency wise to pin them down to a figure and a timeline to start collection of treated water.

Urgent Need for Policy on Use of Treated Waste Water Understood by All Stake holders.

It was apparent during the meeting that the Nodal Department DJB was not pulling its weight and use of treated waste water as a subject appeared to have no ownership. The Chief Engineer concerned Shri Vaishya was unprepared and when the YMC sought data the CE only kept referring to a huge compendium drawn up by the organisation but had no progress to report thereafter. DJB was apparently not working in tandem with the DMCs and other organisations or with the DMs. Other Departments and Agencies were clueless about the overall plans and their roles within that. The meetings to work out demand and supply of treated waste water must be undertaken with each agency individually and a report given as has been done with Forest Department. *This report would be given Agency wise to NGT and as the senior most officer in charge of the subject, CE Mr Vaishya had to organize the implementation of NGT's directions.*

Illegal Borewells in private properties:

It is understood that the illegal bore -wells dug by private farm houses and commercial properties had been identified and some 4000 bore-wells have been sealed and reports are being furnished to various Courts. Since a separate NGT appointed committee is in charge of this the YMC is not pursuing the private establishments. *However the DJB and DMs must have an idea of the alternate sources of water which were being used by these farm houses and commercial properties and there is a need for proactive coordination between DJB and Divisional Commissioner's office and DDA if needed.*

Piped Water supply to Government Agency Parks

The Government Departments and Agencies are numerous and all that DJB seems to have done is to draw up agency-wise cost estimates of piping from the nearest STP to the point of discharge. The number of parks in a radius of 5 Kms of an STP was reported as being more than 11,000. In that case DJB is required to have a better macro idea of the alternatives to be adopted park-wise and Agency wise. The ultimate objective is to stop ground water extraction and encourage conservation of ground water and use water which

has been treated at a very heavy cost and is being thrown back into the river so far only a letter appears to have been written asking for payment for laying pipelines to be made.

Need for Disaggregated Data

DJB should have segregated the data into:

- I. Parks where the tanker alternative is feasible and warranted. If some DMCs have started the process DJB is required to pursue with others which is not being done from the responses received in the meeting.
- II. Parks where piping is a better solution which have to be divided by agency and selected on the basis of data on large scale extraction of ground water. DJB should identify the Blocks where the ground water table is critically low and focus on parks and other activities being carried out there. This information is available with CGWB.
- III. Parks where small decentralized STPs is the best alternative and to start directing the authorities to set up their own treatment.
- IV. A list of commercially/ privately owned properties whose illegal bore wells were sealed/ are in the process of being sealed with corresponding information on alternate supply points being used by these establishments and a plan to see that they use treated waste water mandatorily.

Meeting Held on 26.12.19 Regarding Treated Waste Water

Macro-level picture of use of treated waste water

The use of treated waste water for Horticulture purpose in the parks was found to be moving at a very slow pace. The MC asked the DJB representatives for macro level data and it was indicated that if all parks in a radius of 5 km used treated waste water 21 MGD would be utilized. If all parks regardless of distance were covered approximately 40 MGD would be used.

Whereas two (2DMCs), namely the EDMC and North DMC, had started collection of the water, the rest of the DMCs and other stake holders like DDA seemed to have no ownership for this strategy despite NGT's orders. Sh. Vaishya Chief Engineer DJB should provide the YMC an overview of efforts made agency wise and state why the orders of NGT were being negated.

Permanent Solution and WAPCOS Assessment of need for Piped System to Carry Treated waste water to Parks / Forest areas.

The CEO DJB should hold bilateral meetings with those agencies being asked to pay for laying pipelines to start the process as it is only on paper. MC will review progress to see if there is ownership and the feasibility has been gone into as everything cannot hinge on WAPCOS which hasn't, for example, gone into budget availability or the cost-effectiveness of such piping which is huge in some cases (e.g. Forests.). **This should come before 10.1.2020.**

DJB Action Plan for Utilization of 341 MGD treated water.

The meeting on 27.12.19 was a sequel to this meeting held by DJB under CE Mr Vaishya. The officers that represented DJB namely Sh. D. K. Vaishya, Chief Engineer (SDW) SE, DJB, Sh. M. K Jain, Chief Engineer (Dr.) Pr. II and Shri B.P Sarswat, SE (Dr. (Pr) IV referred to the Action Plan which had been filed before NGT through an affidavit in April 2019 in which the total utilization of 341 MGD treated effluent had been planned. It had referred to the involvement of the Governments of UP and Haryana and the need for approval of Upper Yamuna River Board (UYRB). The idea was firstly, to carry treated water from Coronation STP to Palla and release it into the river to be eventually used as raw water for the Water treatment plant at Wazirabad and secondly, to supply treated waste water to the States for irrigation purposes and in lieu to secure fresh raw water from their share of water at Hathanikund. The MC had referred to this in its report dated 16.1.19 including the **Annexure C-10/1** of that report. The former CEO DJB and Member Drainage had both referred to this plan but the MC's meeting only revealed that there had been no movement on this between April and December 2019 as UYRB has not conveyed approval. It was not clear whether even notional agreement of the states of UP and Haryana had been obtained. However a payment of Rs70 lakhs had been made to UP for having a consultancy report generated. The action plan for large scale use of treated waste water did not seem to be a priority.

The YMC will hold a meeting with CGWB and the representative of UYRB and DJB to determine how best this can be taken forward. There was scope for commercial/industrial/farmhouses to use this water .The progress of the Action plan submitted to NGT in April 2019, will be monitored besides the status of water use by private properties and its source.

No identification of borewells sunk by different Government agencies has been prepared by DJB and nor are DMs pursuing that. DJB and Divisional Commissioner should have a joint plan to get the larger Government bodies to take treated waste water in lieu of ground water extraction.

The CGWB has a clear idea of the ground water table in different blocks. Out of 34 blocks 22 are categorized as over exploited, 2 as critical and 7 as semi-critical. Coordination with CGWB is, therefore, required to decide where the use of treated waste water is non-negotiable because of critical depletion of water table. The strategies for mandatory rain water harvesting and deterrent action against the tanker mafia is needed to be dovetailed.

A meeting to review all these matters will be held in mid-2020 but by 10.1.20 the MC may be given a comprehensive report on the issues above along with supporting data.

Sd/-
Shailaja Chandra,
Member,
Monitoring Committee for Yamuna

Sd/-
B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

To:

1. CEO, DJB
2. VC, DDA,
3. Chairperson, NDMC.
4. Divisional Commissioner, GNCTD.
5. Commissioner, South DMC.
6. Commissioner, North DMC.
7. Commissioner, East DMC.
8. PCCF Forest Department, GNCTD
9. All District Magistrates.

CC: OSD to Chief Secretary for information of CS.

Address: Room No. 58, India International Centre
40, Max Mueller Marg, New Delhi – 110003
Telephone No: 011- 24609270
Email id: rymonitoringcommittee@gmail.com



DELHI POLLUTION CONTROL COMMITTEE
DEPARTMENT OF ENVIRONMENT, GOVT. OF NCT OF DELHI
5TH FLOOR, ISBT BUILDING, KASHMERE GATE, DELHI-110006
visit us at : <http://dpcc.delhigovt.nic.in>

F.No. DPCC/Plg/IM/2006/1111

Dated: 25/07/17

Subject: Revised directions u/s 5 of the Environment (Protection) Act, 1986 read along with Water (Prevention and Control of Pollution) Act, 1974 for the immersion of idols on festive occasions (central act, 29 of 1986).

Whereas, on festive occasions such as Ganesh Chaturthi, Durga Puja, Saraswati Puja etc., it has been a tradition to immerse idols in water bodies like rivers, lakes, ponds, wells etc. Consequent pollution of such water bodies has been a matter of concern and there have been public interest litigations as well. In addition to silting, toxic chemicals used in making idols tend to reach out and pose serious problems of water pollution. Studies carried out to assess deterioration in water quality due to idol immersion reveal deterioration of water quality in respect to Conductivity, Bio-chemical Oxygen Demand and Heavy Metal Concentration.

And whereas, Central Pollution Control Board has issued the Guidelines for immersion of idols and other puja materials reaching in the water bodies during festival.

And whereas, the chemical paints, colours and dyes applied on such PoP idols contain hazardous chemicals / elements like Mercury, Zinc Oxide, Chromium, Lead, Cadmium etc. which cause harmful effects to aquatic life, which when consumed by humans may cause cancer and other diseases including respiratory ailments, skin infections etc. The PoP also contains chemicals elements like Gypsum, Sulphur, Potassium and Magnesium which causes harmful effects to aquatic life (flora & fauna) and in turn causes harmful health effects, if such aquatic life are consumed by human beings.

