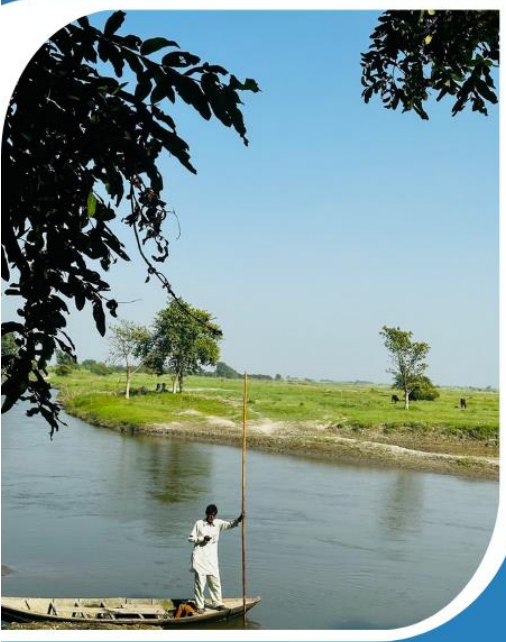
Programme Objectives Series (PROBES)/149/2024

REPORT ON ANNUAL ACTIVITIES UNDER NAMAMI GANGE PROGRAMME 2023



Central Pollution Control Board

Ministry of Environment, Forest and Climate Change

CONTRIBUTION

Planning & Execution	Dr. A. K. Vidyarthi, Director and DH, WQM-II
Report Compilation & Editing	Ms. Reena Satavan, Additional Director, WQM-II Dr. Prabhat Ranjan, Scientist 'B' Dr. Vivek Rana, Research Associate-I Dr. Swati Singh, Research Associate-I
Report Preparation	Ms. Reena Satavan, Additional Director, WQM-II Sh. C. B. Chourasia, Scientist 'E' Dr. Raj Kishore Singh, Scientist 'D' Dr. Pankaj Kumar, Scientist 'D' Dr. Brajesh Srivastava, Scientist 'D' Dr. Priyanka Chaudhary, Scientist 'C' Dr. Prabhat Ranjan, Scientist 'B' Ms. Manu Jindal, Scientist 'B' Dr. Abhas Kumar Maharana, Scientist 'B' Ms. Garima Dublish, Research Associate-III Dr. Firoz Ahmad, Research Associate-III Mr. Vipin Kumar, Research Associate-III Ms. Shraddha Lonarkar, Research Associate-III Ms. Anshul Kumari, Research Associate-III Dr. Jaya Sharma, Research Associate-III Dr. Anu Goel Gupta, Research Associate-III Dr. Jyoti Sharma, Research Associate-II Ms. Yogita Mishra, Research Associate-II Ms. Shivangi Goswami, Research Associate-II Mr. Ashwani Kumar Singh, Research Associate-II Dr. Khyati Mittal, Research Associate-II Dr. Vivek Rana, Research Associate-I Dr. Swati Singh, Research Associate-I Dr. Chandravir Narayan, Research Associate-I Mr. Rakesh K. Ahuja, Senior Technical Supervisor Mr. Ankit Shukla, Senior Research Fellow Ms. Anubha Agarwal, Senior Research Fellow Dr. Divya Raghuvanshi, Senior Research Fellow Ms. Sonam, Senior Research Fellow Mr. Saurabh Garg, Senior Research Fellow
Map Preparation	Ms. Yogita Mishra, Research Associate-II
Regional Directorate Lucknow	Dr. D. K. Soni, Regional Director
Regional Directorate Kolkata	Sh. M. K. Biswas, Regional Director

CONTENTS

EXECUTIVE SUMMARY

'Namami Gange Programme (NGP)', is a flagship programme, initiated by the Union Government in June, 2014 and implemented by NMCG (National Mission for Clean Ganga) and SMCG (State Mission for Clean Ganga) to achieve the twin objectives of abatement of pollution, conservation, and rejuvenation of National River Ganga.

The Central Pollution Control Board (CPCB) is working in tandem with National Mission for Clean Ganga (NMCG) towards abatement of pollution and rejuvenation of the river Ganga, through implementation of three projects, namely, Pollution Inventorization, Assessment and Surveillance on River Ganga (PIAS), Strengthening of Environmental Regulators (SER) and Water Quality Monitoring (WQM) System for River Ganga. CPCB monitors wastewater generation, collection, treatment, and the effectiveness of treatment plants along the Ganga. This report presents various activities undertaken by CPCB during the year 2023 under these projects and findings thereof.

The PIAS project, focuses on identifying pollution sources and evaluating the pollution load entering the Ganga and its tributaries. The WQM project, involves real-time water quality monitoring of the Ganga using bio-monitoring and sensor-based systems. Additionally, CPCB conducts bi-annual bio-monitoring of the Ganga & Yamuna rivers at 42 & 26 locations, respectively. The SER project aims to strengthen the water quality monitoring networks across Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal, in collaboration with State Pollution Control Boards, to meet the mandates of the Water (Prevention & Control of Pollution) Act, 1974.

CPCB is carrying out Annual Inspection of Grossly Polluting Industries operating in Ganga basin states since 2017 by engaging third-party technical institutes in collaboration with State Pollution Control Boards (SPCBs). During 2023, sixth round of annual inspections was carried out and 3186 GPIs were inspected. These GPIs are distributed across various sectors and states, with significant presence in Uttar Pradesh and Haryana. Inspections were carried out on a surprise basis by joint teams from 17 technical institutes and respective SPCBs/PCC, resulting in the identification of 67 cases of non-compliance related to bypass of untreated effluent, non-operational ETPs, or unauthorized operations. Of the 3186 GPIs inspected, 2501 were operational, with 2002 complying with discharge norms or possessing valid consent to operate. Non-compliant GPIs were issued show cause notices or closure directions by respective SPCBs/PCCs. The inspections revealed a total freshwater consumption of 898.72 MLD and wastewater discharge of 402.67 MLD among operational GPIs, contributing to a BOD load of 19.74 TPD. Efforts to reduce pollution included updating sector-specific charters and developing individual action plans for top pollution contributing industries, aiming for a 20-30% reduction in pollution load. Furthermore, CPCB reviewed and updated various industry-specific charters to incorporate stricter environmental norms and encourage compliance. These charters targeted sectors such as pulp & paper, sugar, distillery, textile, and others, setting forth goals for water recycling, pollution prevention, and zero liquid discharge (ZLD). Significant improvements have been observed since 2017, with compliance rates increasing from 39% to 82% and reductions in effluent discharge and BOD load by 28.6% and

47.2%, respectively. Specific freshwater consumption has also decreased due to reuse and recycling initiatives in key sectors like Pulp & Paper, Sugar, Distillery, and Textile. Overall, the annual inspection process has led to enhanced regulatory oversight, improved environmental compliance, and targeted actions towards the polluting industries in the Ganga basin. 34 CETPs located in the Yamuna basin are monitored by CPCB during annual inspection of GPIs to identify gaps in industrial wastewater treatment and the feasibility of establishing CETPs in 27 industrial clusters was found.

CPCB carried out inspections of 1187 Grossly Polluting Industries (GPIs), 8 Common Effluent Treatment Plants (CETPs), and 36 Sewage Treatment Plants (STPs) located in Uttar Pradesh, along the main stems of Rivers Ganga and Yamuna by constituting 40 teams from Head Office and Regional Directorate Lucknow in compliance of the Hon'ble High Court of Allahabad order. Data generated from inspections showed that out of 1080 GPIs inspected, 684 were operational, and 396 were non-operational. Tannery sector has the highest number of non-operational units (44%) during inspections, mainly due to roster/restrictions imposed by UPPCB. Out of 684 operational GPIs, only 333 (48.68%) were found complying. Textile and tannery sectors showed low compliance rates of 34% and 43%, respectively. Higher compliance rates were observed in distilleries (87%) and slaughter houses (81%). Non-compliance issues included effluent norm violations (66% of non-complying GPIs), by-passing of untreated effluents (10%), suspected effluent dilution, absence of necessary consents, and non-compliance with ZLD. Freshwater consumption by GPIs was estimated as 223.81 MLD, with effluent discharge at 123.71 MLD and total pollution load at 5.87 TPD. The chemical sector had largest freshwater consumption (30.5%), while the sugar sector contributed the highest effluent discharge (35%). Pulp & paper sector was responsible for the maximum pollution load discharged (42.1%). Inspection reports were forwarded to UPPCB for initiation of appropriate action as deemed fit.

In compliance with the Hon'ble NGT's directives and public complaints, inspection of 23 pulp and paper units in Muzaffarnagar, seven sugar mills, and five distilleries in various Ganga basin towns such as Laksar, Roorkee, Rampur, Balrampur, and Muzaffarnagar was carried out. In Pulp & Paper sector, the average specific fresh water consumption of these 23 pulp & paper units found as 5.36 KL/MT of the production and average specific effluent discharge was found as 3.28 KL/MT of the production. Significant gaps in estimated and actual plastic waste/boiler ash generation were observed and their end use could not be verified. The gap in estimated and actual ETP sludge generation was found, indicating unscientific disposal or poor record keeping. In sugar sector, reduction in specific fresh water consumption (88%) and specific effluent discharge (43%) was observed in 2023 as compared to 2017. In distillery sector, reduction in specific fresh water consumption (66%) and spent wash generation (41.4%) was observed.

Tri-annual monitoring of eight CETPs & 146 STPs and bi-annual monitoring (pre and post monsoon seasons) of 609 drains discharging into river Ganga or its tributaries were carried out in five Ganga main stem states, namely, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal.

During 2023, total 22 number of monitoring of eight CETPs (tannery cluster-3, textile-2, mixed-3) was conducted for compliance verification and performance evaluation. The total installed capacity of CETPs is 63.3 MLD. The major issues identified in CETPs are non-compliance with treated effluent quality standards, inadequate capacity, outdated treatment technology, and improper operation & maintenance. For improvement in industrial effluent treatment, (i) proper operation and maintenance of CETPs at Rooma, Pantnagar, Sitarganj and Haridwar; (ii) implementation of medium & long term measures as per the charter in tannery clusters of Kanpur; (iii) setting up of common facilities & procurement of chilled/green/brine cures hides as raw material; (iv) regular operation & maintenance of common chrome recovery plant in Kanpur; and (v) upgradation of CETP Banthar due to obsolete technology are recommended.

146 STPs are installed in 68 towns along the River Ganga having total designed treatment capacity of 2589.3 MLD. Various treatment technologies are used across the states, with Sequencing Batch Reactors (SBR), notably predominant in Uttarakhand. In 2023, 437 number of monitoring in three rounds were conducted. The operational and compliance status of monitored STPs were summarized, revealing that only a fraction (11.1%) of operational STPs met notified standards in all rounds of monitoring. The majority of non-compliance for prescribed standards were observed with respect to faecal coliform. Other operational challenges included under-capacity utilization due to incomplete sewerage networks and less sewage generation. Over-capacity operation was also noted, often in cities with significant transient populations. Performance efficiency varied, with some states like Uttarakhand showing high BOD removal efficiency, while others like Bihar had all STPs performing below 70% efficiency. Fifty-five STPs had OCEMS installed at their outlet for continuous monitoring of treated sewage being discharged into surface water; all STPs in Uttarakhand, Bihar, Jharkhand and most in Uttar Pradesh have disinfection systems installed. CPCB has conducted review meetings, communicated findings to state agencies for action on non-complying/non-operational STPs, and issued directions to ensure improved performance and compliance of STPs.

During Pre-Monsoon, 2023, monitoring of 609 drains discharging directly into river Ganga (437) and its tributaries (172) in Ganga main stem states (Uttarakhand: Ganga-81, Banganga & Sukhi-2 & Suswa-Song-4; Uttar Pradesh: Ramganga & tributaries-24, Kali-East-29, Pandu-9, Yamuna-21, Varuna & Moorva-22, Jargo & Ojhala-10, Mansahaita-9, Duar-1; Bihar: Sone-18, Punpun-03, Adari-01, Daha-01, Gandak-01, Budhi-Gandak-06, Panchane-02, Kiul-05 & Gangi-01) were conducted. More than 70% BOD Load and flow is discharged into river Ganga from West Bengal. Out of 609 monitored drains, 182 drains were found tapped (Uttarakhand-67, Uttar Pradesh-95, Bihar-6, Jharkhand-6 and West Bengal-8). During post-monsoon, monitoring of over 700 drains was carried out. Eleven cities, including Dehradun, Meerut, Moradabad, Kanpur, Prayagraj, Varanasi, Patna, Kolkata, Uluberia, Haldia, and Howrah, are responsible for 66% of the total flow and 75% of the total BOD load. Based on monitoring data, CPCB issued letters to SPCBs/NMCG regarding high pollution levels in drains.

Also, 20 rounds of monitoring at 9 river locations (Ganga-8, Pandu-1) and 29 adjoining drains in the Kanpur-Unnao region was completed by CPCB, jointly with the UPPCB during 2023. Notably, high levels of BOD, COD, total chromium, and color were found in certain

drains, indicating the influx of untreated or partially treated industrial effluents. River Ganga, in Bithoor to Fatehpur stretch, was not meeting the primary water quality criteria w.r.t. pH, BOD, and faecal coliforms. River Pandu is identified as a priority I polluted stretch (BOD>30 mg/l).

Manual water quality monitoring of river Ganga during 2023 was carried out by CPCB at 112 locations (Uttarakhand-19, Uttar Pradesh-41, Bihar-33, Jharkhand-04 and West Bengal-15) on main stem of river Ganga through SPCBs. River water quality was meeting the primary water quality criteria for bathing w.r.t. pH, DO and BOD in the entire stretch of river Ganga except marginal exceedance of BOD in the stretches/locations from (i) U/s Kannauj to Purana Rajapur, Kanpur; (ii) Dalmau, Raibareilly; (iii) Ganga bridge, Dheemi (Pratapgarh) and (iv) D/s Mirzapur to Tarighat, Ghazipur in Uttar Pradesh. Stretches/locations found non-conforming in terms of Fecal Coliform (FC) were (i) Nanamau Bridge (U/s Bithoor) to Purana Rajapur, Kanpur (except Bithoor) (ii) D/s Mirzapur to Tarighat Ghazipur (except U/s Varanasi) in Uttar Pradesh, (iii) entire stretch of Bihar except one location namely Arrah Chapra Road bridge, U/s Doriganj; and (iv) entire stretch of West Bengal except four locations namely Farrakha (Murshidabad), Khagra (Behrampore), Nabadip Ghoshpara near Monipurghat and Tribeni near Burning Ghat. The stretches/locations found non-complying in terms of Fecal Streptococci (FS) were from (i) D/s Mirzapur to Tarighat, Ghazipur (except U/s Varanasi) in Uttar Pradesh and (ii) Shitlatala Palta to Serampore in West Bengal. Further, polluted river stretches (PRS) in year 2018 (based on 2016 & 2017 data) and 2022 (based on 2019 & 2021 data) were identified with respect to BOD parameter. The polluted stretches/locations restored in 2023 (based on 2023 data) as compared to 2018 were (i) Haridwar to Sultanpur in Uttarakhand; (ii) River Ganga a/c river Pandu, Kadaghat (Kausahmbi), Prayagraj (Rasoolabad) to U/s Vindhyachal & U/s Varanasi (Vishwa Sundari Bridge) in Uttar Pradesh, (iii) Buxar to Bhagalpur in Bihar and (iv) Khagra Behrampore to Serampore & Ganga at Patikali near Durgachak in West Bengal. CPCB also established a network of 40 Real Time Water Quality Monitoring (RTWQM) stations on river Ganga and its tributaries/sub-tributaries during 2023.

A comprehensive pollution source mapping of River Hindon and its tributaries, including Kali-West, Dhamola, Krishni, and Yamuna was conducted. The river flows through several districts in Uttar Pradesh, originating from Saharanpur and joining the Yamuna at Greater Noida. Monitoring activities were carried out at 66 river locations and 55 adjoining drains, along with groundwater sampling at 31 locations. The objectives included tracing the rivers' courses, characterizing water quality, identifying and quantifying major pollution sources, assessing sewage treatment plants (STPs), monitoring groundwater, and surveying for potential rejuvenation sites. Key findings revealed that 17 river stretches were identified as polluted based on BOD levels greater than 10 mg/l. Pollution hotspots were categorized into two priority levels, with Level I indicating possibility of industrial wastewater impact and Level II indicating dry/encroached stretches or domestic wastewater impact. Groundwater quality assessment showed that 55% of samples were of excellent quality, while 19.3% were good, and the rest varied from poor to unsuitable for drinking. Sewage management evaluation found that many STPs were non-compliant with discharge norms, receiving weak strength sewage and operating below capacity. Industrial pollution control was a significant concern, with 373 Grossly Polluting Industries (GPIs) identified within the river basin. An action plan

proposed for river restoration includes controlling industrial pollution, addressing dairy/cattle farming impacts, maintaining river flow, constructing wetlands, improving sewage and solid waste management, and prohibiting waste dumping in rivers and floodplains.

Water quality monitoring of the River Ganga and its tributaries was assessed to ensure the safety and cleanliness of the waters during Magh Mela, an annual mass bathing event of great religious significance, which is celebrated at the Triveni Sangam in Prayagraj, Uttar Pradesh, from January 6 to February 18, 2023. Monitoring activities included sampling at seven locations along the Ganga and its tributaries such as Dhela, Kosi, Ramganga, Kali-East, and Yamuna, as well as 21 adjoining drains in various districts across Uttarakhand and Uttar Pradesh. Additionally, eight operational Sewage Treatment Plants (STPs) in Prayagraj were assessed for compliance before and after the Magh Mela. At Sangam, Prayagraj, DO levels in River Ganga were 8-11.5 mg/l, BOD was 1.8-5.8 mg/l, and fecal coliform counts ranged from 1.8-35x103 MPN/100 ml. All STPs in Prayagraj were non-compliant with NGT-prescribed sewage discharge norms during the pre-Magh Mela period. However, post-Magh Mela, three STPs remained non-compliant concerning fecal coliform levels. Actions taken by CPCB included issuing directions to State Pollution Control Boards of Uttarakhand and Uttar Pradesh under Section 18 (1) (b) of the Water Act, 1974, to ensure pollution-free condition in river Ganga during the Magh Mela.