And whereas, Hon'ble National Green Tribunal (NGT) is monitoring various activities causing pollution in River Yamuna through O.A. No. 6 of 2012 entitled, "Manoj Mishra Vs U.O.I. and Ors" and O.A. No. 300 entitled, "Manoj Mishra and Madhu Bhandhari Vs U.O.I. and Ors" has pronounced various directions w.r.t. any type of visarjan in River Yamuna vide orders dated 13.01.2015 and 16.09.2015. The orders prohibit throwing puja material or any other material like food-grain, oil, etc into river Yamuna except on the designated site. Any person who is found disobeying this direction shall be liable to pay compensation of Rs. 5,000/- on the "Polluter Pays Principle".

And whereas, as per the provisions Section 15 of Environmental Protection Act, 1986 "Who fails to comply with or contravenes any of the provisions of this Act, or the rules made or orders or directions issued thereunder, shall, in respect of each such failure or contravention, be punished with imprisonment for a term which may extend to five years with fine which may extend to one lakh rupees, or with both, and in case the failure or contravention continues, with additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues."

continues after the conviction for the first such failure or contravention".

And Whereas, inspite of directions not to use Plaster of Paris in making idols, several Plaster of Paris (PoP) idols and other non-recommended materials are being used in making Idols/ are being imported from neighboring states for sale in Delhi during the Festivals.

Now therefore, by virtue of the powers conferred under Section 5 of the Environment (Protection) Act, 1986 vide Notification No. S. O. 881 (E) dated 22 / 09 / 1988, by the Ministry of Environment & Forests (MoEF), Government of India; Delhi Pollution Control Committee hereby issues following directions:

A. General Directions for Idol Makers/ Sellers of Idols / Puja Samitis making Idols in-situ:

1. Idols be made only from natural materials as described in the holy scripts. Use of traditional clay for idol is permitted. Uses of Baked clay, plaster of paris, etc. in idol making are hereby prohibited.
2. Painting of Idols be discouraged. In case idols are to be painted, water soluble and nontoxic natural dyes only be used. Use of toxic and non-biodegradable chemical dyes for painting idols is strictly prohibited.

B. General Directions for Pooja Samitis/General Public:

1. Worship material like flowers, decorating material (made of paper and plastic) etc. be removed before immersion of idols and be put at designated places so that the same may be recycled, composted or disposed of in an environmental safe manner.
2. Make small size idols not more than 5 feet in height so that those can be immersed in ponds to be prepared at designated sites.
3. Immerse idols only at the designated places identified by Govt. of NCT of Delhi/ Concerned Municipal Corporation of Delhi.
4. Separate bins/receptacles have been provided on the ingress and egress of all the Yamuna Bridges for placing Pooja Samagri and flowers separately and no pooja material be disposed directly in the river.

C. General Directions for Local Bodies/ Authorities:

1. Bio-degradable materials to be collected separately for recycling or composting.
2. Non-biodegradable materials to be collected separately for disposal in sanitary landfill.
3. Public be educated on ill effects of immersion in the holy water bodies through mass awareness programme.
4. The 'Idol Immersion Points' shall be cordoned off and barricaded. Synthetic liner may be placed in the bottom, well in advance. The said liner shall be removed on the completion of immersion ceremony so that remains of idols would be brought to the bank. Bamboo and wooden logs, if any would be reused. Clay etc. may be taken to sanitary land fill for disposal.
5. Within 48 hours of the immersion of idols, the left over material at idol immersion points on

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the banks of rivers, lakes, ponds, etc. be collected by the local bodies for disposal as per the Guidelines issued by CPCB.

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6. In case of immersion of idols in rivers and lakes, arrangement may be made for construction of temporary confined ponds with earthen bunds for the purpose of immersion of idols. After the completion of immersion, supernatant water may be allowed to flow in river, pond and lake, as the case may be, after checking for colour and turbidity. Lime may be added in temporary confined ponds.
7. In case of immersion of idols in lakes or ponds, all the flowers, leaves and artificial ornaments of idols be removed and idols may be immersed into a corner of pond using removable synthetic liners in the bottom. Post immersion, liners may be taken out along with remains of idols and lime be added to the pond water for settling the solids. De-sludging of the pond be undertaken afterwards.
8. Temporary ponds having earthen bunds should be created as idol immersion spots. Removable synthetic liner may be placed well in advance in bottom of pond. The said liner along with remains of idols be removed from the point within 48 hours of immersion of idols.
9. All the Municipal bodies, Delhi Police shall check the entry of vehicles / Goods carriers entering the Delhi carrying such PoP idols as its cargo, prevent the entry of the vehicle and attach the vehicle / goods carrier and hand it over to the Police Authorities at the nearest Police Check Post / Police Station.

All the Municipal bodies shall also issue relevant directions to all Zonal Offices to identify locations of illegal sale of PoP idols and shall take necessary action against such illegal sale and also to take action against illegal idol making being done without registration with Revenue Department or is done on unauthorized land.
10. The Delhi Police shall issue relevant directions to the Police Officers at the Police Check Post / Police Station, to take appropriate action against the offenders violating these directions.
11. All the Municipal bodies, shall ensure that all permanent and temporary licensed establishments in Delhi do not conduct any sale of PoP idols during Festivals.
12. District Magistrate shall enforce the above directions by issuing relevant instructions to the concerned officials for monitoring and enforcement of the directions. If any person is violating the above directions then Rs 5000/- as environment compensation be levied, collected and deposited with DPCC
13. All local Bodies/Revenue department shall give wide publicity for mass awareness.

All the concerned agencies are also directed to submit Action Taken Report every fortnight w.e.f 1st July, 2019 to Delhi Pollution Control Committee.

(Sanjeev Khirwar)
Chairman

To,

1. The Commissioner, North Delhi Municipal Corporation, 4th Floor, Civic Centre, Minto Road, New Delhi-110002.
2. The Commissioner, East Delhi Municipal Corporation, 419, Udyog Sadan, Patparganj Industrial Area, Patparganj, Delhi 110092
3. The Commissioner, South Delhi Municipal Corporation, 9th Floor, Civic Centre, Minto Road, New Delhi-110002.
4. The Chairman, New Delhi Municipal Council, Palika Kendra, Parliament Street, New Delhi-110001
5. The Chief Executive Officer, Office of Cantonment Board, Sadar Bazar, Delhi Cantt, Delhi-110010.
6. The Divisional Commissioner, Government of NCT of Delhi, 5, Sham Nath Marg, Delhi-110 054.
7. Commissioner of Transport, Transport Department, Govt. of NCT of Delhi, 5/9, Under Hill Road, Delhi-110054.
8. The Commissioner of Police, Delhi Police, 2nd Floor, MSO Building, Police Headquarter, ITO, Delhi - 110002
9. The Commissioner of Industry, Department of Industry, Udyog Sadan, 419 FIE, Patparganj, Delhi-110092
10. All Pooja Samitis (as per list)

Copy to:

1. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi-110032
2. PS to Secretary (Environment) Cum Chairman, DPCC- for kind information to Chairman, DPCC please.
3. Director (Env.)- for uploading at website of Dept of Env, NCT of Delhi
4. Incharge (IT), DPCC- for uploading at website of DPCC.


(Arun Mishra)
Member Secretary



DELHI POLLUTION CONTROL COMMITTEE
 DEPARTMENT OF ENVIRONMENT, GOVT. OF NCT OF DELHI
 5th FLOOR, ISBT BUILDING, KASHMERE GATE, DELHI-110006
 visit us at : <http://dpcc.delhigovt.nic.in>

By Speed Post

F.No. DPCC/Plg/IM/2006/ 2936-2943

Dated: 28/8/19

CORRIGENDUM

Whereas, Delhi Pollution Control Committee issued Directions u/s 5 of Environment Protection Act, 1986 to the Idol makers, sellers of Idol, Puja Samitis, general public and local bodies / authorities for the immersion of Idols for the festive occasions vide Letter No. DPCC/Plg/IM/2006/ 2779-2792 dated 05.07.2019 in compliance to the order of Hon'ble National Green Tribunal.

And whereas, Puja Samitis have approached various forums to reconsider the size of idols which are to be immersed at the designated sites as per clause 2 of Direction B with the assurance that all other directions issued vide above letter shall be adhered to.