Total 136 bio-monitoring events were conducted in two rounds at 42 locations of river Ganga and at 26 locations of river Yamuna to assess the health of the rivers, using benthic macro-invertebrates as bio-indicators. Biological Water Quality Criteria (BWQC) were calculated based on Saprobic Scores, classifying water quality into five categories from Very Good to Severe. Findings revealed varied water quality, with the Ganga showing "Very Good" to "Moderate" classifications depending on the region and pollution levels, and the Yamuna displaying "Good" to "Moderate" quality, with notable issues in urban stretches. Over the past six years, the Ganga has shown overall improvement in biological water quality, particularly in Uttarakhand and Uttar Pradesh. However, some locations continue to struggle with moderate pollution levels. The Yamuna's quality has fluctuated, with certain stretches improving while others, particularly in urban areas, remain moderate.

LIST OF ABBREVIATIONS

A2O: Anaerobic-Anoxic-Aerobic
APCD: Air Pollution Control Device
ASP: Activated sludge process
BDL: Below Detection Limit
BOD: Biological oxygen demand
BRS: Brine recovery system
BSPCB: Bihar State Pollution Control Board
BTT: Bio Tower Technology
CCA: Consolidated Consent to Operate and Authorization
CCRP: Common Chrome Recovery Plant
CETP: Common Effluent Treatment Plant
COD: Chemical oxygen demand
CPCB: Central Pollution Control Board
CPU: Condensate Polishing Unit
CRP: Chemical Recovery Plant
CTO: Consent to operate
DO: Dissolved Oxygen
DPR: Detailed Project Report
EC: Electrocoagulation
ESP: Electro Static Precipitator
ETP: Effluent Treatment Plant
FAB: Fluidized Aerobic Bioreactor
FC: Faecal Coliform
FF: Falling Film
FS: Faecal Streptococci
GPI: Grossly Polluting Industry
JSPCB: Jharkhand State Pollution Control Board
KLD: Kilo liters per day
LTP: Leather Technology Park
MBBR: Membrane Bed Biofilm Reactor
MEE: Multi Effect Evaporator
MLD: Million litre per day
MPN: Most probable number
MPR: Multi Pressure
MSME: Ministry of Micro, Small & Medium Enterprises
MSW: Municipal Solid Waste
MW: Megawatt
NABL: National Accreditation Board for Testing and Calibration Laboratories
NGRBA: National Ganga River Basin Authority
NGT: National Green Tribunal

NMCG: National Mission for Clean Ganga
NOC: No objection certificate
OCEMS: Online Continuous Effluent Monitoring System
OP: Oxidation Pond
PCC: Pollution Control Committee
PETP: Primary Effluent Treatment Plant
PIAS: Pollution Inventorization, Assessment and Surveillance on River
PRS: Polluted River Stretches
RCF: Recycled Fibre
RO: Reverse Osmosis
SBR: Sequential Batch Reactor
SED: Specific Effluent Discharge
SER: Strengthening of Environmental Regulators
SFWC: Specific Fresh Water Consumption
SMCG: State Mission for Clean Ganga
SOP: Standard operating Procedure
SPCB: State Pollution Control Board
SRS-Sulphate Removal System
STP: Sewage Treatment Plant
TCD: Tonnes Crushed Per Day
TF: Trickling Filter
TN: Total Nitrogen
TPD: Tonnes per day
TSS: Total Suspended Solids
UASB: Up flow Anaerobic Sludge Blanket
UKPCB: Uttarakhand Pollution Control Board
ULB: Urban Local Body
UP: Uttar Pradesh
UPJN: Uttar Pradesh Jal Nigam
UPPCB: Uttar Pradesh Pollution Control Board
WB: West Bengal
WBPCB: West Bengal Pollution Control Board
WQM: Water Quality Monitoring
WSP: Waste Stabilization Pond
ZLD: Zero Liquid Discharge

SECTION 1: INTRODUCTION

Dr. Vivek Rana and Dr. Swati Singh

The Ganga River basin is one of the extremely inhabited river-basin in the world constituting 26% of India's land mass (8,61,404 Km^2) and supporting about 43% of its population (448.3 million as per 2001 census). The basin covers 11 states viz., Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Haryana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal, and Delhi. **Fig. 1.1** shows the map of Ganga River basin. The River Ganga originates from Gangotri glacier at Gaumukh in Uttarakhand and drains through five states (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal) covering a distance of about 2525 Kms before emptying into the Bay of Bengal at Ganga Sagar in West Bengal.

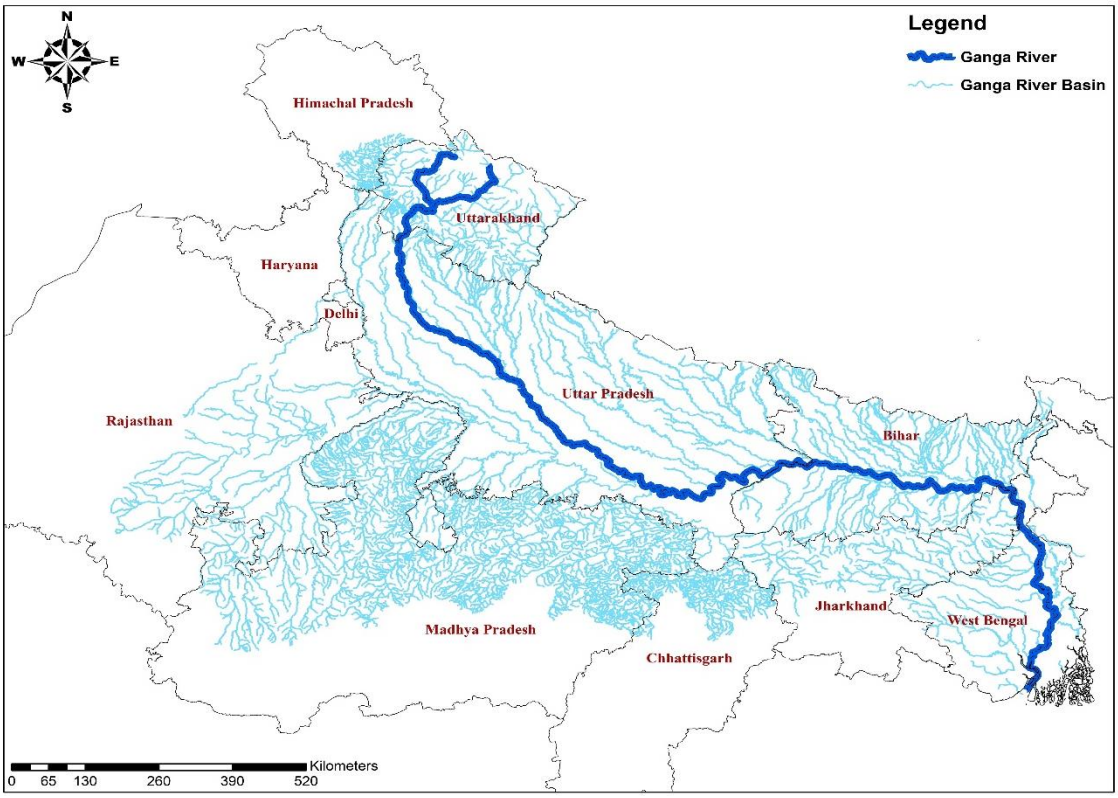


Figure 1.1 Location map showing basin of River Ganga

Despite its profound religious and cultural significance, the River Ganga is currently facing escalating anthropogenic pressures, particularly from rapid industrialization and urbanization over recent decades. Unplanned urban growth and industrial expansion have severely compromised the water quality of the River Ganga, posing a significant threat to biodiversity and sustainability. The main stem of the River Ganga passes through 118 Ganga front towns, collectively generating approximately 3500 MLD sewage. While some of this sewage undergoes treatment, a considerable portion is discharged directly into the river, contaminating its waters. River Ganga is now burdened with incessant sewage flow and substantial volumes of solid and industrial wastes, a result of human and economic activities along its banks and course.

'Namami Gange Programme (NGP)', is a flagship programme, initiated by the Union Government in June, 2014 and implemented by NMCG and SMCG (State Mission Clean Ganga) to achieve the twin objectives of abatement of pollution, conservation, and rejuvenation of National River Ganga.

Central Pollution Control Board (CPCB) is the executing agency (EA) of three projects under NGP. The projects are: Pollution Inventorization, Assessment and Surveillance on River Ganga (PIAS), Strengthening of Environmental Regulators (SER) and Water Quality Monitoring (WQM) System for River Ganga. The PIAS project is a comprehensive initiative of CPCB, supported by NMCG, to conduct thorough monitoring and prioritize remedial measures for pollution abatement in the Ganga basin. The project's scope includes inventorizing sources of pollution, evaluating the pollution burden/load entering the Ganga both directly and via tributaries such as the Banganga, Ramganga, Kali-East, and Pandu. It also includes identification and assessment of quality and quantity of major drains joining river Ganga and its tributaries like river Banganga, Ramganga, river Kali East, river Pandu & Hindon sub-basin (river Hindon, Kali –West and Krishni). The WQM project is funded by the World Bank, for monitoring of water quality of River Ganga through bio-monitoring as well as sensors based real time system. CPCB has been mandated with the responsibility of undertaking continuous Real Time Water Quality Monitoring (RTWQM) of river Ganga. Bio-monitoring of Rivers Ganga & Yamuna and their tributaries is carried out on half-yearly basis (pre- and post-monsoon). SER project includes strengthening of water quality monitoring through a network of 112 locations (Uttarakhand-19, Uttar Pradesh-41, Bihar-33, Jharkhand-04 and West Bengal-15) on main stem of River Ganga under National Water Quality Monitoring Programme (NWMP) in association with State Pollution Control Boards to fulfil the mandate of Water (Prevention & Control of Pollution) Act, 1974 for water quality criteria parameters as per the Standard Operating Procedure (SOP) of CPCB, which stipulates only the parameters to be monitored.

The various activities under these projects are coordinated and executed by WQM-II division of CPCB. However, for Real Time Water Quality Monitoring (RTWQM) of river Ganga WQM-I division and to carry out biomonitoring of Rivers Ganga and Yamuna Bioscience Laboratory at CPCB Head office, Delhi are also engaged. CPCB Regional Directorates at Lucknow and Kolkata are also involved in carrying out monitoring activities of STPs, CETPs, drains, bio-monitoring, industrial inspections etc.

The CPCB carries out regular monitoring of generation of domestic and industrial wastewater and domestic wastewater, their collection and treatment, as well as of the adequacy if ETPs and STPs installed for this purpose along the River Ganga. This report presents the data and outcome of the annual monitoring activities carried out by CPCB during the year 2023.

SECTION 2: INDUSTRIAL POLLUTION CONTROL

Ms. Reena Satavan, Dr. Raj Kishore Singh, Ms. Manu Jindal, Dr. Abhas Kumar Maharana, Dr. Prabhat Ranjan, Ms. Shraddha Lonarkar, Ms. Anshul Kumari, Ms. Shivangi Goswami, Mr. Ashwani Kumar Singh, Ms. Yogita Mishra, Mr. Ankit Shukla, Ms. Sonam

2.1 Annual Inspection During 2023

Grossly Polluting Industries (GPIs) are defined as industries having potential to discharge BOD load of at least 100 kg/day and/or toxic effluent. Inspection of GPIs is being carried out every year in river Ganga basin through third party technical institutes since 2017.

For the sixth round of Annual Inspections (2023), an inventory of 3186 GPIs was updated in consultation with concerned State Pollution Control Boards (SPCBs) of Uttarakhand, Haryana, Delhi, Uttar Pradesh, Bihar, Jharkhand, and West Bengal. For updating of the inventory of 3186 GPIs, 189 GPIs were deleted from 2706 GPIs (updated during 2022) for being dismantled and 669 GPIs were newly added by concerned SPCBs/PCC which were granted consent to operate. State wise changes made in the inventory are shown in **Table 2.1**.

Table 2.1 State-wise changes in GPI inventory from 2022 to 2023

State	GPIs during 2022	GPIs deleted	GPIs newly added	GPIs during 2023
Uttarakhand	69	3	1	67
Haryana	924	89	305	1140
Delhi	210	39	25	196
Uttar Pradesh	1377	57	324	1644
Bihar	66	0	12	78
Jharkhand	5	0	0	5
West Bengal	55	1	2	56
Total	**2706**	**189**	**669**	**3186**

State and sector wise distribution of 3186 GPIs are shown in **Table 2.2**.

Table 2.2 State and sector wise distribution of 3186 GPIs

Sector	Uttarakhand	Haryana	Delhi	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
CETP	3	19	13	7	0	0	0	42
Chemical	2	15	0	10	0	1	2	30
Distillery	4	11	0	73	12	1	3	104
Fertilizer	0	2	0	7	1	0	1	11
Food & Beverages	6	54	3	80	25	1	10	179
Oil & Refinery	0	3	0	1	1	0	1	6
Others	7	405	143	254	9	2	10	830
Pesticide	1	0	0	1	0	0	1	3
Petrochemical	0	1	0	1	0	0	3	5
Pharmaceutical	1	11	0	4	0	0	2	18
Pulp & Paper	33	6	0	98	7	0	18	162
Slaughter House	0	1	1	63	6	0	0	71
Sugar	8	9	0	119	11	0	2	149

Tannery	0	16	0	393	2	0	0	411
Textile	2	587	36	533	4	0	3	1165
Total	**67**	**1140**	**196**	**1644**	**78**	**5**	**56**	**3186**

These 3186 GPIs are located in 121 districts and has the potential to discharge into 45 tributaries/sub-tributaries of river Ganga. Out of total 3186 GPIs in river Ganga basin, 1229 are operating in river Ganga main stem states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal whereas 1957 are operating in river Yamuna main stem states of Uttarakhand, Haryana, Delhi and Uttar Pradesh.

State and sector wise distribution of GPIs in river Ganga and Yamuna main stem stretches are listed in **Table 2.3** and **Table 2.4**, respectively.

Table 2.3 State and sector wise distribution of 1229 GPIs in river Ganga main stem

Sector	Uttarakhand	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
CETP	3	5	0	0	0	8
Chemical	2	10	0	1	2	15
Distillery	3	59	12	1	3	78
Fertilizer	0	7	1	0	1	9
Food & Beverages	5	48	25	1	10	89
Oil & Refinery	0	0	1	0	1	2
Others	7	174	9	2	10	202
Pesticide	0	1	0	0	1	2
Petrochemical	0	0	0	0	3	3
Pharmaceutical	1	2	0	0	2	5
Pulp & Paper	27	43	7	0	18	95
Slaughter House	0	25	6	0	0	31
Sugar	6	101	11	0	2	120
Tannery	0	381	2	0	0	383
Textile	2	178	4	0	3	187
Total	**56**	**1034**	**78**	**5**	**56**	**1229**

Table 2.4 State and sector wise distribution of 1957 GPIs in river Yamuna main stem

Sector	Uttarakhand	Haryana	Delhi-NCT	Uttar Pradesh	Total
CETP	0	19	13	2	34
Chemical	0	14	0	0	14
Distillery	1	11	0	14	26
Fertilizer	0	2	0	0	2
Food & Beverages	1	54	3	32	90
Oil & Refinery	0	3	0	1	4
Others	0	404	143	80	627
Pesticide	1	0	0	0	1
Petrochemical	0	1	0	1	2
Pharmaceutical	0	13	0	2	15
Pulp & Paper	6	6	0	55	67
Slaughter House	0	1	1	38	40
Sugar	2	9	0	18	29

Tannery	0	16	0	12	28
Textile	0	587	36	355	978
Total	**11**	**1140**	**196**	**610**	**1957**

2.1.1 Work accomplished during 2023

The inspections of the GPIs were carried out on surprise basis by the joint teams of officials from third party technical institutes (one faculty member and one Research Scholar) and concerned SPCBs/PCC. During 2023, for inspection of 3186 GPIs, 17 technical institutes were engaged. Approx. 60 teams from 17 technical institutes and SPCBs participated during inspections. The names of technical institutes engaged are listed in **Table 2.5.**

Table 2.5 List of Technical Institutes

S. No	Name of technical institute
1	Aligarh Muslim University (AMU)
2	Central Leather Research Institute (CLRI)
3	Central Pulp & Paper Research Institute (CPPRI), Saharanpur
4	CSIR-Indian Institute of Toxicology Research Lucknow (CSIR-IITR), Lucknow
5	Delhi Technological University (DTU)
6	Harcourt Butler Technical University (HBTU), Kanpur
7	Indian Institute of Engineering Science and Technology (IIEST), Shibpur
8	Indian Institute of Technology, Delhi (IIT-D)
9	Indian Institute of Technology Kharagpur (IIT-Kgp)
10	Indian Institute of Technology Roorkee (IIT-R)
11	Jadavpur University, Kolkata
12	Jamia Milia Islamia (JMI), New Delhi
13	Motilal Nehru National Institute of Technology (MNNIT), Allahabad
14	CSIR- National Environmental Engineering Research Institute (NEERI)
15	National Institute of Technology Patna (NIT Patna)
16	National Sugar Institute (NSI), Kanpur
17	Vasantdada Sugar Institute (VSI), Pune

- Apart from inspections, nodal agencies were identified for compilation of sector specific reports; IIT Delhi for Pulp & Paper and Textile sectors; NSI Kanpur for Sugar sector; VSI Pune for Distillery sector; JMI for Slaughter House; CLRI for Tannery and IIT Roorkee for Food, Dairy & Beverages, Chemical and Others sectors.
- All 3186 GPIs were inspected from February 09, 2023 to June 28, 2023. All inspection reports were uploaded on web-portal by August 24, 2023 for action by concerned SPCBs/PCC and the actions got completed by October 10, 2023. During this period, 34 weekly meetings were organized to review the progress of inspection & report submission by technical institutes and action by SPCBs/PCC. Technical institutes took an average time of 30-90 days for inspection of a GPI and submission of its final report. However, SPCBs/PCC took average time of 30-150 days for scrutiny and completing action on a GPI.
- During inspections, total 67 cases of bypassing the untreated effluent/ non-operational ETP/ entry denied/ unauthorized operation were reported by technical institutes which were forwarded to concerned SPCBs/PCC for necessary action. State-wise details are as follow:

Table 2.6 State-wise details of bypass, entry denied, non-operational ETP and unauthorized operation cases reported

S No.	State	Total cases reported	By-pass	Entry denied	Non-operational ETP	Unauthorized operation
1.	Haryana	15	12	2	0	1
2.	Delhi-NCT	4	4	0	0	0
3.	Uttar Pradesh	47	24	12	5	6
4.	Bihar	1	1	0	0	0
Total		**67**	**41**	**14**	**5**	**7**

2.1.2 Data generation and salient findings

During inspections, out of 3186 GPIs, 2501 were found operational and 685 were non-operational. Out of 2501 operational GPIs, 2002 were complying and 499 were non-complying w.r.t discharge norms or not having valid consent to operate. SPCBs/PCC issued show cause notices to 439 non-complying GPIs and closure directions to remaining 60 non-complying GPIs. **Table 2.7** lists the status of various inspected units.

Table 2.7 Status of inspected GPIs (As on date of inspection)

State	No. of GPIs	Operational	Complied	Non-Complied		Self-Closed	
				SCN	Closure	Temporary Closed	Permanent Closed
Uttarakhand	67	58	48	10	0	9	0
Haryana	1140	940	751	185	4	131	69
Delhi	196	157	107	48	2	13	26
Uttar Pradesh	1644	1234	1013	167	54	367	43
Jharkhand	5	5	2	3	0	0	0
Bihar	78	59	37	22	0	17	2
West Bengal	56	48	44	4	0	8	0
Total	**3186**	**2501**	**2002**	**439**	**60**	**545**	**140**

State-wise map with compliance status of 3186 GPIs of Ganga basin and Yamuna basin shown in **Fig 2.1 to 2.6**.

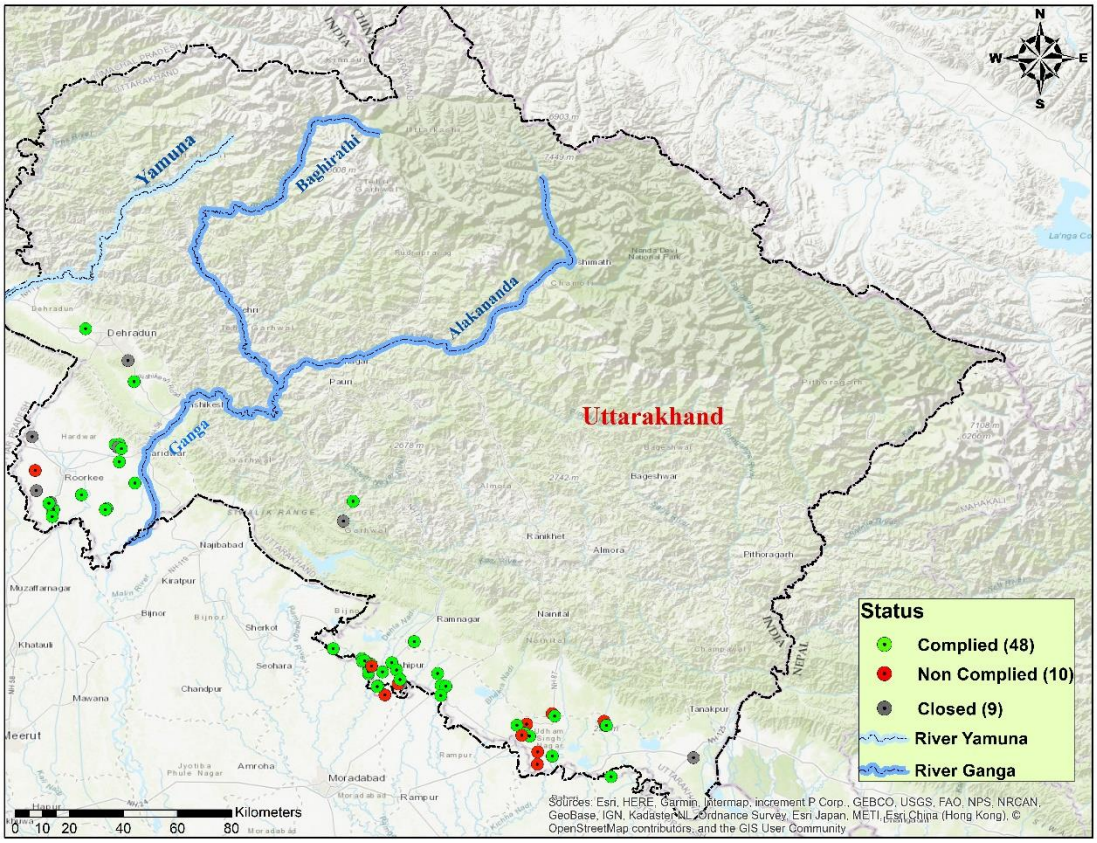


Fig 2.1 Compliance status map of Uttarakhand

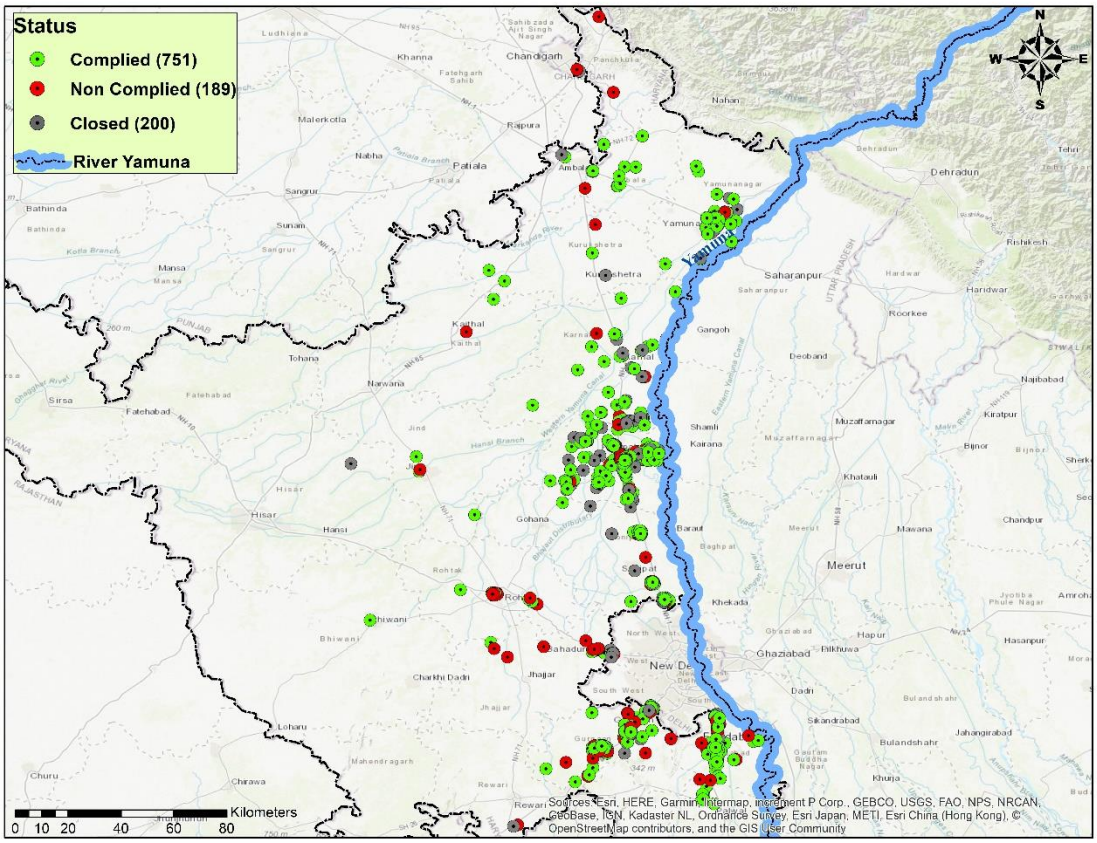


Fig 2.2 Compliance status map of Haryana

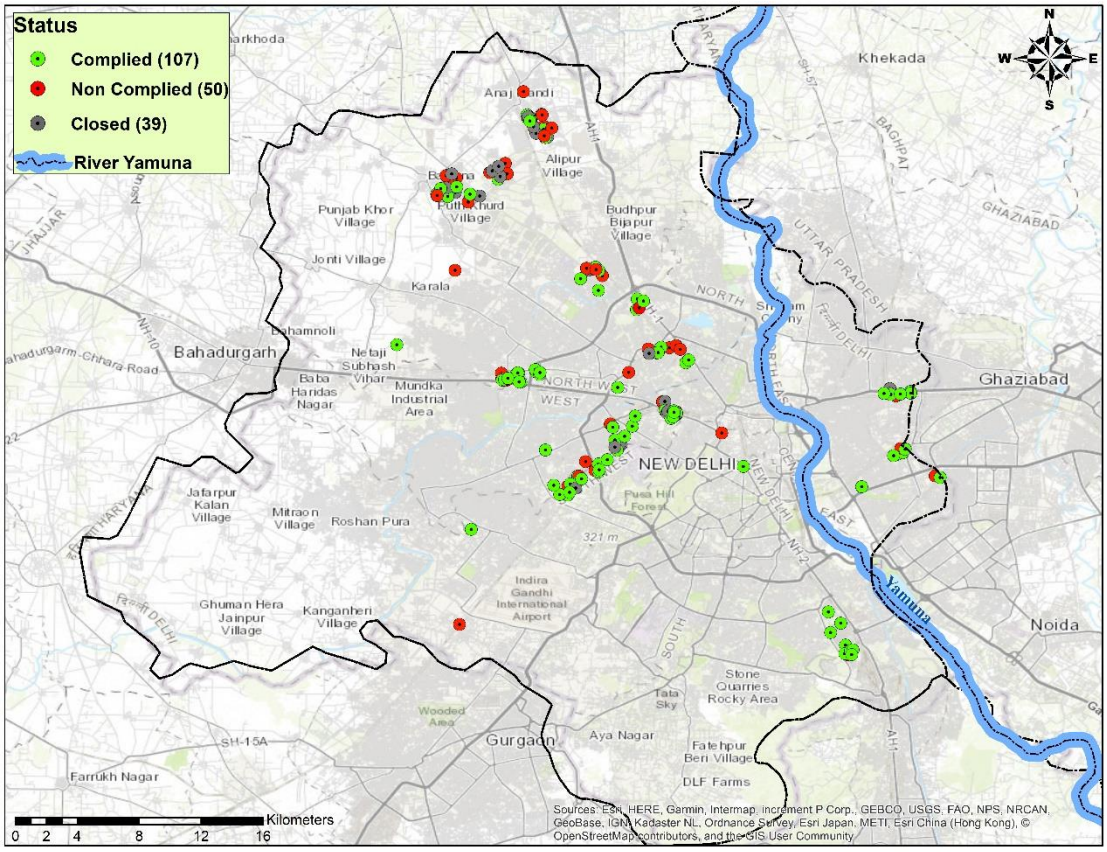


Fig 2.3 Compliance status map of Delhi

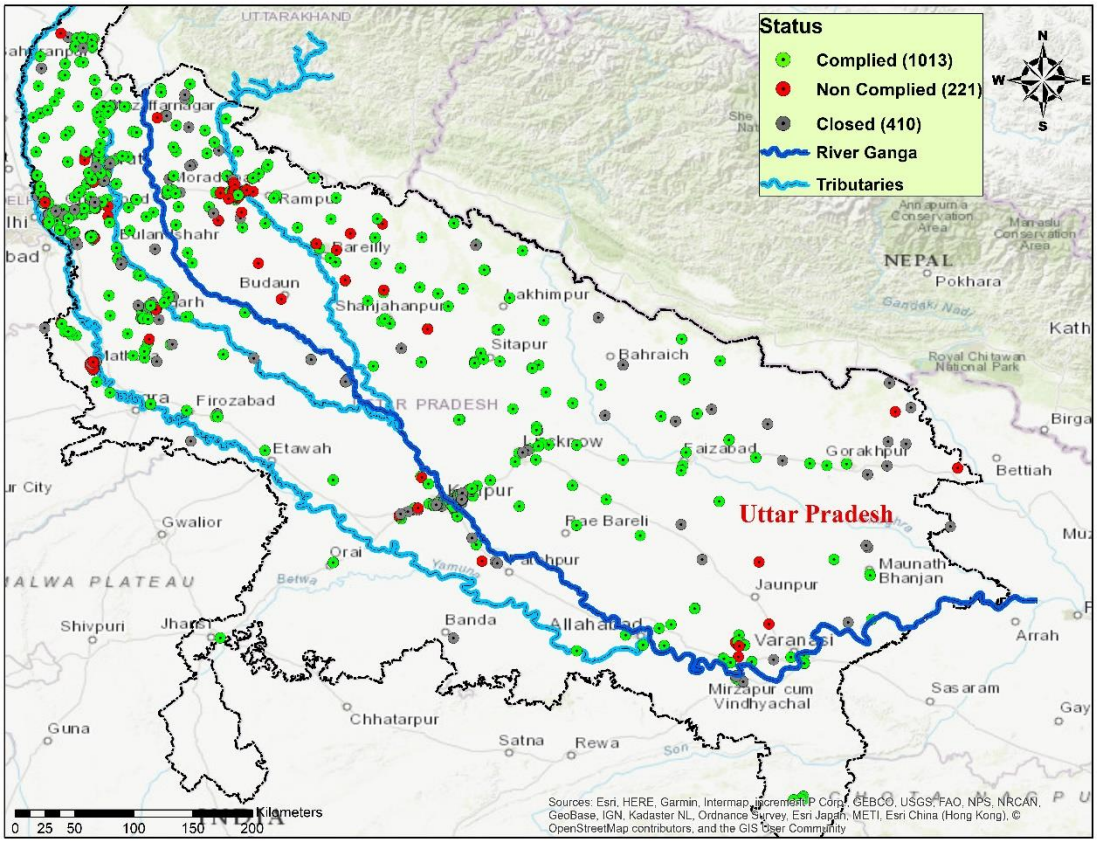


Fig 2.4 Compliance status map of Uttar Pradesh

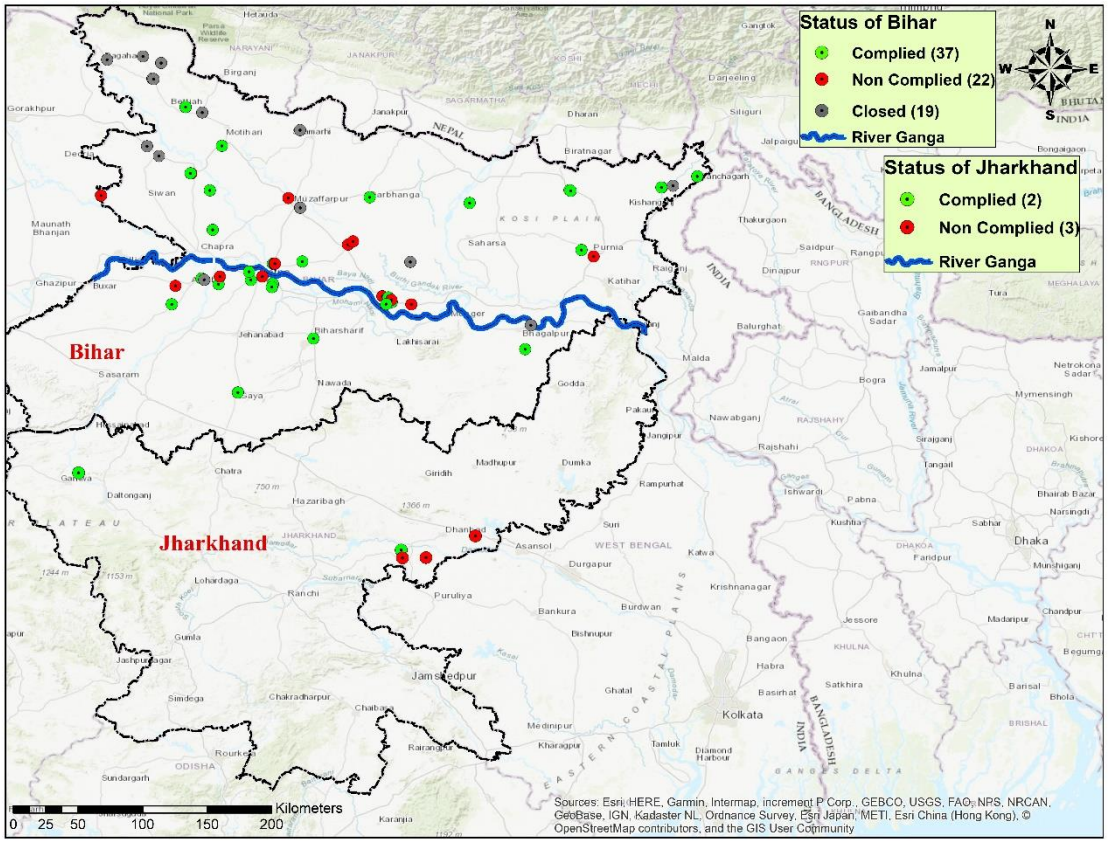


Fig 2.5 Compliance status map of Bihar and Jharkhand

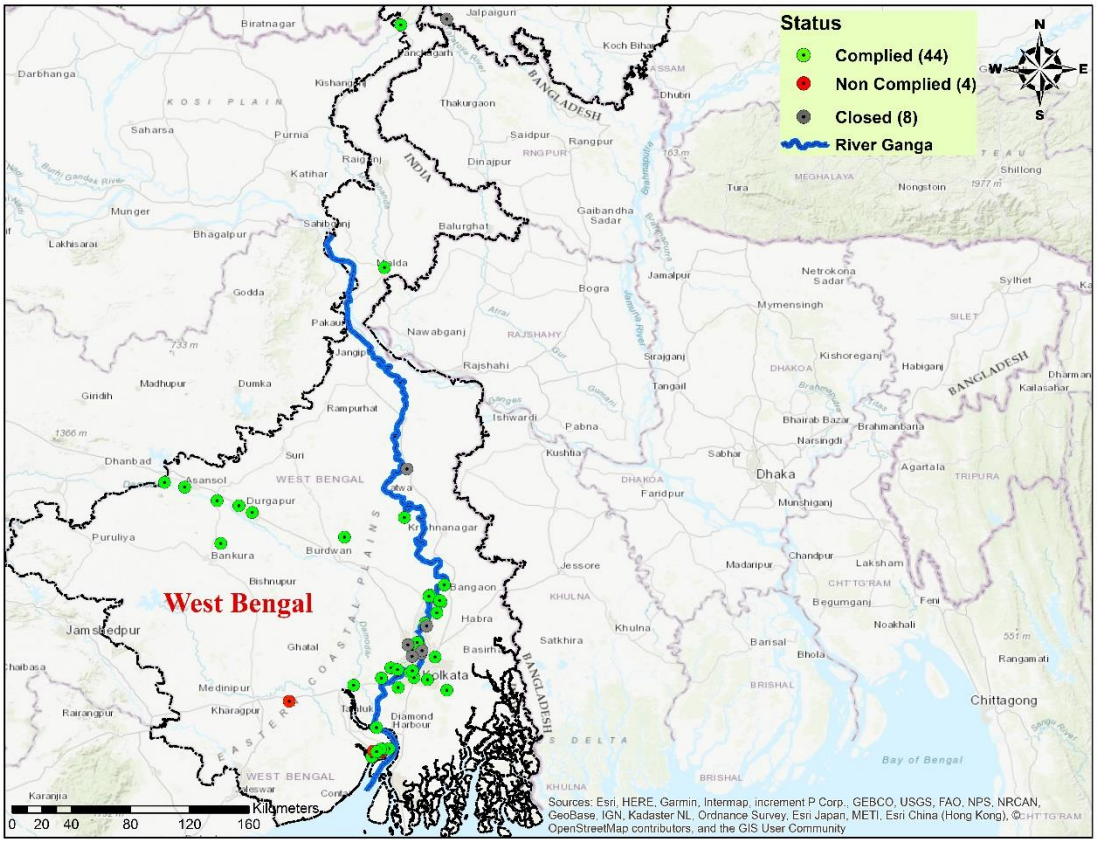


Fig 2.6 Compliance status map of West Bengal

Out of 1229 GPIs operating in Ganga main stem, 968 were operational and 261 non-operational. Out of 968 operational GPIs, 795 were complying and 173 were non-complying w.r.t discharge norms or not having valid consent to operate. SPCBs/PCC issued show cause notices to 143 non-complying GPIs and closure directions to remaining 30 non-complying GPIs. State wise details of GPIs are given in **Table 2.8**.