And whereas, the matter was examined by a committee headed by Director, Environment, Govt. of NCT of Delhi in a meeting dated 22.08.2019 and the committee taking into consideration the submission of Puja Samitis that 5 feet height would restrict the glimpse of Maa Durga during the large gatherings, recommended for an increase in the size of idol for immersion, provided all other clauses of the Directions are complied rigorously.

And whereas, the competent authority in Delhi Pollution Control Committee, taking into account the sentiments expressed in the representations and after due deliberation has decided to amend the clause 2 of the Direction B issued vide Letter No. DPCC/Plg/IM/2006/ 2779-2792 dated 05.07.2019 as under:

"Make small size idol as far as possible preferably not more than 5 feet in height strictly adhering to all pollution control norms and shall be immersed in the designated artificial ponds in consultation with and under overall supervision of concerned District Magistrate.

For the idol of size more than 5 feet, concerned Puja Samitis to ensure that all pollution norms are strictly adhered to and its immersion is done in designated artificial pond suitable for such size in consultation with and under overall supervision of concerned District Magistrate."

N
 28/8/19
 Member Secretary

To,

1. The Commissioner, North Delhi Municipal Corporation, 4th Floor, Civic Centre, Minto Road, New Delhi-110002.
2. The Commissioner, East Delhi Municipal Corporation, 419, Udyog Sadan, Patparganj Industrial Area, Patparganj, Delhi 110092

1

3. The Commissioner, South Delhi Municipal Corporation, 9th Floor, Civic Centre, Minto Road, New Delhi-110002
4. The Chairman, New Delhi Municipal Council, Palika Kendra, Parliament Street, New Delhi-110001
5. The Chief Executive Officer, Office of Cantonment Board, Sadar Bazar, Delhi Cantt, Delhi-110010.
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9. The Commissioner of Industry, Department of Industry, Udyog Sadan, 419 FIE, Patparganj, Delhi-110092
10. All Pooja Samitis (as per list)

Copy to:

1. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi-110032
2. PS to Secretary (Environment) Cum Chairman, DPCC- for kind information to Chairman, DPCC please.
3. Director (Env.)- for uploading at website of Dept of Env, NCT of Delhi
4. Incharge (IT), DPCC- for uploading at website of DPCC.


28/10/19
Member Secretary



HARYANA STATE POLLUTION CONTROL BOARD
C-11, SECTOR-6, PANCHKULA
Ph. 0172-2577870-73
E-mail: hspcbho@gmail.com

No. HSPCB/WC/1579-1580
To

Dated:- 11-06-2020

1. Smt. Shailaja Chandra, IAS (Retd.),
Member, RYMC.
2. Sh. B.S. Sanjwan, IFS (Retd.),
Member, RYMC.

Sub:- Compliance of Hon'ble NGT order dated 05.03.2020 in OA No. 6/2012 in the matter of Manoj Mishra Vs UOI & Ors.

Sir/Madam,

Kindly refer to the subject noted above.

In this connection, it is intimated that the Hon'ble NGT order dated 05.03.2020 in OA No. 6/2012 in the matter of Manoj Mishra Vs UOI & Ors directed the State of Haryana to ensure action on the pattern of Delhi Government to setup Integrated Drain Management Cell (IDMC) under Chief Secretary and to constitute a special purpose vehicle (SPV) for rejuvenation of Yamuna. Accordingly, the IDMC and SPV for the state of Haryana are constituted by the Government vide letter dated 10.06.2020 (copy enclosed). It has also been decided that IDMC will also be the single agency for remediation and management of all the drains of Yamuna in Haryana. The Haryana Yamuna Monitoring Committee, constituted by the State of Haryana, shall work under IDMC. Further, the ACS, PHED has been made nodal to formulate a policy on "Alternate technologies for management of water in drains" vide letter dated 10.06.2020 (copy enclosed).

Submitted for your kind information please.

DA/As Above

[Signature]
Sr. Env. Engineer (HQ)
For Member Secretary

Endst. No. HSPCB/WC/1581-1582

Dated 11-06-2020

A copy of the above is forwarded to the following for information please.

1. Dr. P.K.M.K Dass, Member, Haryana Yamuna Monitoring Committee.
2. Sh. YK Garg, Member, Haryana Yamuna Monitoring Committee.

[Signature]
Sr. Env. Engineer (HQ)
For Member Secretary

From:

The Additional Chief Secretary to Government of Haryana,
Environment & Climate Change Department, Chandigarh.

To

The Additional Chief Secretary to Government of Haryana,
Public Health Engineering Department.

Memo No. 16/04/2020-3Env.
Dated:- 10.06.2020

Sub: Formulation of Policy on 'Alternate Technologies for Management of Waste Water in Drains' based on CPCB's Report- Reg.

Ref: Directions of Hon'ble NGT dated 05.03.2020 in OA No.6/2012 in the matter of Manoj Mishra Vs UoI and Others- Reg.

Please refer to the above subject and directions of Hon'ble NGT dated 05.03.2020 in OA No. 06/2018 in the matter of 'Manoj Mishra Vs UoI and Others' wherein Hon'ble Tribunal advised the State of Haryana to 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 CPCB, within three weeks.

You are, therefore, requested to formulate a draft policy on 'Alternate Technologies for Management of Water in Drains' and place the same before the 'Integrated Drain Management Committee' of Haryana, for consideration and its approval.

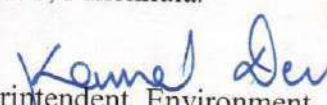
-sd/-
Superintendent Environment,
for Additional Chief Secretary to Govt. Haryana,
Environment and Climate Change Department.

Endst No.16/04/2020-3Env.

Dated:- 10.06.2020

Copy for information to

1. PS to Chief Secretary, Government of Haryana
2. PS to Additional Chief Secretary to Government of Haryana,
Department of Environment and Climate Change.
3. PS to Chairman, Haryana State Pollution Control Board, C-11, Sector-6, Panchkula.


Superintendent Environment,
for Additional Chief Secretary to Govt. Haryana,
Environment and Climate Change Department.

From:

The Additional Chief Secretary to Government of Haryana,
Environment & Climate Change Department Chandigarh.

To

1. Chief Executive Officer, Gurugram Metropolitan Development Authority (GMDA), Plot No. 3, Sector- 44, Near HUDA City Centre Metro Station, Pin-122003, Gurugram (Haryana)
2. Additional Chief Secretary to Government of Haryana, Department of Irrigation and Water Resources.
3. Additional Chief Secretary to Government of Haryana, Department of Public Health Engineering Department.
4. Additional Chief Secretary to Government of Haryana, Department of Urban Local Bodies.
5. Additional Chief Secretary to Government of Haryana, Department of Industries and Commerce.
6. Principal Secretary to Government of Haryana, Department of Development and Panchayat.
7. Principal Secretary to Government of Haryana, Department of Town and Country Planning.
- ✓ 8. Chairman, Haryana State Pollution Control Board, C-11, Sector-6, Panchkula.

Memo No.16/4/2020-3Env.

Dated:- 10.06.2020

Sub: Constitution of Integrated Drain Management Cell for River Yamuna- Reg.
Ref: Directions of Hon'ble NGT dated 05.03.2020 in OA No. 6/2012 in the matter of Manoj Mishra Vs UoI and Others- Reg.

Please refer to the above subject and directions of Hon'ble NGT dated 05.03.2020 in OA No. 06/2018 in the matter of "Manoj Mishra Vs UoI and Others" wherein Hon'ble Tribunal advised the State of Haryana to ensure action on the pattern of Delhi Government to set up 'Integrated Drain Management Cell' (IDMC) under Chief Secretary with representatives of all agencies/ departments and the IDMC shall 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 CPCB, within three weeks.

IDMC will also be the single agency for remediation and management of all the drains of Yamuna in Haryana. The Haryana Yamuna Monitoring Committee, constituted for the State of Haryana, shall work under IDMC.

Accordingly, the 'Integrated Drain Management Committee' for the State of Haryana is hereby constituted with the following members.

Sr. No.	Officer and Department	Designation
1.	Chief Secretary to Government of Haryana	Chairperson
2.	CEO, GMDA	Member
3.	Administrative Secretary, Department of Environment and Climate Change, Government of Haryana	Member

4.	Administrative Secretary, Department of Irrigation and Water Resources, Government of Haryana	Member
5.	Administrative Secretary, Department of Urban Local Bodies, Government of Haryana	Member
6.	Administrative Secretary, Department of Industries and Commerce, Government of Haryana	Member
7.	Administrative Secretary, Department of Development and Panchayat, Government of Haryana	Member
8.	Administrative Secretary, Department of Town and Country Planning, Government of Haryana	Member
9.	Chairman, HSPCB	Member
10.	Administrative Secretary, Department of Public Health Engineering Department, Government of Haryana	Member- Secretary

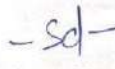

 Superintendent Environment,
 for Additional Chief Secretary to Govt. Haryana,
 Environment and Climate Change Department.