Table 2.8 State-wise details of complying and non-complying GPIs of river Ganga main stem states (As on date of inspection)

State	No. of GPIs	Operational	Complied	Non-Complied		Self-Closed	
				SCN	Closure	Temporary Closed	Permanent Closed
Uttarakhand	56	52	43	9	0	4	0
Uttar Pradesh	1034	804	669	105	30	210	20
Bihar	78	59	37	22	0	17	2
Jharkhand	5	5	2	3	0	0	0
West Bengal	56	48	44	4	0	8	0
Total	**1229**	**968**	**795**	**143**	**30**	**239**	**22**

Out of 1957 GPIs operating in Yamuna main stem, 1533 were operational and 424 were non-operational. Out of 1533 operational GPIs, 1207 were complying and 326 were non-complying w.r.t discharge norms or not having valid consent to operate. SPCBs/PCC issued show cause notices to 296 non-complying GPIs and closure directions to remaining 30 non-complying GPIs. State wise details of Yamuna main stem GPIs are given in **Table 2.9.**

Table 2.9 State-wise details of complying and non-complying GPIs of river Yamuna main stem states (As on date of inspection)

State	No. of GPIs	Operational	Complied	Non-Complied		Self-Closed	
				SCN	Closure	Temporary Closed	Permanent Closed
Uttarakhand	11	6	5	1	0	5	0
Haryana	1140	940	751	185	4	131	69
Delhi	196	157	107	48	2	13	26
Uttar Pradesh	610	430	344	62	24	157	23
Total	**1957**	**1533**	**1207**	**296**	**30**	**306**	**118**

Closure of GPIs, which are issued closure directions by the concerned SPCBs/PCC is to be ensured through the District Administration through physical verification, sealing of premises, and power disconnection. During 2023, total of 53 District Magistrates have been requested to ensure the closure of 539 GPIs, which were issued closure directions by SPCBs.

Inspection reports submitted by technical institutes were reviewed by CPCB. It was estimated that total freshwater consumption was 898.72 MLD by 2501 operational GPIs. Wastewater discharge was 402.67 MLD having pollution load of 19.74 TPD. State-wise details of

freshwater consumption, wastewater discharge and BOD load are given in **Table 2.10** and corresponding sector-wise details are given in **Fig. 2.7.**

Table 2.10 State-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs

State	No. of GPIs	Operational GPIs	Freshwater consumption (MLD)	Wastewater discharge (MLD)	BOD Load (TPD)
Uttarakhand	67	58	79.05	51.44	1.51
Haryana	1140	940	162.85	73.02	3.35
Delhi-NCT	196	157	2.01	1.12	0.095
Uttar Pradesh	1644	1234	364.13	214.51	13.63
Bihar	78	59	29.04	3.38	0.12
Jharkhand	5	5	56.28	0.52	0.005
West Bengal	56	48	205.36	58.68	1.03
Total	3186	2501	898.72	402.67	19.74

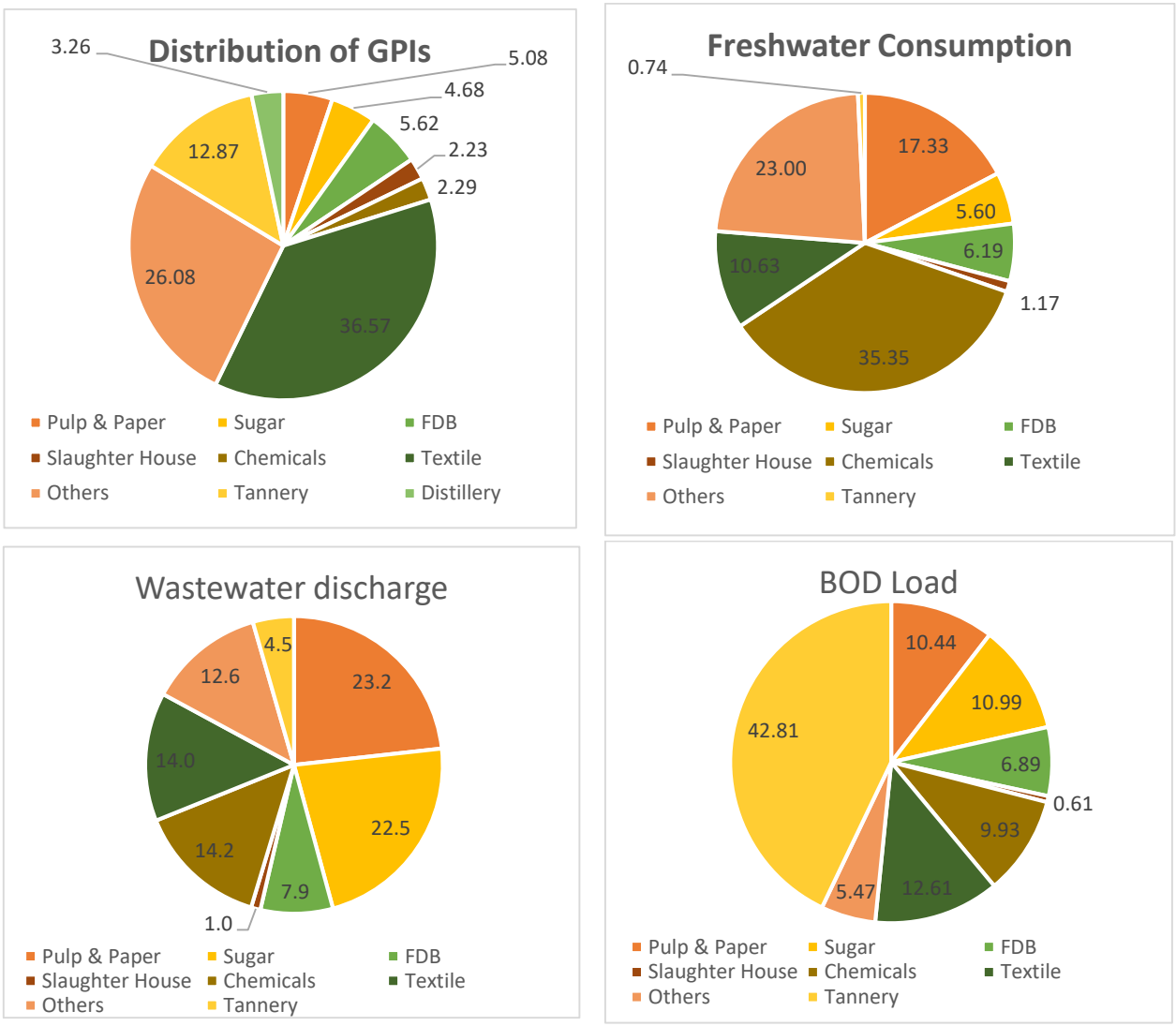


Fig. 2.7 Sector-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs

a) River Ganga main stem

State-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of river Ganga main stem are given in **Table 2.11** and sector-wise details are given in **Fig. 2.8.**

Table 2.11 State-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of river Ganga main stem

State	No. of GPIs	Operational GPIs	Freshwater consumption (MLD)	Wastewater discharge (MLD)	BOD Load (TPD)
Uttarakhand	56	52	76.80	50.28	1.49
Uttar Pradesh	1034	804	234.46	136.45	11.09
Bihar	78	59	29.04	3.38	0.12
Jharkhand	5	5	56.28	0.52	0.005
West Bengal	56	48	205.36	58.68	1.03
Total	**1229**	**968**	**601.94**	**249.31**	**13.73**

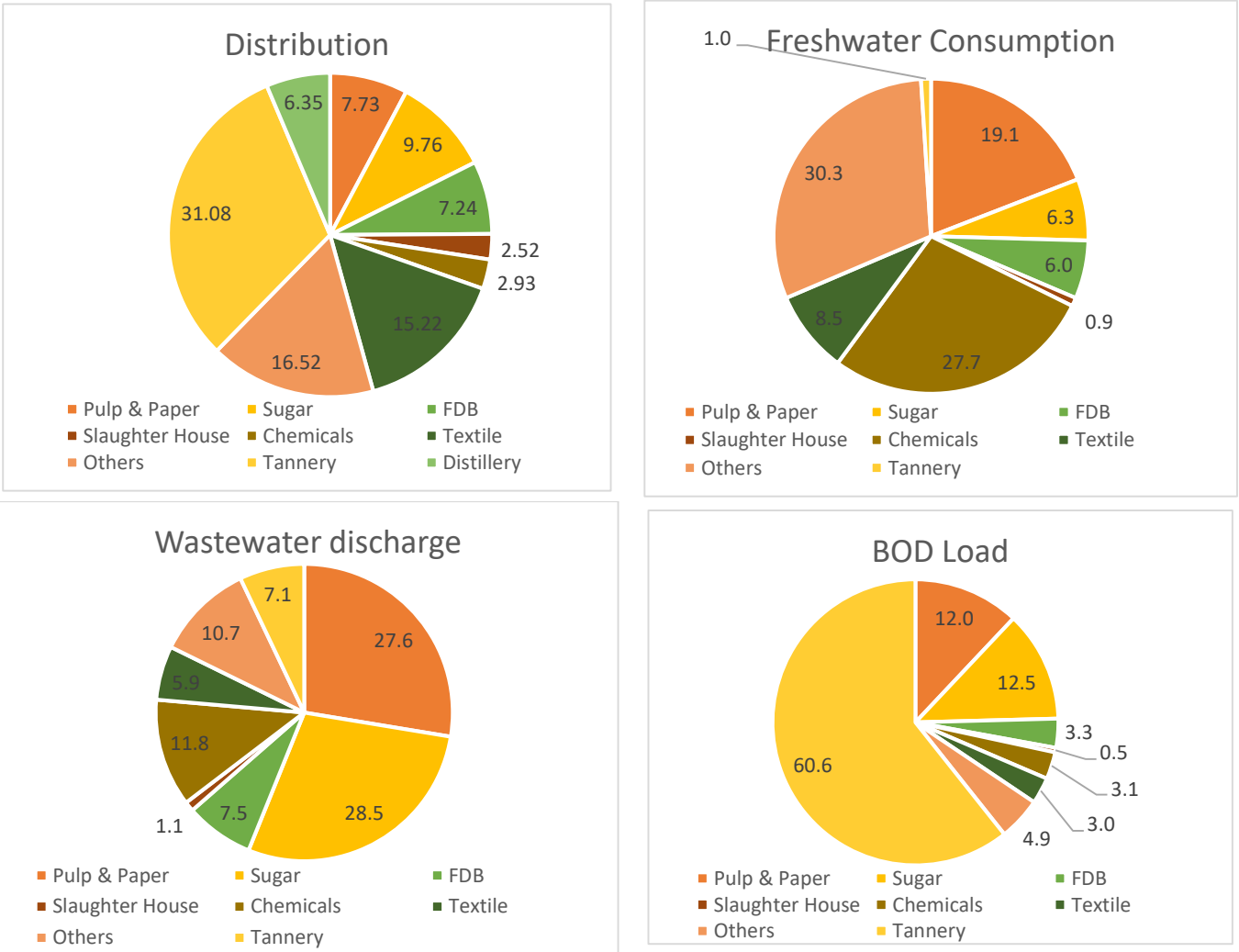


Fig. 2.8 Sector-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of river Ganga main stem

b) River Yamuna main stem

State-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of River Yamuna main stem are given in **Table 2.12** and sector-wise details are given in **Fig. 2.9.**

Table 2.12 State-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of river Yamuna main stem

State	No. of GPIs	Operational GPIs	Freshwater consumption (MLD)	Wastewater discharge (MLD)	BOD Load (TPD)
Uttarakhand	11	6	2.25	1.16	0.025
Haryana	1140	940	162.85	73.02	3.35
Delhi-NCT	196	157	2.01	1.12	0.095
Uttar Pradesh	610	430	129.66	78.06	2.54
Total	**1957**	**1533**	**296.77**	**153.36**	**6.01**

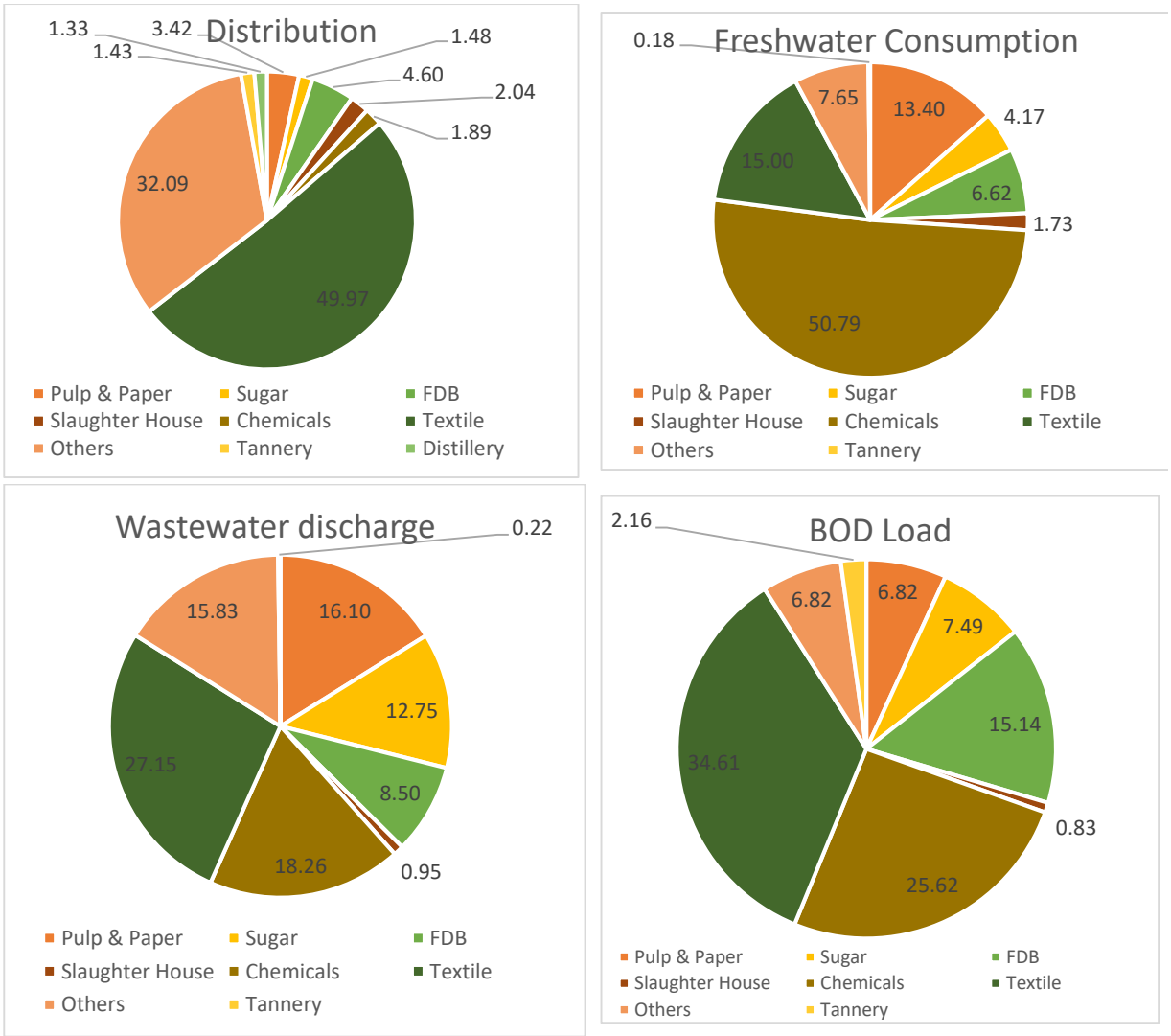


Fig. 2.9 Sector-wise details of freshwater consumption, wastewater discharge and BOD load of GPIs of river Yamuna main stem

c) Stretch wise discharge

The stretch-wise effluent discharge and BOD load status in various stretches of Rivers Ganga and Yamuna are shown in **Fig. 2.10** and **2.11**, respectively.

As per data generated during 2023, the stretch of river Ganga from Farrukhabad to Jajmau cluster exhibits highest pollution load. It has 741 GPIs, mostly tannery and textile industries, discharging approximately 118.11 MLD of wastewater, carrying a pollution load of 10.962 TPD. Following closely is the stretch from Behrampore to Diamond Harbour, with 57 GPIs contributing around 57.4 MLD of wastewater, carrying a pollution load of 1.006 TPD. The Bijnore to Narora stretch has around 152 GPIs, contributing about 40.1 MLD of wastewater, with a pollution load of 0.897 TPD. Kalakankar to u/s Mirzapur is impacted by 24 sugar, distillery, and food, dairy & beverage units, contributing about 10.2 MLD of wastewater, carrying a pollution load of 0.206 TPD. The stretch from Mirzapur to Ghazipur contributes 5.7 MLD of wastewater, with a pollution load of 0.292 TPD. The stretch from Narora to Farrukhabad has 60 GPIs, contributing about 5 MLD of wastewater, carrying a pollution load of 0.103 TPD. Stretch from Jajmau to Dalmau stretch has 21 GPIs contributing about 3.7 MLD of wastewater, with a pollution load of 0.07 TPD. The Kahalgaon to Behrampore stretch accommodates 13 slaughter houses and food units, contributing 2.6 MLD of wastewater, with a pollution load of 0.085 TPD. Ghazipur to Patna stretch has 34 GPIs contributing about 2.1 MLD of wastewater, carrying a pollution load of 0.081 TPD. The stretch from Patna to Kahalgaon has 64 GPIs contributing about 1.8 MLD of wastewater, carrying a pollution load of 0.058 TPD. Haridwar to Bijnor stretch is impacted by 12 GPIs contributing 1.6 MLD of wastewater, with a pollution load of 0.061 TPD. The Dalmau to Kalakankar stretch is affected by 6 GPIs, contributing 1.1 MLD of wastewater, with a pollution load of 0.013 TPD.

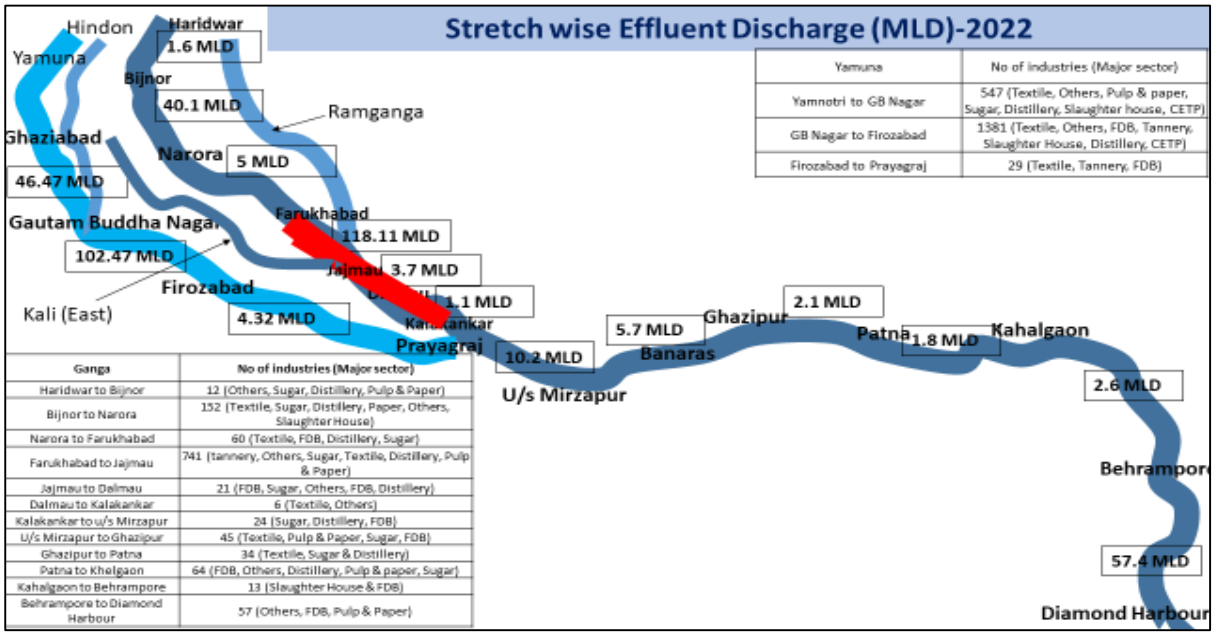


Fig.2.10 Stretch-wise effluent discharge in various stretches of Ganga and Yamuna

For Yamuna, G.B. Nagar to Firozabad stretch has the highest pollution load. It has 1381 GPIs (Textile, Others, FDB, Tannery, Slaughter House, Distillery, CETP) which contribute about 102.47 MLD wastewater having pollution load of 4.644 TPD. This is followed by Yamunotri to G.B. Nagar stretch having 547 GPIs which contribute about 46.47 MLD with pollution load

of 1.123 TPD. Firozabad to Prayagraj stretch has 29 textile and tannery units which contribute about 4.32 MLD with pollution load of 0.313 TPD.

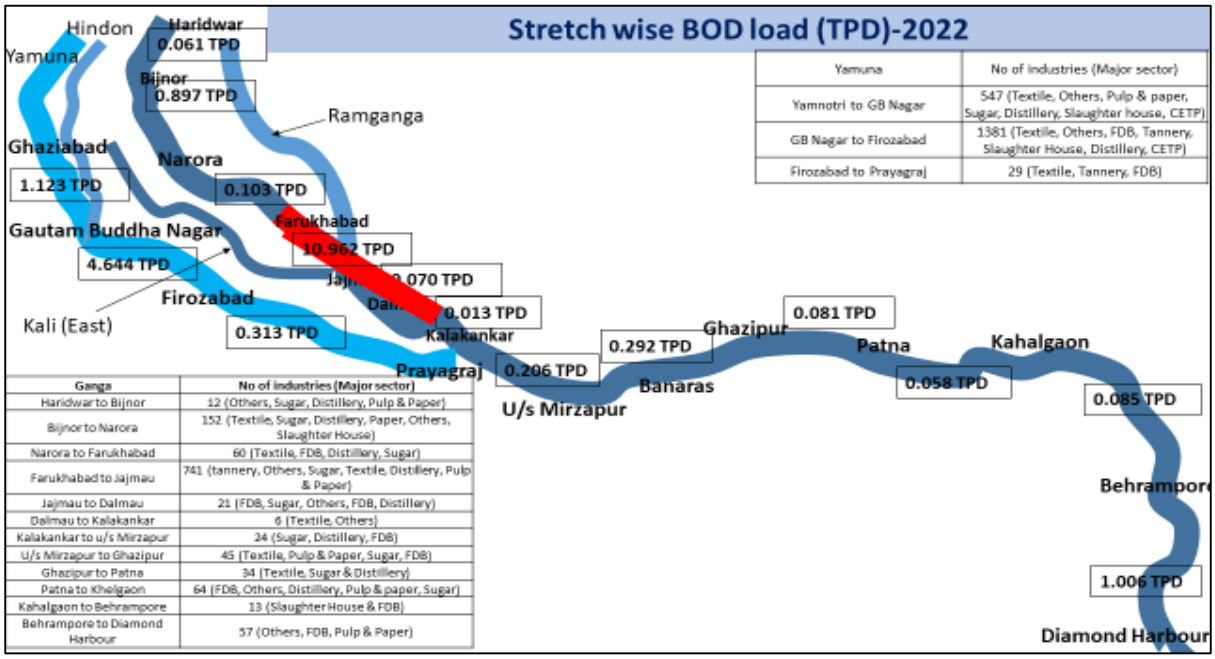


Fig.2.11 Stretch-wise BOD load in various stretches of Ganga and Yamuna

d) Sector wise findings

i ***Pulp & Paper***

There is a total of 162 Pulp & Paper mills, with 95 located in states along the main stem of the River Ganga and 67 in states along the main stem of the River Yamuna. These mills are spread across five states: Haryana, Uttarakhand, Uttar Pradesh, Bihar, and West Bengal. During inspections, 131 units were found operational (Ganga-77; Yamuna-54). Total production was estimated to be 27,459 MTD (Ganga- 11670 MTD; Yamuna-15789 MTD). Freshwater consumption for operational units was estimated to be 155.71 MLD (Ganga-114.85 MLD; Yamuna-39.77 MLD). Effluent discharge was 94.48 MLD (Ganga-68.79 MLD; Yamuna-24.69 MLD) with estimated pollution load of 2.06 TPD (Ganga-1.65 TPD; Yamuna- 0.41 TPD). Among the total 162 units, 45 are operating under the Zero Liquid Discharge (ZLD) scheme, with 26 along the Ganga and 19 along the Yamuna.

In river Ganga main stem, overall specific freshwater consumption was estimated to be 9.84 KL/MT; ranging from 5.15 KL/MT for unbleached RCF category to 37.16 KL/MT for bleached agro based category. Similarly, overall specific effluent discharge was estimated to be 5.89 KL/MT; ranging from 1.99 KL/MT for unbleached RCF category to 23.48 KL/MT for bleached agro based category. Pulp & Paper mills which were found non-complying is mainly due to not meeting discharge norms of BOD.

<u>Top pollution load contributing pulp & paper units</u>

On the basis of the analysis of data of 5th round of GPIs inspections carried out by CPCB authorized third party agencies, 246 GPIs were identified as top pollution load contributing industries which were found meeting the following criteria:

1. *Industries discharging BOD load more than 30 kg/day*

2. *Industries making the maximum contribution to the pollution load from respective industrial sectors.*
3. *Consistent non-compliers: Non-complying industries which were found to be non-complying in the previous two rounds of inspections as well.*
4. *Industries which were reported to have bypass arrangements, non-functional ETP etc.*

These 246 GPIs were found contributing about 50% of the total pollution load in Ganga basin and individual action plans for reduction in pollution load by 20-30% were also prepared for these GPIs.

Out of these 246 GPIs, 23 (Uttarakhand-08; UP-12; Bihar-01 and WB-02) were pulp & paper units. Four workshops were organized at IIT Delhi & Muzaffarnagar for preparation, evaluation and finalization of individual action plans for these 23 units including short term, medium term and long-term goals for reduction in pollution load by 20-30%.

Out of 23 units, 21 have achieved short term goals, 19 have achieved medium term goals and 14 have achieved long term goals.

Link of Charter for Water Recycling and Pollution Prevention in Pulp & Paper Industries (Specific to ganga River Basin States): https://cpcb.nic.in/ngrba/charter_pulpandpaper.pdf

ii Sugar sector

There were 149 sugar mills out of which 120 were located in river Ganga main stem and 29 in river Yamuna main stem. During 2023, 119 sugar mills were found operational and 89% were found complying. Total production from operational units was estimated to be 646447.8 TCD (Ganga-477077.5 TCD; Yamuna-169370.3 TCD). Freshwater consumption was estimated to be 50.35 TCD (Ganga-37.97 MLD; Yamuna-12.39 MLD). Effluent discharge was estimated to be 90.65 MLD (Ganga-71.09 MLD; Yamuna-19.56 MLD) with pollution load of 2.17 TPD (Ganga-1.72 TPD; Yamuna-0.45 TPD). In river Ganga main stem, overall specific freshwater consumption and specific effluent discharge were estimated to be 79.58 KL/MT (ranging from 50-140 KL/MT) and 149.02 KL/MT respectively. During inspections, 05 sugar mills were found to bypass the untreated effluent.

About 57 sugar mills have installed CPU to treat the excess condensate & low strength effluent. Further, 109 sugar mills have Sulphur Removal System (SRS) for spray pond/ PCT overflow treatment. The salient features of sugar mills are summarised below:

- All the sugar mills were having tertiary level effluent treatment systems.
- Most of the sugar mills were having lagoons for storage of the treated effluent to be used for irrigation purpose.
- All the sugar mills had borewells for abstraction of groundwater and are having CGWA/UPGWD NOCs.
- All the sugar mills had installed electromagnetic flow meters at ETP inlet, outlet and water abstraction points. The sugar mills had maintained daily records of fresh water consumption, effluent discharge, regular analysis of ETP effluent parameters, energy consumption etc.
- Environmental laboratories for the analysis of general parameters of ETP inlet and outlet are developed by the mills.

- Wet scrubber/Electrostatic precipitator are installed as Air Pollution Control Devices.
- The total 4103.17 KLD of treated effluent was being used in irrigation purpose by six operational sugar mills in 656-hectare command area.
- Out of seven sugar mills, two mills have conventional RO based CPU and one mill has common CPU with distillery unit.
- Sewage Treatment Plants were found installed in all sugar mills for treatment of the sewage generated from the residential colonies within the premises.
- Most of the sugar mills have implemented Irrigation Management Plan (IMP).

Updation of Sugar Charter

The charter was formulated to enforce appropriate technologies for effluent treatment in sugar factories in Ganga basin and to motivate the sugar industries to comply with the prescribed environmental norms. Overall, implementation and adoption of charter by the sugar industries in Ganga basin achieved the desirable outcomes viz. reduction in specific fresh water consumption from 299 L/T of cane crushed in the year 2017 to 77.90 L/T of cane crushed in the year 2022-23, showcasing a substantial reduction of 73.94%. Similarly, reduction of specific effluent discharge from 216 L/T of cane crushed in the year 2017 to 140.24 L/T of cane crushed in the year 2022-23 showcasing a substantial reduction of 35.18%.

On the basis of annual data generated from sugar sector, the industries were categorized in four categories viz. Standalone, Sugar with co-generation, Refinery, Refinery with co-generation.

Positive results of execution of previously implemented charter has led to the formulation of Charter 2.0 in which much stringent norms for specific freshwater consumption and specific effluent discharge were proposed to be revised on the basis of type of sugar industry. Proposed revised targets in Charter 2.0 are as follows:

- For standalone units, specific freshwater consumption < 100 L/T, specific effluent discharge < 120 L/T and BOD < 20 mg/L.
- For sugar mill with co-generation facility, specific freshwater consumption < 80 L/T and specific effluent discharge < 120 L/T and BOD < 20 mg/L.
- For sugar refinery, specific freshwater consumption < 100 L/T, specific effluent discharge < 100 L/T and BOD < 20 mg/L.
- For sugar refinery with co-generation facility, specific freshwater consumption < 80 L/T, specific effluent discharge < 150 L/T and BOD < 20 mg/L.

Meetings for upgradation of sugar charter with expert institutes (VSI, Pune and NSI, Kanpur) and best performing sugar industries were conducted in 2023.

Action plan for top pollution load contributing sugar industries

CPCB identified 40 top pollution load contributors from sugar sector based on either BOD load > 30 kg/day or consistent non-compliant sugar unit or bypass cases or non-operational ETP. The mills were tasked with developing action plans to meet charter norms, with a technical evaluation of these plans conducted through discussions with individual sugar industry representatives in Lucknow. Two meetings convened with stakeholders, including the Vasantdada Sugar Institute, Pune, and the National Sugar Institute, Kanpur, along with industry representatives, to vet and review the progress of action plans.

A national seminar on "Water & Effluent Management in Sugar Industry-Emerging Challenges" was held at National Sugar Institute, Kanpur on 10th May, 2023 which was attended and addressed by senior officials of CPCB regarding the best practices adopted by sugar industries, which has resulted in remarkable reduction of fresh water consumption and effluent discharge.

Link of Charter for Effluent treatment by Sugar factories situated in River Ganga basin: https://cpcb.nic.in/ngrba/charter_sugar.pdf

iii Distillery sector

There were 104 distilleries out of which 78 were located in river Ganga main stem and 26 in river Yamuna main stem. During 2023, 83 distilleries were found operational (Ganga-59; Yamuna-24). During inspections, specific freshwater consumption was estimated to be 5-7 KL/KL of production whereas spent wash generation was estimated to be 6-8 KL/KL of production. During inspections, 2 distillery units were found to have spent wash stored in the kaccha pits in the premises and bypassing the untreated effluent. About 83 Distilleries are running on ZLD scheme (Ganga-60; Yamuna-23).

In 2023, it was found that 02 distilleries, M/s Wave Distillery in Dhanaura, UP, and M/s Saraswati Distillery in Yamuna Nagar, Haryana, are integrated with sugar mills and use a common borewell with them. Treated effluent from sugar mills is being used by the distilleries for molasses dilution after further treatment through CPU. There is no extra freshwater consumption in distillery unit.

Updation of Distillery Charter

After analysing the third-party annual inspection reports for 2023, CPCB noted that many distilleries have upgraded their process technology to fed batch fermentation and Multi-Pressure Distillation (MPR), while also installing CPU systems to recycle condensate water. Additionally, a shift from B-heavy molasses to C-heavy molasses as raw material contributed to reduced fresh water consumption and spent wash generation. Based on these findings, it was decided to upgrade the distillery charter by incorporating new norms for water consumption and spent wash generation. Several meetings with technical institutes were held in this regard, with representatives from CPCB, Sugar Mills Associations, Expert from National Sugar Institute (NSI), Kanpur, Vasantdada Sugar Institute (VSI), Pune, technical representatives from sugar and distillery industries wherein the best practices/methodology and technology adopted by best performing sugar and distillery industries to achieve the norms were presented. Presentations were also made by some of the best performing sugar and distillery industries in terms of fresh water consumption and effluent generation wherein they highlighted methodology, advance technology, best practices adopted and modifications in the effluent treatment facility to achieve the set norms.

CPCB has formulated a charter to encourage the distilleries operating in the Ganga basin, with following targets:

1. To further reduce the fresh water consumption
    a) For the distillery units, whose current fresh water consumption is greater than 8 KL/KL of production shall reduce it to 5 – 8 KL/KL of production.

b) For the distillery units, whose current fresh water consumption is 5 - 8 KL/KL of production shall maintain it to 5 KL/KL of production or further reduce it to <5 KL/KL of production.

2. To further reduce the spent wash generation
   a) For the distillery units, whose current spent wash generation is greater than 8 KL/KL of production shall reduce it to 6 – 8 KL/KL of production.
   b) For the distillery units, whose current spent wash generation is 6 - 8 KL/KL of production shall maintain it to 6 KL/KL of production or further reduce it to <6 KL/KL of production.