Endst No.16/04/2020-3Env

Dated: 10.06.2020

Copy for information to-

1. PS to Chief Secretary, Government of Haryana.
2. PS to Additional Chief Secretary to Government of Haryana, Department of Environment and Climate Change.


 Superintendent Environment,
 for Additional Chief Secretary to Govt. Haryana,
 Environment and Climate Change Department.

From:

The Additional Chief Secretary to Government of Haryana,
Environment & Climate Change Department,
Chandigarh.

To

1. Chief Executive Officer, Gurugram Metropolitan Development Authority (GMDA), Plot No. 3, Sector- 44, Near HUDA City Centre Metro Station, Pin-122003, Gurugram (Haryana).
2. Additional Chief Secretary to Government of Haryana, Department of Irrigation and Water Resources.
3. Additional Chief Secretary to Government of Haryana, Department of Public Health Engineering Department.
4. Additional Chief Secretary to Government of Haryana, Department of Urban Local Bodies.
5. Additional Chief Secretary to Government of Haryana, Department of Industries and Commerce.
6. Principal Secretary to Government of Haryana, Department of Development of Panchayat.
7. Principal Secretary to Government of Haryana, Department of Town and Country Planning.
- ✓ 8. Chairman, Haryana State Pollution Control Board, C-11, Sector-6, Panchkula.

Memo No.16/04/2020-3Env.

Dated:- 10.06.2020

Sub: Constitution of Special Purpose Vehicle for River Yamuna- Reg.
Ref: Directions of Hon'ble NGT dated 05.03.2020 in OA No. 6/2012 in the matter of Manoj Mishra Vs UoI and Others- Reg.

Please refer to the above subject and directions of Hon'ble NGT dated 05.03.2020 in OA No. 06/2012 in the 'Manoj Mishra Vs UoI and Others', wherein Hon'ble Tribunal directed the Government of Delhi Development Authority (DDA) to constitute a Special Purpose Vehicle for rejuvenation of Yamuna. It was further observed by the Hon'ble Tribunal that the State of Haryana may have their own appropriate mechanism for monitoring and place the same before the Tribunal before next date of hearing. Hon'ble Tribunal has also observed that it should be possible for such SPV set up by DDA and Chief Secretaries of Delhi, UP and Haryana to directly monitor further steps, extensively laid down in the order of the Tribunal dated 11.09.2019 and the order dated 05.03.2020 in a time bound manner.

Accordingly, the 'Special Purpose Vehicle (SPV)' for rejuvenation of River Yamuna in the State of Haryana is hereby constituted with the following members.

Sr. No.	Officer and Department	Designation
1	Engineer in Chief, Irrigation Department.	Chairman
2	Chief Engineer, HQ, Department of ULB	Member
3	Chief Engineer, HQ, Department of PHED	Member
4	Chief Engineer, HQ, Department of TCP	Member
5	Chief Engineer, GMDA	Member
6	Representative from Department of Industries and Commerce, not	Member

	below the rank of Chief Engineer.	
7	Representative from Department of Development of Panchayat, not below the rank of Joint Director.	Member
8	Senior Environmental Engineer, Water Cell, HSPCB	Member-Secretary

The functions of the SPV will include ecological restoration of the flood plain zones, setting up of bio-diversity parks, artificial wetlands, phyto-remediation of drains at the river mouth locations, maintaining the vigil and undertaking flow measurement, creating ecological services, removing encroachments and undertaking other activities including river front development. It may also take steps to attract and educate the citizens and nature enthusiasts for nature related activities including building environmental temper amongst citizenry, without in any manner causing any damage to the flood plains.


 Superintendent Environment,
 for Additional Chief Secretary to Govt. Haryana,
 Environment and Climate Change Department.

Endst No.16/04/2020-3Env.

Dated:-10.06.2020

Copy for information to

1. PS to Chief Secretary, Government of Haryana.
2. PS to Additional Chief Secretary to Government of Haryana,
Department of Environment and Climate Change.

-sd-
 Superintendent Environment,
 for Additional Chief Secretary to Govt. Haryana,
 Environment and Climate Change Department.

Status of STPs in the catchment area of River Yamuna

A. Status of Existing STPs

Sr. No.	Name of STP	Total progress achieved till date	Issues Pending	Road map and timelines for future course of action	Present status	Remarks of HYMC
1.	20 MLD STP at Radaur Road, Yamuna Nagar, PHED	New STP commissioned on 27.08.2019.	Nil	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
2.	10 MLD STP at Baddi Majra, Yamuna Nagar by PHED	New STP commissioned on 27.08.2019.	Nil	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
3.	24 MLD STP at Parwaloo, Jagadhri by PHED	a) Discharge of about 16-17 MLD is reaching to STP. b) Sensor placed to facilitate SCADA operation. c) MLSS is more than 3,000 mg/l with adequate sludge generation. d) Sludge removal centrifuge installed. e) Jamia Millia Islamia University (JMIU) observations attended. STP	Nil	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.

		is achieving Central Public Health and Environmental Engineering Organisation (CPHEEO) norms.				6848
4.	3 MLD STP at Chhachhrauli by PHED	a) STP upgraded with Tertiary Treatment facility. b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
5.	3.5 MLD STP at Radaur PHED	a) STP upgraded with Tertiary Treatment facility. b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
6.	7 MLD STP at Gharaunda, Panipat by PHED	a) New 7 MLD STP commissioned on SBR Technology. b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
7.	6 MLD STP at Nilokheri, Karnal by PHED	a) STP upgraded with Tertiary Treatment facility. b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
8.	4 MLD STP	a) STP	Nil		Complying	The complying status of

	at Nissing Karnal by PHED	upgraded with Tertiary Treatment facility. b) JMIU observations attended. STP is achieving CPHEEO norms				the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
9.	5.5 MLD STP at Tarori by PHED	a) STP upgraded with Tertiary Treatment facility. b) JMIU observations attended. STP is achieving CPHEEO norms	Nil	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
10.	35 MLD STP at Sewah, Panipat by PHED	a) 16 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS – 2400 mg/l with adequate sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
11.	25 MLD STP at Sewah, Panipat by PHED Panipat	a) 14 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS – 2500 mg/l with adequate sludge generation. d) JMIU	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.

		observations attended. STP is achieving CPHEEO norms.				6850
12.	20 MLD STP at Jattal Road, Panipat by PHED	a) 14 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS – 2400 mg/l with adequate sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
13.	10 MLD STP at Jattal Road, Panipat by PHED	a) 6 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS – 2900 mg/l with adequate sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
14.	5 MLD STP at Samalkha by PHED	a) 03 MLD discharge is reaching the STP b) DNIT for upgradation of existing STP from 5 MLD to 7.5 MLD approved and tenders floated, but no agencies	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.

		came forward for bidding. c) JMIU observations attended. STP is achieving CPHEEO norms.				6851
15.	4.5 MLD STP at Kharkhoda Sonapat by PHED	a) 2 MLD discharge is reaching at STP. b) Plant is under stabilization.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
16.	7 MLD STP at Ganaur Sonapat by PHED	a) 4.5 MLD discharge is reaching at STP. b) Plant is under stabilization. c) JMIU observations attended. STP is achieving CPHEEO norms..	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
17.	3 MLD STP at Gohana Sonapat by PHED	a) 2 MLD discharge is being received. b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
18.	8.3 MLD STP at Gohana Sonapat by PHED	a) 6.5 MLD discharge is reaching b) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.