Preparation of action plans by top pollution contributing Distilleries

CPCB identified 246 GPIs as top pollution load contributors on the basis of Third-Party Inspections (2021-22), responsible for approximately 50% of the total pollution load in the Ganga basin, warranting priority action. Among these, five distilleries were identified as top pollution load contributing industries, either due to discharging more than 30 kg/day of pollution load or persistent non-compliance or having by-pass arrangements, or not complying with ZLD norms.

In 2023, sector specific meetings were conducted wherein identified polluting industries were instructed to develop individual action plans, outlining short-term, medium-term, and long-term targets for implementation. The aim of these action plans was to reduce pollution load by 20% and enhance compliance by 90%.

In Jan, 2023, Central Pollution Control Board (CPCB) took proactive steps to ensure implementation of action plans to address environmental concerns through vetting by organizing workshops, involving representatives from technical institutes, State Pollution Control Boards (SPCB), CPCB, and distillery units, for sharing knowledge and expertise. The progress of action plan implementation was also reviewed by conducting meetings through video-conferencing and correspondence with individual units.

Link of Charter for Zero Liquid Discharge (ZLD) in molasses based Distilleries: https://cpcb.nic.in/ngrba/charter_distillery.pdf

iv Textile sector

There were a total of 1165 Textile units, with 187 located in states along the main stem of the river Ganga and 978 in states along the main stem of the river Yamuna. Of these, 814 units were found to be operational during inspections, with 121 along the Ganga and 693 along the Yamuna. Textile units are classified into three categories: Small (< 1 MTD), Medium (≥1 to <5 MTD), and Large (>5 MTD). Approximately 45% of textile units fall into the small category. Out of these units, 397 are connected to Common Effluent Treatment Plants (CETPs), and 104 are operating under the Zero Liquid Discharge (ZLD) scheme, with 10 along the Ganga and 94 along the Yamuna.

During inspections, the total production of textile units was estimated to be 9953.87 MTD, with 515.38 MTD from units along the Ganga and 9438.48 MTD from units along the Yamuna. The freshwater consumption for operational units was estimated to be 95.52 MLD, with 51 MLD from units along the Ganga and 44.52 MLD from units along the Yamuna. The effluent

discharge was 56.3 MLD, with 14.66 MLD from units along the Ganga and 41.64 MLD from units along the Yamuna, resulting in an estimated pollution load of 2.49 Tons per Day (TPD), with 0.41 TPD from units along the Ganga and 2.08 TPD from units along the Yamuna. In the main stem of the river Ganga, the overall specific freshwater consumption and specific effluent discharge were estimated to be 33.47 KL/MT and 26.84 KL/MT, respectively.

Implementation of Charter

CPCB has formulated the Charter for 'Water Recycling and Pollution Prevention in Textile Industries' in April, 2019 and implemented the charter in units, engaged in textile wet processing, and operating in River Ganga & Yamuna basin main stem states. The important objectives of charter are sustainability in practices in textile wet processing, emphasizing the optimization of utility (water, energy, time), ensuring sustainability across ecological, economic, and social aspects, and promoting circularity through the principles of reduction, reuse, and recycling in textile industries.

During 2023, CPCB organized workshop cum training program for implementation of Textile Charter in textile industries at various location along with expert of textile process like ICT Mumbai, Solidaridad, NITRA, etc.

Individual action plan of participating industries was prepared with the aim to reduce in non-profit outputs while conserving the resources (like water, fuel, energy, process chemical/dyes), mitigation of pollution load, maximize the profit and to meet the compliance to various statuary norms via. installing ETP of proper treatment scheme with adequate retention time.

Short-, medium-, and long-term targets were given to the units for execution of activities agreed by industries representatives to achieve the above targets. Details of participating industries are given in **Table 2.13.**

Table 2.13 Details of workshops and participating industries

S. No.	Workshop location	Date	Industries participated
1.	Meerut	13.06.2023	65
2.	Mathura	14.06.2023	56
3.	Ghaziabad	15.06.2023	150
4.	Panipat	07.08.2023 to 09.08.23	177
5.	Sonipat	10.08.23	51
6.	Gurugram	11.08.23	37

Link of Charter for Water Recycling and Pollution Prevention in Textile Industries in Ganga River Basin: https://cpcb.nic.in/ngrba/charter_textile.pdf

v Tannery sector

During 2023, there were 410 tanneries out of which 382 were located in Ganga main stem and 28 in Yamuna main stem. Out of 410, 317 tanneries were found operational (Ganga-293; Yamuna-24). In Ganga main stem, tanneries are located mainly in 03 clusters namely Jajmau, Banthar and Unnao. About 367 tanneries are connected to CETPs namely CETP Jajmau (325), CETP Banthar (27) and Site-II Unnao (15) whereas 43 have individual ETP to treat the effluent. About 04 tanneries have are running on ZLD scheme. Effluent discharge was estimated to be

17.96 MLD (Ganga-17.62 MLD; Yamuna-0.34 MLD) with pollution load of 8.45 TPD (Ganga-8.32 TPD; Yamuna-0.13 TPD). About 04 tanneries in Yamuna main stem are running on ZLD scheme.

vi Food, Dairy & Beverages (FDB)

There were 179 FDB units during 2023 out of which 89 were located in river Ganga main stem and 90 in river Yamuna main stem. Out of 179, 149 units were found operational (Ganga-78; Yamuna-71). During inspections, compliance was found as 84%, freshwater consumption 55.60 MLD (Ganga-35.95 MLD; Yamuna-19.65 MLD), effluent discharge 31.62 MLD (Ganga-18.59 MLD; Yamuna-13.03 MLD) and pollution load 1.36 TPD (Ganga-0.45 TPD; Yamuna-0.91 TPD). About 20 FDB units are running on ZLD scheme (Ganga-17; Yamuna-03).

vii Slaughter House

There were 71 slaughter houses out of which 31 were located in river Ganga main stem and 40 in river Yamuna main stem. Out of 71, 46 units were found operational (Ganga-22; Yamuna-24). During inspections, compliance was found as 83%, freshwater consumption 10.51 MLD (Ganga-5.29 MLD; Yamuna-5.13 MLD), effluent discharge 4.09 MLD (Ganga-2.64 MLD; Yamuna-1.45 MLD) and pollution load 0.12 TPD (Ganga-0.07 TPD; Yamuna-0.05 TPD). About 20 slaughter houses are running on ZLD scheme (Ganga-8; Yamuna-12).

viii Chemicals

There were 73 chemical units (*including chemical, fertilizers, pharmaceuticals, petrochemicals, oil & refinery, pesticides*) out of which 36 were located in river Ganga main stem and 37 in river Yamuna main stem. Out of 73, 68 units were found operational (Ganga-36; Yamuna-32). During inspections, freshwater consumption 317.68 MLD (Ganga-166.97 MLD; Yamuna-150.72 MLD), effluent discharge 57.3 MLD (Ganga-29.3 MLD; Yamuna-28 MLD) and pollution load 1.96 TPD (Ganga-0.42 TPD; Yamuna-1.54 TPD) were found. About 15 units are running on ZLD scheme (Ganga-13; Yamuna-2).

ix Others

There were 831 GPIs which belong to Others sector (*including Automobile, Electroplating, Galvanized Iron structure, Hair Oil Manufacture, Manufacturing & Repair of aircraft, Paint, Telephone sets, Diesel locomotive units*) out of which 203 were located in river Ganga main stem and 628 in river Yamuna main stem. Out of 831, 733 units were found operational (Ganga-184; Yamuna-549). During inspections, freshwater consumption 206.68 MLD (Ganga-182.59 MLD; Yamuna-22.70 MLD), effluent discharge 50.85 MLD (Ganga-26.58 MLD; Yamuna-24.27 MLD) and pollution load 1.08 TPD (Ganga-0.67 TPD; Yamuna-0.41 TPD) were found. About 60 Others units are running on ZLD scheme (Ganga-29; Yamuna-31).

x Identification of 233 top pollution load contributing GPIs

Based on the data of annual inspections 2023, a total of 233 GPIs (UP-136, Haryana-61, Uttarakhand-14, Delhi-NCT-10, Bihar-6, West Bengal-4, Jharkhand-2) were identified as top pollution load contributors/consistent defaulters as per following criteria:

- GPIs discharging more than 30 kg/day pollution load – 88 nos.

- Consistent non-complying GPIs (GPIs which were found non-complying in last two rounds of annual inspections i.e. 2022 & 2023) – 110 nos.
- GPIs reported to have by-pass arrangements/non-functional ETP – 67 nos.
- These GPIs together contribute about 45% of total pollution load. These GPIs have been directed by concerned SPCBs to prepare, submit and implement individual action plans to reduce pollution load by at least 20-30%. State-wise and sector-wise distribution of top polluting industries is given in **Table 2.14**.

Table 2.14 State and sector-wise distribution of 233 top polluting industries

Sector	Uttarakhand	Haryana	Delhi	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
Chemicals	1	3	0	4	0	0	2	10
Distillery	0	0	0	2	0	1	0	3
Food & Beverages	4	4	0	8	5	1	0	22
Others	0	20	6	13	1	0	1	41
Pulp & Paper	9	0	0	7	0	0	1	17
Slaughter House	0	0	1	1	0	0	0	2
Sugar	0	2	0	31	0	0	0	33
Tannery	0	0	0	38	0	0	0	38
Textile	0	32	3	32	0	0	0	67
Total	**14**	**61**	**10**	**136**	**6**	**2**	**4**	**233**

- There is an improvement in compliance from 39% in 2017 to 82% in 2023.
- About 28.6% reduction in effluent discharge from 349 MLD in 2017 to 249.31 MLD in 2023 has been estimated. Sector wise effluent discharge in River Ganga during 2017 and 2023 is given in **Fig. 2.12.**
- About 47.2% reduction in BOD load from 26 TPD in 2017 to 13.73 TPD in 2023 has been estimated. Sector wise BOD load in River Ganga during 2017 and 2023 is given in **Fig. 2.13.**
- Also, reduction in specific freshwater consumption through re-use and recycle of treated effluent (Pulp & Paper-42%, Sugar-73%, Distillery-66% and Textile-76%) has been estimated.

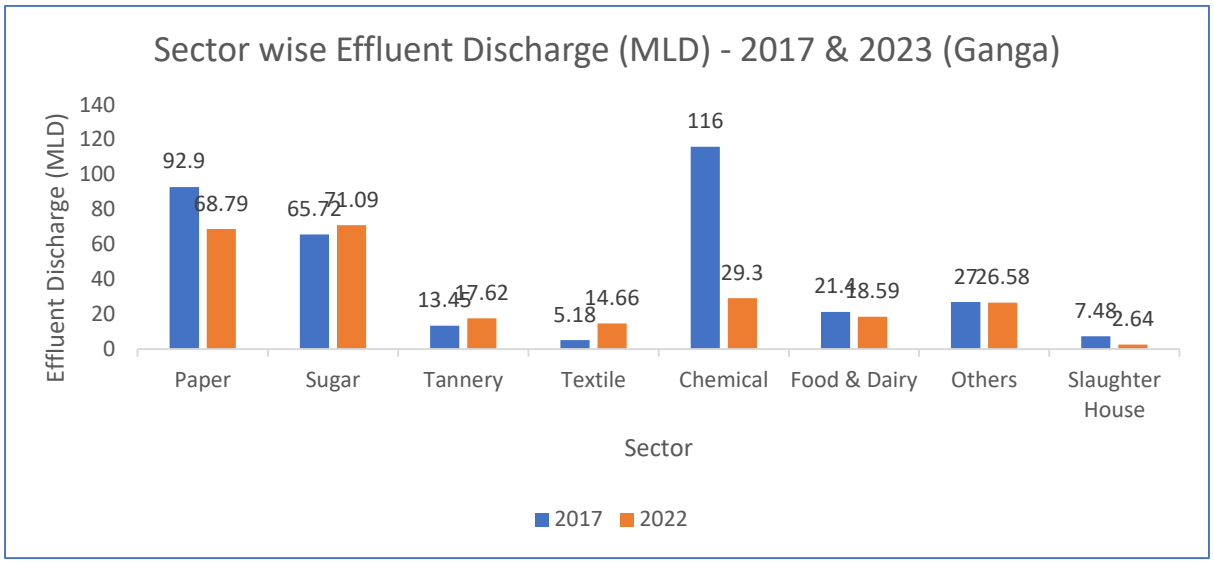


Fig. 2.12 Sector wise effluent discharge (MLD) during 2017 & 2023 in River Ganga

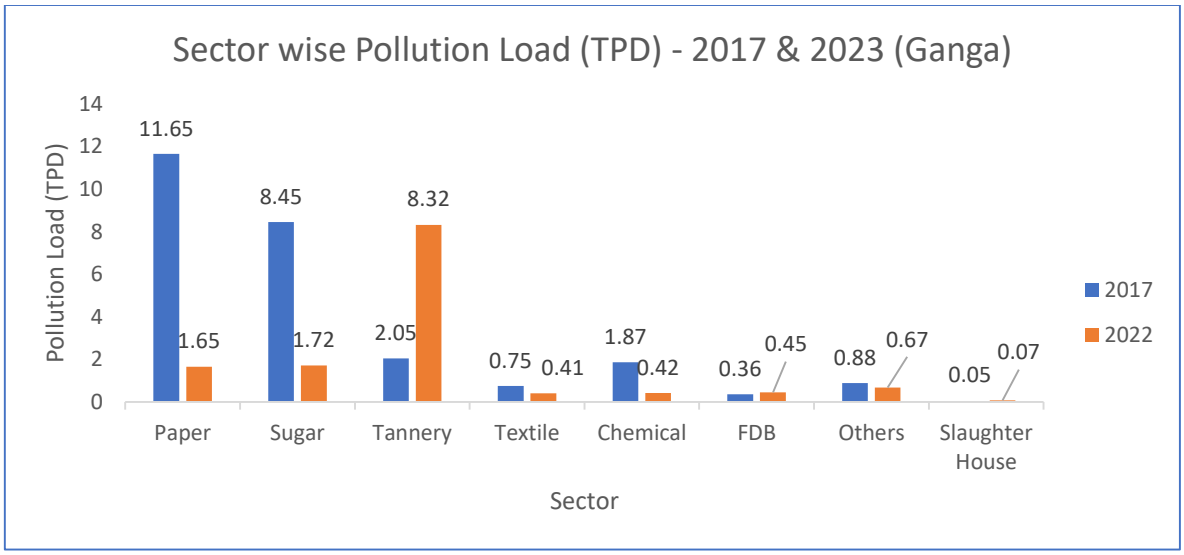


Fig. 2.13 Sector wise Pollution load (TPD) during 2017 & 2023 in River Ganga

2.2 Inspections carried out in compliance of the Hon'ble high court of Allahabad order dated 27.07.2022 in reference to public interest litigation (PIL) 4003 of 2006

Hon'ble High Court of Allahabad, vide order dated 27.07.2022, directed Central Pollution Control Board (CPCB) to carry out inspections of 1370 GPIs, 08 CETPs and 36 STPs located in the state of Uttar Pradesh and covered under the main stem of Rivers Ganga and Yamuna.

2.2.1 Work accomplished during 2023

- **Inventorization and Inspection** - The list of GPIs, STPs and CETPs along with their locations, districts and sectors were compiled based on the GPI inventory. Forty teams from Head Office, Delhi and Regional Directorate, Lucknow were deputed to carry out the inspections of 1370 GPIs located in the state of Uttar Pradesh.
- **Formulation of Standard Operating Procedure (SOP)** - A SOP was devised to conduct inspections, mandating surprise visits.

- **Development of Online portal and mobile App** - To ensure confidentiality of surprise inspections, an online portal and mobile application was created, which assigns the district and location of the GPI to team leaders just a day before the scheduled date of inspection. Whereas, the unit codes for allocated GPIs were disclosed only on the inspection day. Team leaders were directed to maintain due secrecy throughout the inspection.
- **Follow up, submission and review of inspection reports** - A mechanism was devised for team leaders to submit real-time field reports directly from the field, including the operational status of the unit and its Effluent Treatment Plant (ETP), using a mobile application.

  The final inspection report was submitted within 10 days of receiving the laboratory analysis results.

  The report underwent review by a committee of senior officials to ensure factual accuracy. Following this review, the final report was submitted by the team on a portal, from where it was forwarded to the UPPCB for appropriate action.

  Additionally, several meetings were convened with officials from the CPCB and UPPCB to follow up on inspection matters and discuss any related issues.

- **Submission of affidavits** - CPCB has submitted 03 affidavits dated 23.09.2022, 31.10.2022 and 30.11.2022 including compliance status of 276 GPIs before the Hon'ble High Court of Allahabad.

  The matter was then transferred to Hon'ble National Green Tribunal (NGT). Thus, in compliance of Hon'ble NGT order dated 28.08.2023, operational and compliance status of 962 GPIs, 36 STPs and 08 CETPs was also filed before the Hon'ble NGT on 14.10.2023.

2.2.2 Data generation and salient findings

1080 GPIs located in the state of Uttar Pradesh were inspected in compliance of the Hon'ble High Court of Allahabad order dated 27.07.2022. Out of these 1080 GPIs, 684 were found operational and 396 were non-operational. On analysis of the generated data, it was observed that the maximum number of operational units were from chemical sector followed by food and beverages (81%) and pulp & paper (80%). The highest number of non-operational units were found in the tannery sector which has only 56% of operational units. Most units in this sector were found non-operational due to roster imposed by UPPCB. Some units were also found non-operational due to personal issues such as power failure and maintenance purpose, the compliance status of which could not be verified. Such units are proposed to be re-inspected by UPPCB. The sector-wise break up of operational GPIs and percentage operational & percentage compliance status of these inspected GPIs are given in **Fig. 2.14 and 2.15, respectively.**

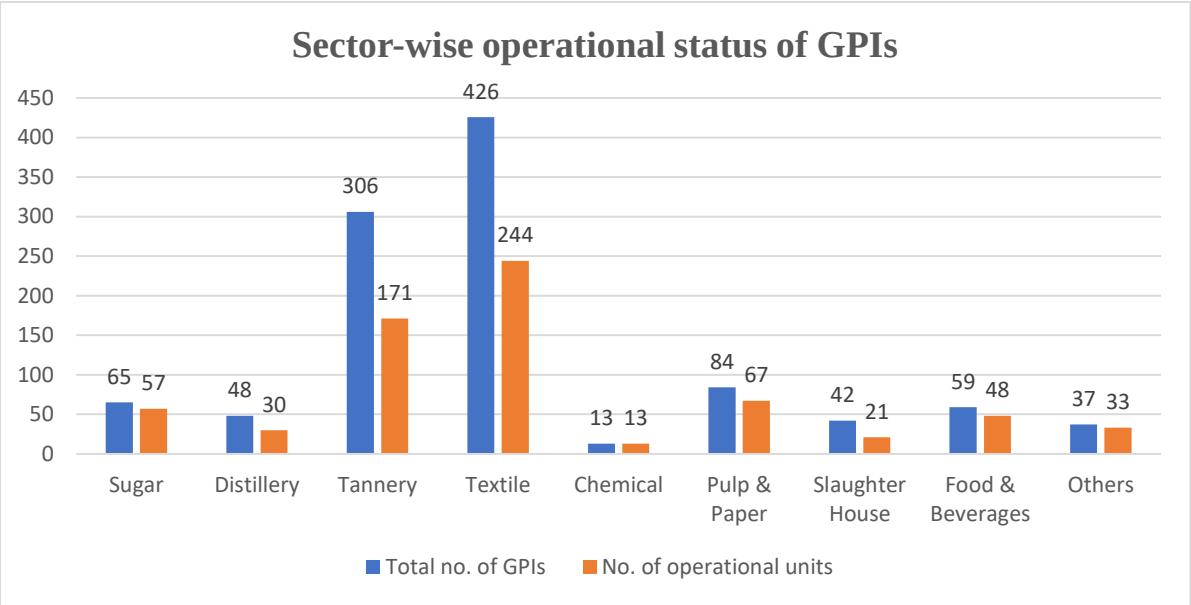


Fig. 2.14 Sector-wise break up of operational GPIs in U.P.

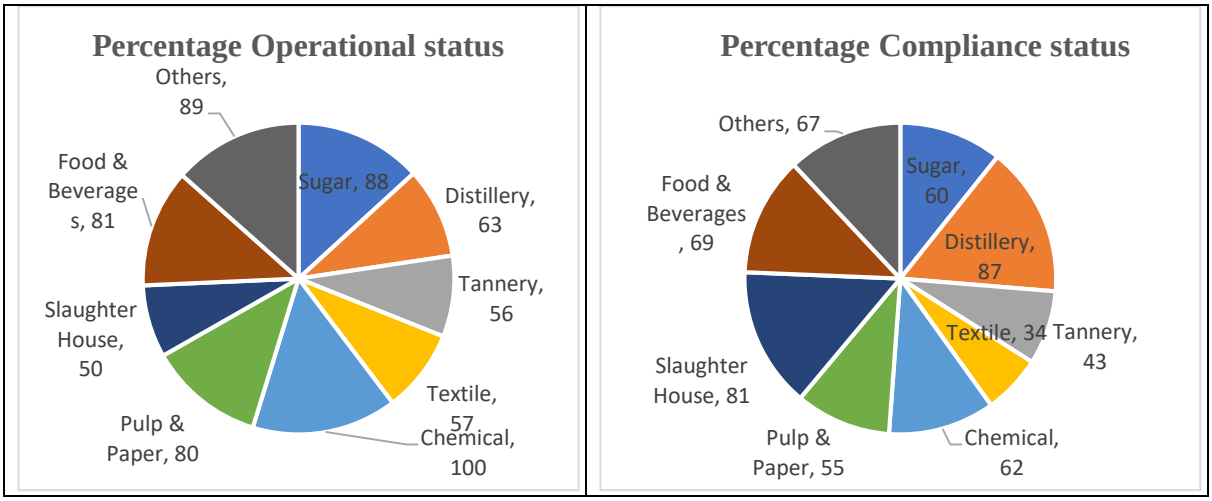


Fig. 2.15 Percentage operational & compliance status of GPIs

Compliance status of GPIs

Out of the 684 operational GPIs, 333 were found complying which indicates 48.68% compliance whereas 351 were found non-complying. On analysis of the generated data, it was observed that the compliance percentage was very less especially in textile industry, only 34% of which were found to be complying followed by tannery which showed 43% compliance. The other sectors namely, chemical, sugar, food & dairy, pulp and paper and others showed 62%, 60%, 69%, 55% and 67 % compliances, respectively. The highest percentage compliance was observed in distilleries (87%) followed by slaughter houses (81%).

Non-compliance status of GPIs

Breakup of non-compliance observed during inspection of these GPIs in percentage is given in **Fig. 2.16** and discussed below.

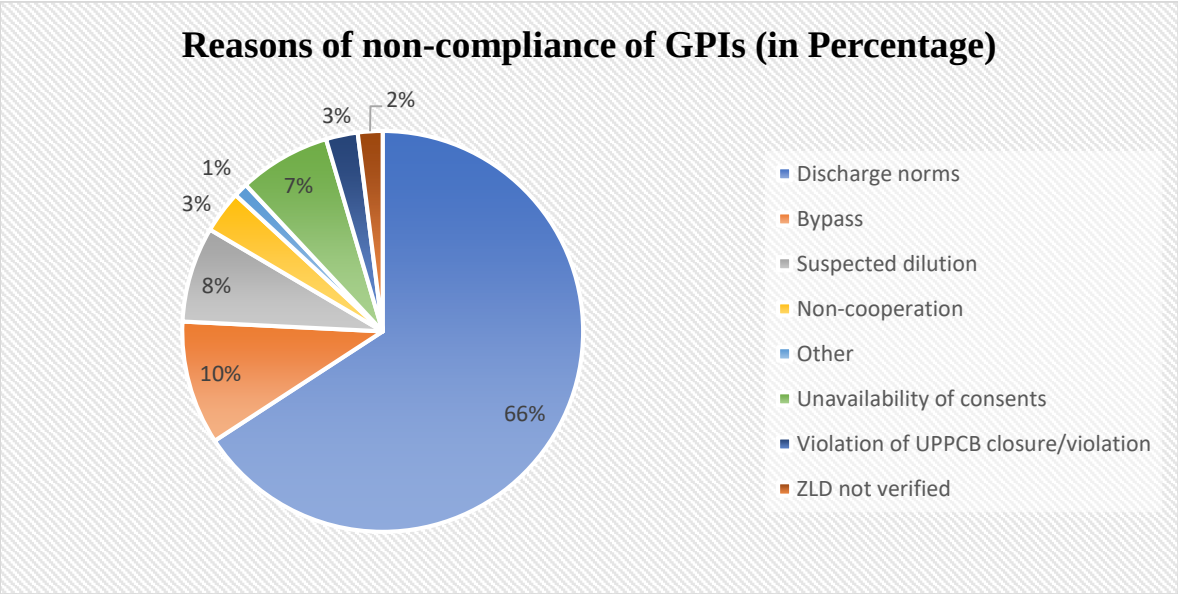


Fig 2.16 Reasons of non-compliance of GPIs (in percentage)

Out of 351 non-complying GPIs, 66% GPIs were non-compliant w.r.t effluent discharge norms. Out of non-complying GPIs, 10% GPIs were found non-compliant due to by-pass of untreated/partially treated effluent. The remaining units were found non-complying due to non-cooperation with CPCB team, suspected dilution in effluent discharged, unavailability of required consents from UPPCB and CGWA and non-verification of Zero Liquid Discharge system (in case of ZLD units).

Freshwater consumption and pollution load discharged into the main stem of Rivers Ganga and Yamuna in Uttar Pradesh through GPIs

Total fresh water consumption by 1080 GPIs was found to be 223.81 MLD, total effluent discharge was found to be 123.71 MLD and total pollution load discharge was found to be 5.87 TPD. Out of total fresh water consumption, the maximum fresh water consumption i.e., 30.5% of the total water consumption was observed in the chemical sector (68.29 MLD) followed by pulp & paper sector (64.45 MLD) which is 28.8% followed by sugar sector i.e., 11.5% (28.85 MLD). The lowest fresh water consumption was observed in tannery (1.8%) and slaughter house (2.5%). The same is represented in **Fig. 2.17.**

It was observed that out of total effluent discharge, the major portion of the effluent discharge was from the sugar sector i.e., 35% followed by pulp & paper sector (28.7%). The other sectors such as chemical, food & beverage, textile, tannery, slaughter house and others are contributing small amounts i.e., 9.3%, 8.7%, 7.7%, 2.7 %, 3.4 % and 4.7 % respectively. The same is represented in **Fig. 2.18.**

Out of total pollution load discharge, the maximum pollution load found discharged by pulp & paper sector (42.1%) followed by food & beverage sector (23.1%) and sugar (13%) & textile (13%). The same is represented in **Fig. 2.18.**

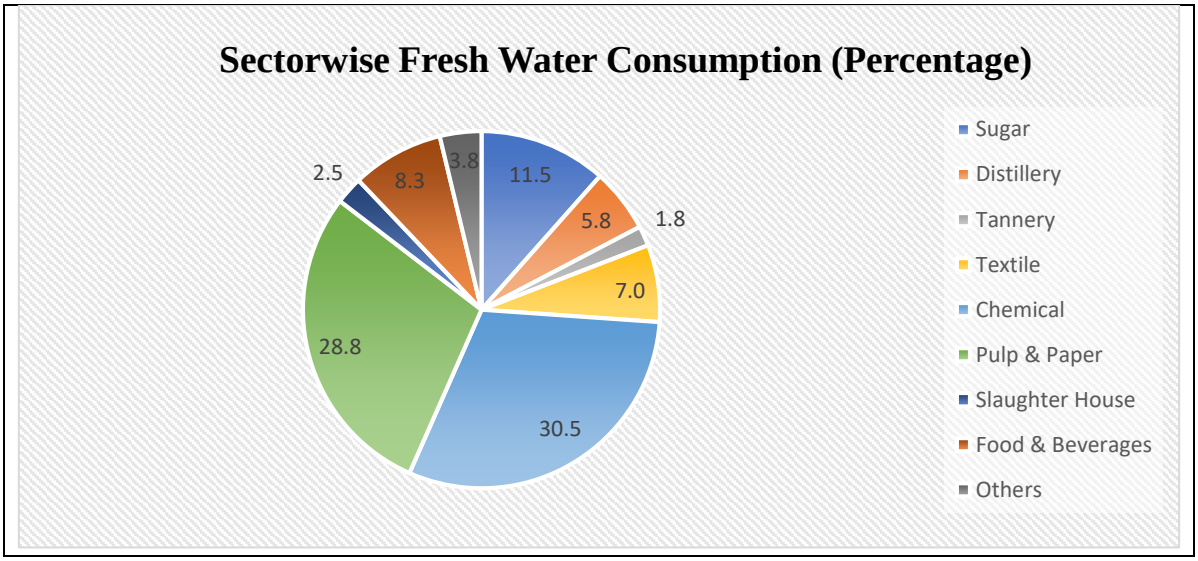


Fig 2.17 Sector-wise fresh water consumption (Percentage)

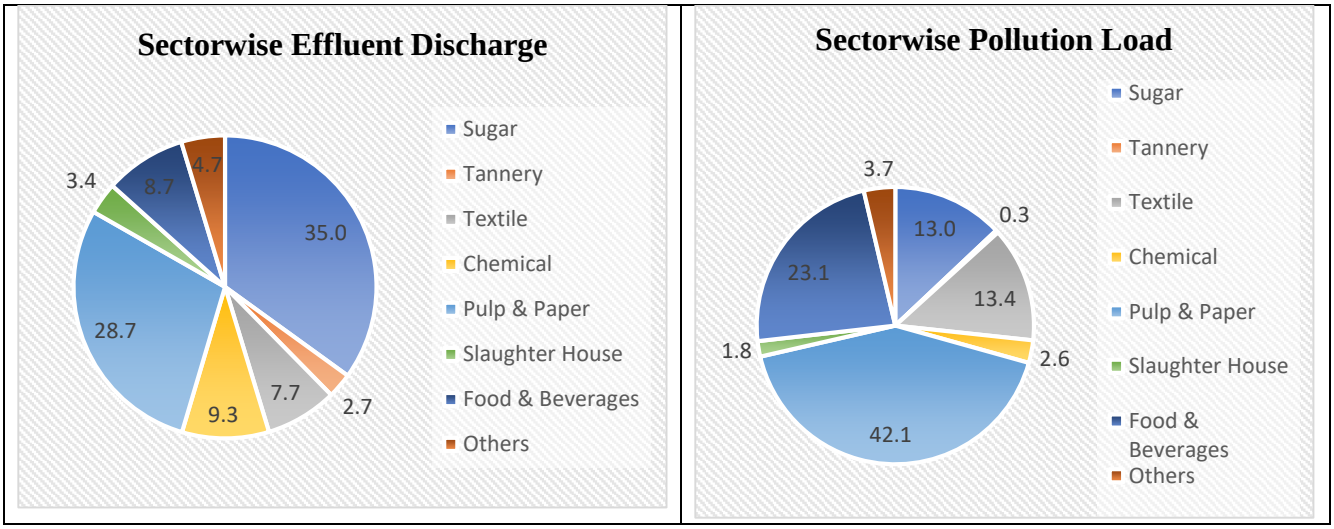


Fig 2.18 Sector-wise percentage of effluent discharge and pollution load

2.3 Inspections carried out in compliance of Hon'ble NGT

In response to NGT matters and public complaints, 23 pulp & paper units in Muzaffarnagar, UP; seven sugar mills & five distilleries located in Ganga basin towns, including Laksar, Roorkee, Rampur, Balrampur, and Muzaffarnagar were inspected in 2023.

2.3.1 Work Accomplished during 2023

i Pulp & Paper

In compliance to the NGT matters/public complaints, 23 nos. of pulp & paper units of Muzaffarnagar, UP, were inspected by CPCB officials during the year 2023 in five rounds i.e., on Dec 27-28, 2023, Jan 03-04,2024, Jan 11-12, 2024, Jan 16-17, 2024 and Jan 29-30, 2024 to investigate pollution issues like plastic waste management, boiler ash management and effluent system management.

ii Sugar

The inspections of sugar mills were carried out under various court matters, public complaints and VIP references in the year 2022-23. Total seven sugar mills located in Ganga basin districts

namely Laksar, Haridwar, Sitapur, Balarampur, and Muzaffarnagar were inspected. The crushing capacity of the inspected sugar mill was in the range of 7000 TCD to 16000 TCD. These sugar mills also have the provision of co-generation. The wet scrubbers and electrostatic precipitators are installed in the sugar industries as Air Pollution Control Devices (APCD). Industries have provision to use the treated effluent for irrigation purpose.

iii Distillery

The inspections of distillery units were carried out under various court matters/public complaints. During 2022-23, total five distilleries located in Ganga basin towns namely Laksar, Roorkee, Rampur, Balarampur, and Muzaffarnagar were inspected.

2.3.2 Data generation and salient findings

i Pulp & Paper: As per the inspection carried out in 23 pulp & paper units, 21 units were waste paper-based paper mills and 02 units were agro waste-based paper mills. The category-wise average daily production, specific fresh-water consumption and specific effluent discharge are shown in **Fig. 2.19, 2.20 and 2.21**, respectively.

- ✓ Out of 21 waste paper-based paper mills, 07 units were found engaged in manufacturing of bleached grade paper (C1 category) & 14 units were found engaged in manufacturing of unbleached grade paper (C2 category), from waste paper/readymade pulp as raw material.
- ✓ Out of 02 agro waste-based industries, 1 unit was found engaged in manufacturing of bleached grade paper (writing-printing) (B1 category) & 01 unit was found engaged in manufacturing of unbleached grade paper (Kraft) (B2 category), using agro residues as raw material for producing:

- Out of 21 waste paper-based industries, 6 units were found operating on Zero Liquid Discharge (ZLD) (1-Category B1; 1-Category C1 & 4-Catgory C2). ZLD scheme majorly consisting of fibre recovery units (Sedicell, Krofta, etc.) followed by primary settling unit (**Fig. 2.19**)
- Out of total 23 pulp & paper mills, 16 units having permission to discharge the effluent have installed ETP for treatment of generated effluent consisting of Primary treatment units, Secondary (aerobic biological) treatment units followed by tertiary filtration system (such as Pressure Sand Filter, Activated Carbon Filter, Dual Media Filter, Multi Grade Filter etc.).