19.	5 MLD STP at Jhajjar by PHED	a) 3 MLD discharge reaching at STP. b) MLSS 2500-3000 mg/l with adequate sludge generation. c) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
20.	5.5 MLD STP at Jhajjar by PHED	a) 4.2 MLD discharge is reaching at STP. b) Sensors being installed. c) MLSS 2500-3000 mg/l with adequate sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
21.	18 MLD STP Line Par, Bahadurgarh by PHED	a) 7.5 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
22.	36 MLD STP at Najafgarh road Bahadurgarh by PHED	a) 10 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS is 2500 to 3500 mg/l	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards

		with adequate sludge generation a) JMIU observations attended. STP is achieving CPHEEO norms.				to the efficacy of the sewage treatment plant
23.	19.5 MLD STP at PGI Rohtak by PHED	a) 10 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS is 2500 to 3500 mg/l with adequate sludge generation d) JMIU observations attended. STP is achieving CPHEEO norms.	Complying	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
24.	40 MLD STP at Sonaria, Rohtak by PHED	Operational deficiencies removed. STP under stabilization.	-		Non-Complying	
25.	3.5 MLD STP at Kalanaur Rohtak by PHED	a) 2.95 MLD discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation.. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
26.	5 MLD STP at Meham Rohtak by PHED	a) 3.9 MLD discharge is reaching the STP b) Diversion of sewage yet to be completed	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the

		c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.				position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
27.	14 MLD STP at Singhpura, Rohtak by PHED	a) 7 MLD discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
28.	4 MLD STP at Sampla by PHED	a) 3.1 MLD discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation.. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
29.	4.5 MLD STP at Tarou by PHED	a) 4 MLD discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
30.	4.5 MLD STP at Punhana by PHED	a) 1.3 MLD discharge is reaching the STP b) Diversion of	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for

		sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.				COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
31.	3.6 MLD STP Nuh by PHED	a) 1.5 Insufficient discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
32.	5 MLD STP at Ferozpur Jhirka by PHED	a) 5 MLD STP made functional and stabilized. Treated effluent is being used by farmers for agriculture purpose. b) Tender flotted for reconstruction of clarifier and reactor. c) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
33.	3 MLD STP at Hassanpur by PHED	a) 1.25 Insufficient discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line

		generation. d) JMIU observations attended. STP is achieving CPHEEO norms.				departments with regards to the efficacy of the sewage treatment plant.
34.	4.5 MLD STP at Hathin by PHED	a) 2.5 Insufficient discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
35.	9 MLD STP at Hodal by PHED	a) 4.6 Insufficient discharge is reaching the STP b) Diversion of sewage yet to be completed c) Insufficient MLSS and Sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
36.	9 MLD STP at Palwal by PHED	a), b) & c) to counter the excess sewage, new STP is being constructed under AMRUT by ULB. Construction of 15 MLD new STP has been under taken by ULB under AMRUT.	-	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
37.	7 MLD STP at Indri Road, Ladwa by PHED	a) 4 MLD discharge is reaching the STP. b) Diversion of sewage yet to be completed. c) MLSS – 3200 mg/l with	Nil		Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards

		adequate sludge generation. d) JMIU observations attended. STP is achieving CPHEEO norms.				to the efficacy of the sewage treatment plant.
38.	30 MLD STP at Sec-19, Panipat by HSVP	Plant is functional and complying	Nil	N.A	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
39.	0.8 MLD STP at Sec-6, Panipat by HSVP	Plant is functional and complying	Nil	N.A	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
40.	7.5 MLD STP at Rajiv Gandhi Edu. City, Phase-I, Sonapat by HSVP	Plant is functional and complying	Nil	N.A	Plant is functional and complying	The Statement of HSVP is not correct. The STP is non functional as the trunk sewer is yet to be connected with the STP.
41.	10 MLD STP at Sec-36, Bahadurgarh by HSVP	Estimate and DNIT for up-gradation of existing STP approved;	Nil	Likely date of completion of work is 31.12.2021.	Non Complying . Estimate and DNIT for up-gradation of existing STP approved and Tender floated	The STP is lying non functional. Untreated sewage from the catchment area being disposed to the adjoining drain.
42.	10 MLD STP at Sec-25, Rohtak by	Estimate and DNIT for up-gradation of 10 MLD STP	Nil	Likely date of completion of work is 31.12.2021.	Non Complying . Upgradati	The STP is lying non functional. Untreated sewage from the catchment area being

	HSVP	approved.			on work will be completed by 31.12.2021	disposed to the adjoining drain. 6858
43.	50 MLD STP at Dhanwapur, Gurgaon by GMDA	Plant commissioned during January 2019	-	-	Meeting the prescribed parameters	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
44.	68 MLD STP at Dhanwapur, Gurgaon by GMDA	Upgradation work completed	-	Work got delayed due to NGT ban on construction to prevent air pollution in the end of 2019 and current epidemic of COVID-19. Work will be completed by 31-08-2020	STP working properly up to secondary treatment meeting the prescribed parameters	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
45.	120 MLD STP at Behrampur by GMDA	All operational deficiencies have been attended.	-	-	Meeting the prescribed parameters.	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
46.	50 MLD STP at Behrampur, Gurgaon by GMDA	Upgradation work completed	-	Work got delayed due to NGT ban on construction to prevent air pollution in the end of 2019 and current epidemic of COVID-19. Work will be completed by 31-08-2020	STP working properly up to secondary treatment meeting the prescribed parameters	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
47.	100 MLD STP at Dhanwapur, Gurgaon by	All operational deficiencies have been attended.	-	-	Meeting the prescribed parameters	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The

	GMDA				rs.	HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
48.	45 MLD STP at Badshahpur, Faridabad by ULBD	The plant has now been made functional after attending shortcomings in respect of repair of parts and operating procedure.	-	-	Non-Complying	The STP is lying non functional. Untreated sewage from the catchment area being disposed to the adjoining drain.
49.	10 MLD STP at Gogharipur Road, Karnal by ULBD	The plant has now been made functional after attending shortcomings	-	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
50.	8 MLD STP at RK Puram, Karnal by ULBD	The plant has now been made functional after attending shortcomings	-	-	Complying	The complying status of the Sewage Treatment Plant cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the sewage treatment plant.
51.	30 MLD STP at Rathdana Road, Sonapat by ULBD	Work of replacement of main trunk sewer line is in progress and likely to be completed by 31.03.2021.		31.03.2021	Non Complying	The STP is lying non functional. Untreated sewage from the catchment area being disposed to the adjoining drain.
52.	25 MLD STP at Kakroi Road, Sonapat ULBD	Work of de-silting and CIPP lining of defunct main trunk sewer line has been allotted	-	31.12.2020	Non Complying	The STP is lying non functional. Untreated sewage from the catchment area being disposed to the adjoining drain.

B. Status of New STP under Construction/Upgradation.

6860

Sr. No.	Name and Address	Total progress achieved till date	Pending issues	Road map and timelines for future course of action	Remark of HYMC
1	25 MLD STP at Radaur Road, Yamuna Nagar, PHED	100%	-	STP under stabilization.	The efficacy of the new STP is yet to be assessed.
2	50 MLD STP at Transport Nagar, Karnal, ULBD	95%	-	Work in Progress Target Date for Completion of all construction work by 30.06.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
3	8 MLD STP Shiv Colony, Karnal, ULBD	53%	-	Work in Progress Target Date for Completion of all construction work by 30.10.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
4	20 MLD STP at Phooshgarh, Karnal, ULBD	55%	-	Work in Progress Target Date for Completion of all construction work by 31.12.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
4	3 MLD STP at Murthal, ULBD	0%	Work not yet started	Work will be started soon after Lockdown and to be completed by 30.06.2021.	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
5	12 MLD STP at Garhi Bohar, Rohak by ULBD	10%	-	Work in Progress Target Date for Completion of all construction work by 31.12.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
6	10 MLD STP at Singhpura, Rohtak by ULBD	72%	-	Work in Progress Target Date for Completion of all construction work by 31.12.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
7	15 MLD STP at Peer Bodhi, Rohak by ULBD	0 %	Land not transferred until now.	Work will be started after transfer of land. Target Date- 30.06.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.

8	1 MLD STP at Sarai Alawardi by ULBD	95%	-	Work in Progress Target Date for Completion of all construction work by 31.10.2020.	The HYMC is of opinion that the Department may not able to complete the work within the target date.
9	1 MLD STP at Gadoli Kalan by ULBD	90%	-	Work in Progress Target Date for Completion of all construction work by 31.10.2020.	The HYMC is of opinion that the Department may not able to complete the work within the target date.
10	2 MLD STP at Mohmadpur Jharsa by ULBD	50%	-	Work in Progress Target Date for Completion of all construction work by 31.10.2020.	The HYMC is of opinion that the Department may not able to complete the work within the target date.
11	7.5 MLD STP at Faridabad by ULBD	78%	-	Work in Progress Target Date for Completion of all construction by 30.09.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
12	10 MLD STP at Kithwari (against Ferozpur, Palwal) by ULBD	33%	-	Work in Progress Target Date for Completion of all construction by 30.11.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
13	15 MLD STP at Jodhpur Road, Palwal by ULBD	33%	-	Work in Progress Target Date for Completion of all construction by 31.07.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
14	2.5 MLD STP at Ferozpur, Palwal by ULBD	33 %	-	Work in Progress Target Date for Completion of all construction by 31.07.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
15	10 MLD STP at Baddimajra, Yamuna Nagar by PHED	80%	-	Work in Progress Target Date for Completion of all construction by 30.09.2020	The HYMC is of opinion that the Department may not able to complete the work within the target date.
16	2 MLD STP at Beri by PHED	0%	-	Work not yet started. Target Date for Completion of all construction by 30.06.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.

17	1.5 MLD STP at Indri, Karnal by PHED	70%	-	Work in Progress Target Date for Completion of all construction by 31.12.2020	The HYMC is of opinion that the Department may not be able to complete the work within the target date. 6862
18	10 MLD STP at Sector-21, Faridabad by ULBD	0%	-	-	• CTE obtained from HSPCB • Land NoC received from land owning agency HSVP. • Forest diversion proposal for Badkhal Lake submitted via FP/HR/Pipeline/ 41348/2019 on 25th July Meeting on the same of REC held on 12th March 2020. • Forest approvals awaited for laying of DI pipe.

C. Proposed STPs

Sr. No.	Name and Address	Total progress achieved till date	Pending issues	Road map and timelines for future course of action	Remark of HYMC
1	20 MLD STP at Jhazgarh by GMDA	Estimate approved. DNIT Under finalization. Work not yet started	-	Administrative approval obtained. Target Date for Completion of all construction work by 31.12.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
2	100 MLD STP at Dhanwapur by GMDA	Estimate approved. DNIT Under finalization. Work not yet started	-	Administrative approval obtained. Target Date for Completion of all construction work by 31.12.2022	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019.
3	15 MLD STP at Sonapat(Aterna) by HSVP	Tender approved; work allotted	N.A	Administrative approval obtained. Target Date for Completion of all construction work by 30.06.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
4	10 MLD STP Rohtak by HSVP	Tender approved work allotted	N.A	Administrative approval obtained. Target Date for Completion of all construction work by 31.07.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
5	30 MLD STP at Faridabad by HSVP	Tender invited work not allotted	N.A	Administrative approval obtained. Target Date for Completion of all construction work by 31.12.2021.	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
6	0.5 MLD STP at Dhankot, Gurugram by GMDA	Estimate and DNIT approved. Work not allotted		Administrative approval obtained. Target Date for Completion of all construction work by 30.09.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
7	2 MLD STP at Bajghera by GMDA	Estimate and DNIT approved. Work not allotted	-	Administrative approval obtained. Target Date for Completion of all construction work by 30.09.2021	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The line department must complete the construction work on or before 31.12.2020.
8	25 MLD STP at Manesar and	DNIT under finalization	-	Administrative approval obtained. Target Date for Completion of all	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019.

	Naharpur Kasan, Gurugram by GMDA			construction work by 31.12.2022	6864
9	80 MLD STP at Mirjapur, Faridabad by ULBD	Tenders Floated	-	Administrative approval obtained. Target Date for Completion of all construction work by 31.07.2022	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019.
10	100 MLD STP at Partapgarh, Faridabad by ULBD	Tenders Floated	-	Administrative approval obtained. Target Date for Completion of all construction work by 31.07.2022	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019.

Progress report regarding laying of sewerage in approved areas.

Sr. No.	Name of town	Length of sewer to be laid(in km)	Length of the sewer laid till date (in km)	Length of Sewer yet to be laid (in km)	Pending issues	Road map for future course of action	Remarks by HYMC, Haryana
1	Jagadhri, ULB	109.32	52.55	56.77	NOCs required from various departments	Target Date 30.11.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
2	Yamunanagar, PHED	0	0	0		100% sewer laid	-
3	Radaur, PHED	2	2	0		100% sewer laid	-
4	Chhachhrauli, PHED	0	0	0		100% sewer laid	-
5	Ladwa, PHED	4.4	4.4	0		100% sewer laid	-
6	Nilokheri, PHED	3.64	1.43	2.21		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
7	Taraori, PHED	4.7	2.72	1.98		Target Date 30.09.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
8	Indri, PHED	7.35	7.35	0		100% sewer laid	-
9	Karnal, ULB	152	122.142	29.858	NOCs required from various departments	Target Date 31.12.2020.	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
10	Nissing, PHED	3.85	3	0.85		Target date 30.06.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
11	Gharaunda, PHED	23.34	8.5	14.84		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
12	Panipat, ULB	211.548	82	129.548	NOCs required from various departments	Target Date 31.07.2021	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
13	Samalkha, PHED	3.7	1.806	1.894		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
14	Gohana, PHED	18	18.05	-0.05		100% sewer laid	-
15	Ganaur, PHED	0	0	0		100% sewer laid	-
16	Sonepat, ULB	63.5	39.35	24.15		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in

							its order dated 11.09.2019. 6866
17	Kharkhoda, PHED	0	0	0		100% sewer laid	-
18	Maham, PHED	0	4.905	-4.905		100% sewer laid	-
19	Rohtak, ULB	174.69	75.173	99.517		Target date 30.02.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
20	Kalanaur, PHED	17	17	0		100% sewer laid	-
21	Sampla, PHED	3.72	3.72	0		100% sewer laid	-
22	Beri, PHED	8.72	0	8.72		Target Date 31.12.2021	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
23	Bahadurgarh, ULB	25	19.6	5.4	NOCs required from various departments	Target date 31.08.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
24	Jhajjar, PHED	3.595	3.595	0		100% sewer laid	-
25	Taoru, PHED	10.07	10.07	0		100% sewer laid	-
26	Gurugram, GMDA	0	0	0		100% sewer laid	-
27	Nuh, PHED	4.857	4.857	0		100% sewer laid	-
28	Ferozepur Jhirka, PHED	4	1.95	2.05		Target Date 31.12.2020 Due to	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
29	Punahana, PHED	25.839	21.4	4.439		Target date 30.04.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
30	Faridabad, ULB	450	318	132		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
31	Palwal, ULB	148.7	76.31	72.39	NOCs required from various departments	Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
32	Hathin, PHED	1.887	1.887	0		100% sewer laid	-
33	Hassan Pur, PHED	4	3.7	0.3		Target date 31.03.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
34	Hodal, PHED	26.82	26.57	0.25		Target Date 31.12.2020	The progress is unsatisfactory. The work will not be completed within the timeline fixed by Hon'ble NGT in its order dated 11.09.2019.
		1516.2	934.0	582.2			

Status of Diversion of sewage in unapproved areas

S.No	Name of Town	Quantity of sewage to be diverted MLD	Quantity of Sewage in diverted In MLD	Quantity of Sewage yet to be diverted MLD	Pending Issues	Road map for future course of action
1&2	Yamuna Nagar & Jagadhri	38.56	3	35.56	NOC pending from some State Govt. departments	The target all work be completed in time line fixed by NGT
3	Radaur	0.3	0.3	0	0	0
4	Chhachhrauli	0	0	0	0	0
5	Ladwa	0.33	0.03	0.3	0	0
6	Nilokheri	0	0	0	0	0
7	Taraori	0	0	0	0	0
8	Indri	0.56	0	0.56	0	0
9	Karnal	4	0	4	Proposal has been submitted to State level technical Committee under AMRUT for approval	The untreated effluent from Narsi Village Part-I & Part-II will be diverted by 30.09.2020
10	Nissing	0	0	0	0	0
11	Gharaunda	0.97	0.97	0	0	0
12	Panipat	19.82	9.5	10.32	28 points yet to be tapped for which sewerage line being laid	Balance 28 points having 10.32 mld discharge) shall be tapped up to Dec.- 2020.
13	Samalkha	0	0	0	0	0
14	Gohana	0.25	0.25	0	0	0
15	Ganaur	0	0	0		
16	Sonepat	21.48	1.83	19.65	0	0
17	Kharkhoda	0	0	0	0	0
18	Maham	0	0	0	0	0
19	Rohtak	3.6	0	3.6	0	0
20	Kalanaur	0	0	0		
21	Sampla	1.3	1.3	0	0	0
22	Beri	0	0	0	0	0
23	Bahadur garh	5.48	1.18	4.3		Tapped all points shall be tapped upto 30-08-2020
24	Jhajjar	0.5	0	0.5		Balance 2 points shall be tapped up to Dec-2020.
25	Taoru	0	0	0	0	0
26	Gurugram	138.69	87.3	51.39	Balance 49 points of 51.30 MLD is yet to be diverted Which is delayed due to ban on construction activity by Hon'ble Supreme Court in NCR region due air pollution and lockdown due to Covid-19	Likely to be completed by 31- 12- 2021 however, subject to availability of labour due to various phases of lockdown in future in view of epidemic of COVID-19

27	Nuh	0	0	0	0	0	6868
28	Ferozepur Jhirka	0	0	0			
29	Punahana	0.5	0	0.5			Laying of sewerline works in wards is under progress
30	Faridabad	0	0	0	30		Tenders for const. of 2 STPs of 100 & 80 MLD capacity have already been floated by MCF. Also 10 MLD STP is being const. by FSCL.
31	Palwal	2.5	0	2.5	0		laying of new sewer line is in progress under AMRUT scheme after completion of this scheme tapping of flow from unauthorized area will be connected to new sewer line.
32	Hathin	0	0	0	Nil		Nil
33	Hassan Pur	0	0	0	Nil		Nil
34	Hodal	0	0	0			
		238.84	105.66	133.18			

Remarks of HYMC :

The complying status of diversion of sewage was not assessed by HYMC due to the Lockdown for COVID-19 pandemic.

Status Common Effluent Treatment Plant

A. Existing CETPs

Sr. No.	Name of CETP	Issues Pending	Road map and timelines for future course of action and timelines	Present status	Remarks of HYMC
1	5 MLD CETP at Industrial Estate, Rai, Sonapat, HSIIDC		CETP Proposed to be upgraded to 10 MLD with addition of Tertiary Treatment facilities. Tender invited. Work not allotted. Short terms measures as suggested by IIT Delhi shall be executed by 31.12.2020. Target date for construction of New CETP is 30.06.2022	Operational	The Existing CETP is not capable to treat the quantum of effluent generated from the Industrial Estate. Partially Treated Effluent will be discharged till the execution of short term and long term action plan i.e., 31.12.2020 and 30.06.22 respectively. Significant quantum of effluent is being discharged to the adjoining drains without any treatment in the existing CETP.
2	16 MLD CETP, Industrial Estate, Barhi, Sonapat, HSIIDC		CETP proposed to be upgraded to 26 MLD. Tender invited. Work not allotted. Short Terms measures as suggested by IIT Delhi shall be executed by 31.12.2020 the Construction of New CETP expected to be completed by 30.06. 2022.	Plant functional and running.	The Existing CETP is not capable to treat the quantum of effluent generated from the Industrial Estate. Partially Treated Effluent will be discharged till the execution of short term and long term action plan i.e., 31.12.2020 and 30.06.22 respectively. Significant quantum of effluent is being discharged to the adjoining drains without any treatment in the existing CETP.
3	4 MLD CETP, Industrial Estate, Kundli, Sonapat, HSIIDC		CETP proposed to be upgraded to 10 MLD. Work allotted. Short Terms measures as suggested by IIT Delhi shall be executed by 31.12.2020 the Construction of New CETP expected to be completed by 31.12.2021	Plant functional but non complying running.	The Existing CETP is not capable to treat the quantum of effluent generated from the Industrial Estate. Partially Treated Effluent will be discharged till the execution of short term and long term action plan i.e., 31.12.2020 and 31.12.2021 respectively. Significant quantum of effluent is being discharged to the adjoining drains without any treatment in the existing CETP.
4	0.2 MLD CETP Industrial Estate, Murthal, Sonapat, HSIIDC		CETP Proposed to be upgraded to 2 MLD with addition of Tertiary Treatment facilities. Tender invited. Work not allotted. Short terms measures as suggested by IIT Delhi shall be executed by 31.12.2020. Target date for construction of New CETP is 30.06.2022	Plant functional and running.	The Existing CETP is not capable to treat the quantum of effluent generated from the Industrial Estate. Partially Treated Effluent will be discharged till the execution of short term and long term action plan i.e., 31.12.2020 and 31.06.2022 respectively. Significant quantum of effluent is being discharged to the adjoining drains without any treatment in the existing CETP.
5	10 MLD			Plant functional,	The complying status of the CETP

	CETP, IMT Rohtak, HSIIDC			no up-gradation needed at this stage. CETP system is treating the effluent properly as it received from industrial estate. No untreated / partially treated effluent being discharged to the environment. The same is being monitored time to time by the representative of HSPCB, which parameters were found in order.	cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to collaborate the observations of the line departments with regards to the efficacy of the CETP.
6	3 MLD CETP, Industrial Estate, Kutana, Rohtak, HSIIDC	-	Re-designing of Existing CETP is being considered. Expert opinion of IIT Delhi for remedial measure shall be undertaken.	Plant under trial run.	The CETP is not complying. Partially treated effluent being discharged to the adjoining drains.
7	2.5 MLD CETP, Industrial Estate, Panipat Refinery Complex, Panipat, HSIIDC	Industries do not exist in the Industrial area.	-	CETP is non functional due to unavailability of effluent.	The efficacy of the non functional CETP cannot be assessed at this stage.
8	12.5 MLD CETP at Sector 16-17, Bahadurgarh, HSIIDC	The CETP is recently constructed. Quantum of effluent reaching to the CETP is very less.	NA	No up-gradation needed at this stage.	The complying status of the CETP cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the CETP.
9	10.5 MLD CETP at IMT Faridabad, HSIIDC		Short terms remedial measures suggested by IIT Delhi shall be undertaken.	No up-gradation needed at this stage.	The complying status of the CETP cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the CETP.
10	55 MLD	-	-	Meeting the	The complying status of the CETP

	CETP at IMT Manesar, Gurugram, GMDA			prescribed parameters.	cannot be assessed due to the Lockdown for COVID-19 pandemic. The HYMC is not in the position to corroborate the observations of the line departments with regards to the efficacy of the CETP.
11	21 MLD CETP(Old) at Sector-29, Panipat, HSVP	CETP is not complying	No target date for upgradation submitted	CETP functional but non complying the provisions of Water Act, 1974.	The CETP is not complying. Partially treated effluent being discharged to the adjoining drains. Target date for complying the standards not submitted.
12	21 MLD CETP(New) at Sector-29, Panipat, HSVP	CETP is not complying	-	CETP functional but not complying the provisions of Water Act, 1974.	The CETP is not complying. Partially treated effluent being discharged to the adjoining drains. Target date for complying the standards not submitted.
13	0.6 MLD CETP at Faridabad Electroplaters Association	CETP is complying	-	-	No action required
14	0.2 MLD CETP at Gurugram Electroplaters Association Sec-37, Gurgaon	CETP is complying	-	-	No action required

B. Proposed CETPs

Sr. No.	Name of CETP	Issues Pending	Road map and timelines for future course of action and timelines	Present status	Remarks of HYMC
1	9 MLD CETP at Industrial Area, Sector-37, Gurugram, HSIIDC	3 Acre Land yet to be transferred to HSIIDC by GMDA. Financial approval pending.	Expected to be completed by Dec, 2022.	-	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. Industrial Effluent being discharge to adjoin sewer system.
2	3 MLD CETP, Industrial Estate, Manakpura, Yamuna Nagar, HSIIDC		i) EC recently received. But, construction not started due to lockdown. ii) Construction of CETP is likely to be started in June, 2020 and to be completed by December, 2021.	To be constructed.	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. The HSIIDC yet to relocate industries operating in the non conforming areas of Jagadhri Yamuna Nagar Towns to the Industrial Estate Manakpura.
3	10 MLD CETP at Industrial Estate, Bahadurgarh, HSIIDC		i) EC Likely to be received by July, 2020. ii) Construction will be started immediately after receipt of EC.	The CETP is likely to be completed by 31.03.2022	The target date is exceeding the timeline i.e., 31.12.2020 fixed by Hon'ble NGT in its order dated 11.09.2019. Untreated/Partially treated Industrial Effluent being discharge to River Yamuna through KBC and Mungeshpur Drain.
4	50 MLD CETP at Partapgarh Faridabad, HSIIDC		Land identified, Financial approval is awaited.	Target date not submitted.	Partially treated effluent being discharge to the Sewage System.
5	25 MLD CETP at Mirzapur, Faridabad, HSIIDC		Land identified, Financial approval is awaited.	Target date not submitted.	Partially treated effluent being discharge to the Sewage System.
6	15 MLD CETP at Badshahpur, Faridabad, HSIIDC		Land identified, Financial approval is awaited.	Target date not submitted.	Partially treated effluent being discharge to the Sewage System.
7	20 MLD CETP at Sector-34, Gurugram, HSIIDC	Land acquisition stayed. Appeal filed in Hon'ble Punjab &	Land identified, Financial approval is awaited.	Target date not submitted.	Partially treated effluent being discharge to the Sewage System.

	HSIIDC	Haryana High Court is pending. Next date of hearing is fixed for 03-07-2020.			6873
8	25 MLD CETP at Manesar, Gurugram, GMDA		Land identified, Financial approval is awaited.	Target date not submitted.	Partially treated effluent being discharge to the Sewage System.

Annexure - C- 14/1**Related to Chapter 14- Creating Public Awareness Through Information
Dissemination Strategies**

**OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA 8 INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI – 110003**

DO No. YPMC/2019/ 68

Dated: 10.01.2019

Dear Minister Sisodia

Thank you for a positive meeting on 24.12.2018 in your office. As Members of the Monitoring Committee constituted by the Hon'ble National Green Tribunal to monitor directions of the Tribunal relating to the abatement of pollution in the River Yamuna and promote its revival. Building public awareness has been a repeated direction of the NGT.

We are providing a Record Note of the Discussions held (attached). We would appreciate it if this could be acknowledged and necessary action started at an early date as the milestones have already been included in the Progress Report being sent to the Hon'ble NGT.

During the meeting you gave several progressive ideas and it is hoped that a series of promotional activities involving school children, the general public and more particularly organized and unorganized clusters of citizens living in different kinds of habitation are planned and started as soon as possible. It was agreed that it was necessary to make school children aware of the connection between their daily lives and the creation and disposal of human, domestic and other waste. The linkage of how this leads to choking of storm water drains and fills them with filth, which ultimately goes to destroy the river needs to be emphasized imaginatively. That, the pollution in the river has given rise to unacceptable levels of faecal coliform, debris (malba) and toxic chemicals and destroyed what could be a beautiful river has to be understood by all concerned. The public, starting with school children should not only understand how

pollution in water bodies, drains and the river affects their own lives but why there is a need for preventive, deterrent and enforcement action if the river as well as peoples' quality of life is to be protected and is to improve.

We look forward to all the positive ideas being given shape at an early date. The Record Note of Discussion may kindly be seen and acknowledged by your office.

With Regards,

Shailaja Chandra,
Member,
Monitoring Committee for Yamuna

Sd/-
B.S. Sajwan,
Member,
Monitoring Committee for Yamuna

To: Sh. Manish Sisodia, Deputy Chief Minister of Delhi & Minister of Education,
A-Wing, 6th Level, Delhi Secretariat, I.P.Estate, New Delhi-110002.

Copy to:

1. Sh. Madhup Vyas, Secretary (Environment & Forest).
2. Sh. Sanjay Goel, Director of Education.

Address: Room No. 58, India International Centre
40, Max Mueller Marg, New Delhi – 110003
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**OFFICE OF THE YAMUNA POLLUTION MONITORING COMMITTEE
APPOINTED BY HON'BLE NGT
ROOM NO. 58, INDIA 8 INTERNATIONAL CENTRE
40, MAX MUELLER MARG, LODHI ESTATE
NEW DELHI – 110003**

Subject: Record Note of Discussions of Meeting held on 24.12.2018 with Deputy Chief Minister of Delhi and the Monitoring Committee set up by NGT on Public Awareness.

At the outset the Monitoring Committee thanked the deputy CM for having invited them for a meeting and explained how there was an urgent need to start awareness campaigns about the pollution in the drains, water bodies the River Yamuna which affects the quality of life of citizens adversely. The MC requested the Deputy CM to start campaigns to build public awareness at the school level which can be expanded to cover all organized and unorganized colonies as a comprehensive approach to stopping pollution but also rejuvenating the water bodies, outfall drains and the river. The subjects discussed are given below:

- (i) The Deputy Chief Minister suggested a meeting with religious leaders of all religions who can be used to convey messages about how households and eventually the residential colonies contribute to the pollution which each family must avoid. Environment & Forests Department was asked to convene a meeting with religious leaders of all religions on the urgent need to combat water pollution caused by human activity which was choking the drains.
- (ii) The Deputy Chief Minister asked the Director of Education to plan an awareness campaign for school children and in particular to organize a painting competition on the banks of the Yamuna to enable children to internalize the message of cleanliness starting with the home but ending with a clean, flowing river.
- (iii) The Deputy Chief Minister indicated that the Government would use prominent NGO's to set up collection points at Wazirabad, ISBT, Signature Bridge, Nizamunddin Bridge which are today being used for throwing Pooja Samagri into the river.

- (iv) Efforts to convert the retrieved waste into agarbattis and other useful products would be promoted. Permanent boards would be put up at prominent places at the entry to the bridges to stop pollution and use special *Pooja samagri* receptacles to be provided specially for this purpose.
- (v) The MC suggested that the Government should set up a Consortium of NGOs and Board members of DPCC to jointly consider and approve small, innovative projects which can lead to reducing pollution and can utilize the Pooja remnants, plastic waste and other recyclable waste material retrieved from the Yamuna to make utility items as is already being done with flower waste at Kanpur. Such initiatives would be a route to build public awareness. Establishing a Consortium serviced by the Department of Environment & Forests would ensure providing flexibility and freedom to the proposed Consortium to approve and fund out of – the –box ideas within systems and procedures that the Consortium can decide.
- (vi) A public awareness campaign was agreed to be undertaken for discouraging agriculture and cultivation of vegetables on the Yamuna Flood plain and by dissuading people from eating such produce as it leads to entry of toxins in the food chain. Enforcement action to stop such sale on the bridges over and leading to the River would be got mounted by the MCD.

Since the pollution of the river has increased manifold the Monitoring Committee requested that an early direction be given to the concerned authorities.

Shailaja Chandra,
Member,
Monitoring Committee for Yamuna

Sd/-
B.S. Sajwan,
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Annexure - C- 14/2**Related to Chapter 14- Creating Public Awareness Through Information
Dissemination Strategies**

SUMMARY REPORT : ACTION PLAN FOR CLEANLINESS OF RIVER YAMUNA							
Directorate of Education							
S. No.	Name of Activity	Place	Date	Number of Schools who participa ted in the Activity	Number of Participants		
					Students participat ed	Teachers involved	HoS
1	Painting Competition	Bank of River Yamuna	12.02.2019	415	800	415	415
2	Demonstration regarding Drainage and Industrial Waste	School Premises, Nearby Locality of School, Thyagraj Stadium, Yamuna River	From July to December, 2019	902	365719	16280	872
3	Pledge taking	School Premises, Nearby Locality of School	Mostly in the month of August to December	1026	10,39,735	66775	1003
4	Tree Plantation Drive	School Premises, Nearby Locality of School	August , September , October 2019	1026	238724	11330	1006
5	Reduce, Reuse and Recycle of Waste Materials	School Premises	Mostly in the month of July to September	1026	456740	20023	1010

6	Eco Friendly Idols Making	School Premises	Mostly in the month of July & August	906	232042	6247	868
7	Slogan Writing and Poster Making Competitions	School Premises and zones/district premises	Mostly in the month of July to September	1026	295868	6837	984
8	Nukkad Natak and Rallies	School Premises and outside location nearer to school	July to November	1005	145101	17215	980
9	Role Plays	School Premises	August to December 2019	948	129262	4348	919
10	Say No to Plastic	School Premises	October 2019	1026	500829	28842	1045
11	Visit to Biodiversity Parks	Yamuna Biodiversity Parks	October to December 2019	721	169315	5767	678
12	Painting and Drawing Competitions	School Premises	July to November 2019	1026	324535	20270	1005
13	Orientation Programme organized by SCERT Delhi	Thyagraj Stadium, Delhi	07.06.2019	1026	2439 HoSs, Eco-Club Incharge, Programme Officers, NSS Incharge of all Govt. Schools and Officers of Directorate of Education participated.		
14	The video of Greta Thunberg full speech at UN Climate change COP24 Conference (available at https://youtube/oC VQdr9QFwy) was shown to the students in the schools. COP 24 Conference Speech (panel Discussion)	School Premises	September to December 2019	908	312160	16821	875

					Number of Participants		
S. No.	Name of Activity	Place	Date	Number of Schools who participated in the Activity	Students participated	Parents who were sensitised on the day of PTM / Annual Day	Parents who were sensitised on subsequent days
1	Mega PTM held on 19.10.2019	School Premises	19-10-2019	1026	738456	662960	338480
2	Mega PTM held on 04.01.2020	School Premises	04-01-2020	1026	605806	506090	262493
3	Annual Day	School Premises	October , November & December 2019	1026	926655	340397	209329