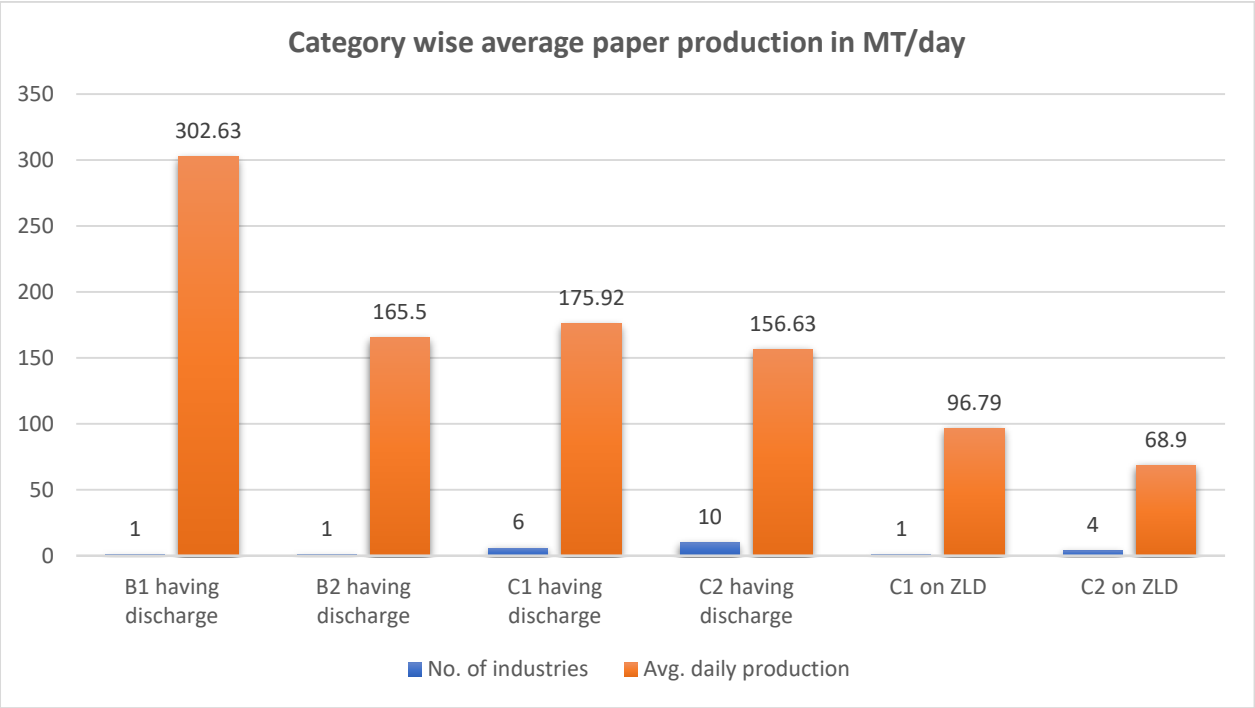


Fig. 2.19 Category wise average paper production in MT/day

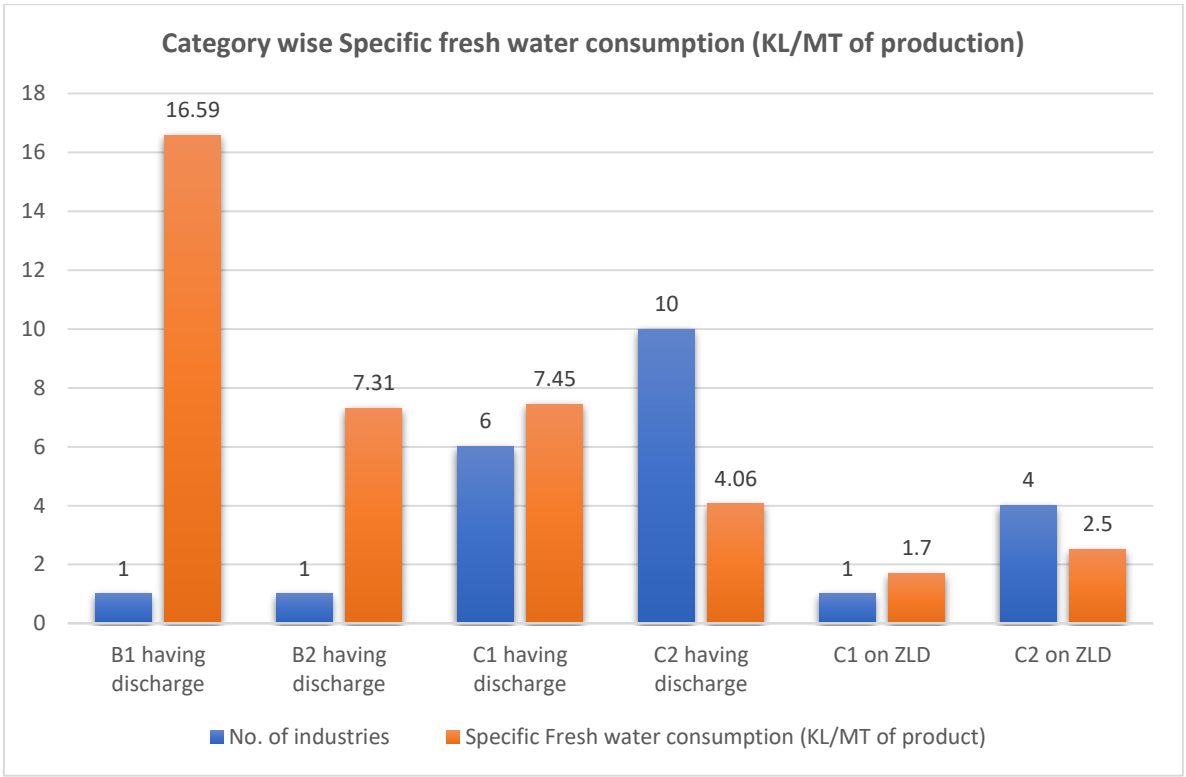


Fig. 2.20 Category wise average specific freshwater consumption in KL/MT

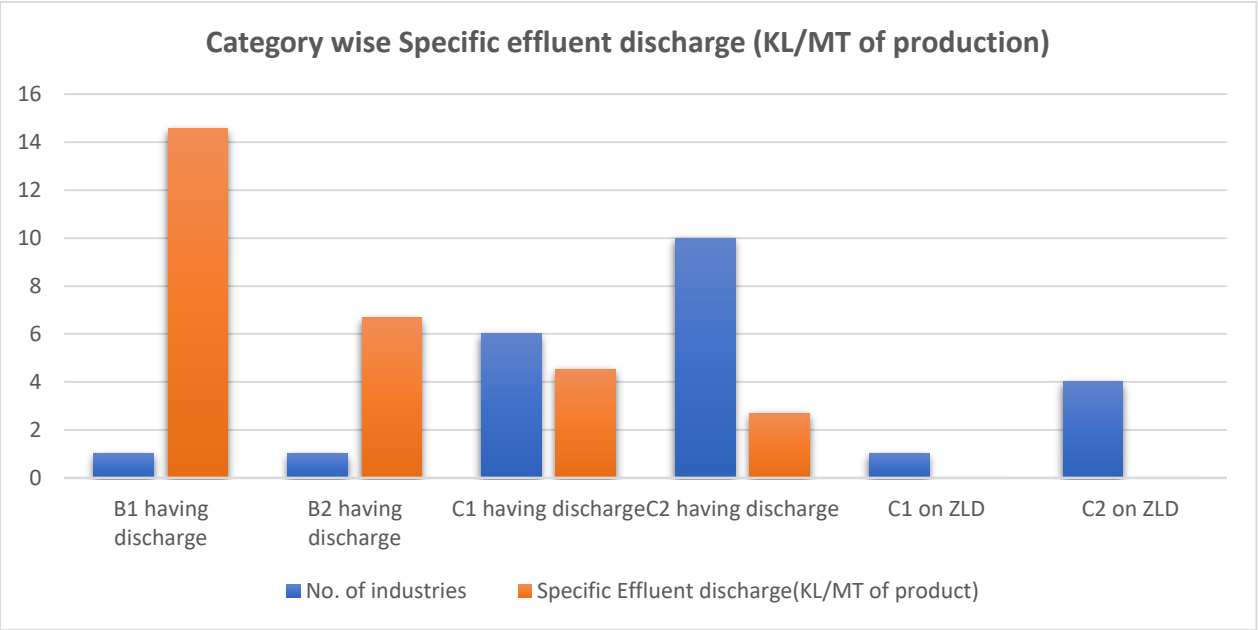


Fig. 2.21 Category wise specific effluent discharge in KL/ MT

- As per the details and documents submitted by these 23 units, category wise average production, specific fresh water consumption and specific effluent discharge is as below:
  a. Actual average daily production of these 23 pulp & paper units found as 3449.81 MT/day.
  b. Average specific fresh water consumption of these 23 pulp & paper units found as 5.36 KL/MT of the production.
  c. Average specific effluent discharge by these 23 pulp & paper units found as 3.28 KL/MT of the production.
     - Analysis results of sample collected from inlet and outlet/recycling line of ETPs installed in waste paper based ZLD units showed negligible reduction in effluent parameters such as BOD and TSS (3 – 13 %) which indicates poor performance of ETP, due to high concentration of BOD, COD & TSS.

a. Plastic Waste

- Total plastic waste generation from these 23 pulp & paper units was estimated as 118.55 MT/day.
- Actual plastic waste quantity generated and reported by these 23 units found as 71.76 MT/day.
- Gap of 46.79 MT/day was found in estimated and actual plastic waste generation quantity.
- Generated plastic waste is being provided to plastic waste recyclers, Waste to energy plants authorized by SPCB. Therefore, industries are meeting with the legal requirements for plastic waste management/disposal, however end use couldn't be verified by joint committee.

b. Boiler ash

- Total boiler ash quantity generation from these 23 pulp & paper units was estimated as 787.98 MT/day.
- Total actual boiler ash quantity generated and reported by these units was found as 592.46 MT/day.
- Gap of 195.52 MT/day was found in estimated and actual boiler ash generation quantity indicates unscientific disposal or poor record keeping.
- It was observed that most of the generated ash was being disposed off for land filling in low lying areas within and outside the premises.
- Some units have made agreements with brick kilns for brick manufacturing, however end use couldn't be verified.

c. ETP Sludge

- Total ETP sludge quantity generated from these 23 pulp & paper units was estimated as 33.92 MT/day.
- Total actual ETP sludge quantity generated and reported by these units was found as 10.12 MT/day.
- Gap of 23.8 MT/day was found in estimated and actual ETP sludge generation quantity indicates unscientific disposal or poor record keeping.

ii Sugar sector

The data of inspections carried out by CPCB in the year 2023 was analysed regarding fresh water consumption, effluent discharge and pollution load. The reduction in freshwater consumption and specific effluent discharge in 2023 as compared to 2017 is shown in **Fig. 2.22.**

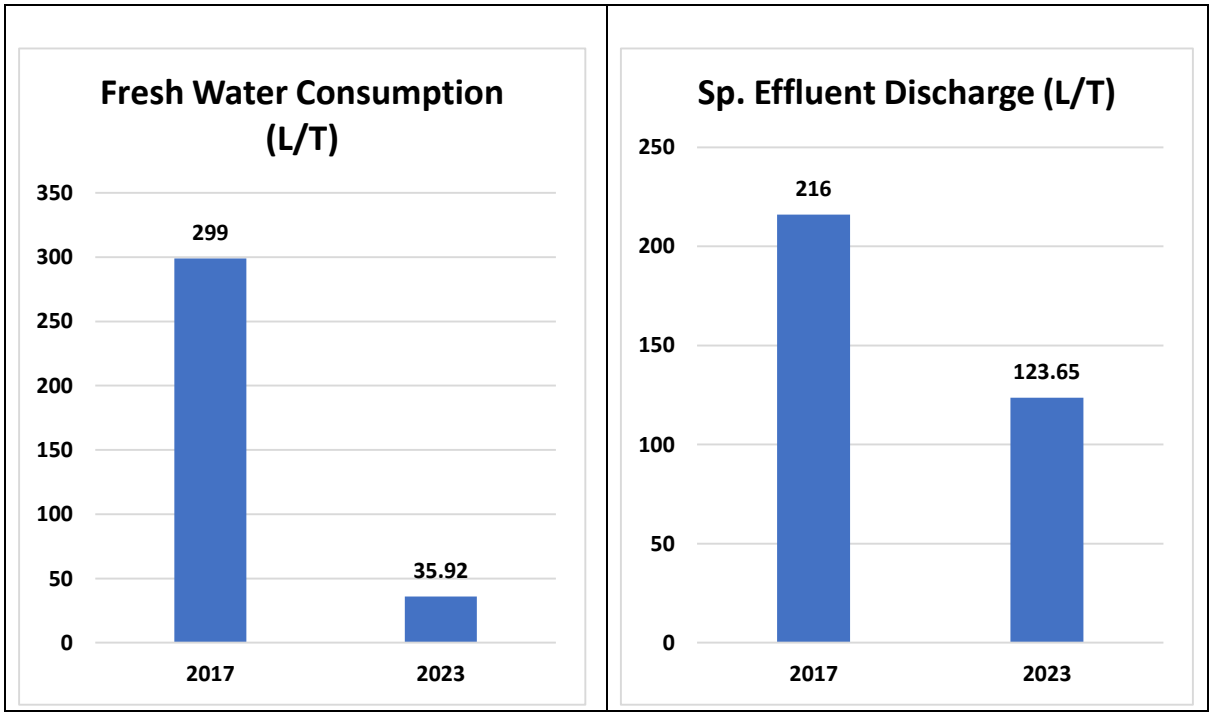


Fig. 2.22 Comparison of specific fresh water consumption and specific effluent discharge during 2017 and 2023

i. The range of crushing capacity was 6250 TCD to 16000 TCD. Two sugar mills were integrated with distillery, 1 was integrated backend refinery, 3 were refinery and 1 was standalone sugar with cogeneration.
ii. Out of seven inspected units, three sugar mills were found non-complying w.r.t. discharge norms.
iii. The total 4103.17 KLD of treated effluent was being used in irrigation purpose by six operational sugar mills in 656-hectare command area.
i. The specific fresh water consumption was in the range of 39.50 L/T to 120.66 L/T of cane crushed.
ii. The specific effluent discharge was in the range 79.79 L/T to 185.52 L/T of cane crushed.
iii. The specific effluent discharge of the sugar industries was complying with the notified discharge limit of 200 L/T of cane crushed.
iv. The BOD load was in the range 8.02 to 620.79 kg/day.
v. As compared to 2017 data, there is a drastic reduction in specific fresh water consumption (SFWC) and specific effluent discharge (SED). SFWC and SED reduced from 299 L/T to 35.92 L/T (88% reduction) and 216 L/T to 123.65 L/T (43% reduction) of cane crushed respectively.

iii Distillery sector

The CPCB's inspection data from 2023 was analysed to evaluate water conservation through reuse and recycling, focusing on specific fresh water consumption, specific spent wash generation, and the quantity of treated water reused in the process from CPU.

Salient features of Distillery

- All distilleries have upgraded their process technology from batch fermentation to fed batch fermentation and distillation technology from atmospheric distillation to Multi Pressure Distillation (MPR).
- For concentration of spent wash/bio-methanated spent wash all the distilleries have installed MEE and mass flow meters with totalizer at the inlet & outlet of MEE.
- To recycle and reuse process condensate, distilleries have installed Condensate Polishing Unit (CPU) for treatment of low strength effluent (spent lees, MEE condensate, boiler and cooling tower blowdown).
- Installed PTZ cameras in bio-compost yards/DDGS production area.
- Out of five units, four units have installed incineration boiler for achieving ZLD. One unit is achieving ZLD by following bio-compositing route and is having 60-acre land for carrying out bio-compositing.
- The average specific fresh water consumption in all the inspected units is now 4.7 KL/KL of alcohol produced as compared to 15 KL/KL of alcohol produced during 2016-17 (before charter implementation) leading to 66 % reduction in specific fresh water consumption.
- Specific spent wash generation rate has reduced from 11.1 KL/KL (2017) of alcohol produced to 6.56 KL/KL (2023) of alcohol produced leading to 41.4% reduction in spent wash generation.
- The decrease in Sp. freshwater consumption as compared to specific spentwash generation may be attributed to the following:

- Distilleries integrated with sugar is using common Borewell and no separate record for distillery consumption.
- Treated effluent/excess condensate from sugar mills is used by the distilleries for molasses dilution after further treatment through CPU.
- Five distilleries which were identified as top pollution load contributors have completed their long term, short term & medium-term goals as per the submitted action plan.

2.4 Way Forward

Based on the analysis of data and information generated through the monitoring of GPIs during 2023, CPCB is setting following goals for future:

A. Grossly Polluting Industries (GPIs)

- **Orange/Green Certification to Distilleries and RCF Based (unbleached) Paper Mills:** The categorization of Distilleries and RCF Based (unbleached) Paper Mills in Orange/Green category will promote ease of doing business which will also incentivize environmental responsibility.
- **SOP for Integrated Sugar & Distillery Units for Reduction in Freshwater Consumption:** Standard Operating Procedures streamline water usage in sugar and distillery units through efficient technologies and recycling measures, minimizing freshwater dependency and enhancing sustainability.
- **CETP Feasibility Study:** Assessing the feasibility of CETPs, evaluates their effectiveness in treating industrial wastewater, considering factors like effluent types, infrastructure requirements, and regulatory compliance to combat pollution effectively.
- **Adoption of Model CCA:** Adoption of model CCA will provide a structured framework for sustainable industrial regulation, freshwater conservation, and pollution control.
- **Formulation of Charter for Chemicals Sector, Slaughter House and Food, Dairy & Beverages:** Establishing a Charter for industries outlines commitments to sustainable practices, setting goals for resource utilization efficiency, waste management, and environmental compliance to foster responsible industrial practice.
- **Carbon Footprint:** Measuring and reducing carbon emissions in industries involves comprehensive assessments and strategies such as energy efficiency improvements, renewable energy adoption, and carbon offset initiatives, contributing to global climate change mitigation efforts and promoting a low-carbon economy.

B. Sector-specific

i Pulp & Paper

- All Pulp & Paper industries shall:
  - Install rotary drum screener at ETP inlet for separation of plastics (or other floating materials) from raw effluent stream and collected plastics shall be disposed scientifically.
  - Install electromagnetic *flow meter with totalizer at ETP Inlet,* ETP outlet, effluent recycle line at ETP and effluent reuse point, and maintain logbooks for the same on daily basis.

- Install separate flow meter with totalizer at all freshwater consumption points such as process area, domestic consumption and boiler, and maintain logbooks for the same on daily basis.
- Ensure scientific disposal of solid waste (i.e. plastic waste, boiler ash and ETP sludge) and maintain proper records of generation and disposal.

- Agro residue-based pulp & paper units shall be encouraged to upgrade/augment their ETP by installing secondary biological treatment system (either anaerobic-aerobic treatment or 02 stage extended aeration system in series) followed by tertiary treatment units consisting of filtration system (i.e. Pressure Sand Filter, Activated Carbon Filter followed by Micro-filtration/Ultrafiltration). For treatment of effluent generated from wet washing section, industries shall install anaerobic treatment unit.

- Waste paper/recycle fiber based industries operating at ZLD must:
  - Upgrade/augment their ETP by installing secondary biological treatment (anaerobic-aerobic).
  - Ensure 80 % reduction in BOD after secondary biological treatment stage.
  - Ensure that characteristics of recycled water used in process (in closed loop) shall meet BOD <2000 mg/l; COD < 4000 mg/l and TSS < 400 mg/l.

- Waste paper/recycle fiber based industries operating at ZLD may also explore other advance technologies available like advance oxidation, membrane filtration, electro-oxidation etc. for complete reuse/recycling to ensure ZLD.

- Waste paper/recycle fiber-based industries discharging treated effluent shall:
  - Upgrade/augment their ETP by installing physico-chemical treatment, secondary biological treatment (either anaerobic-aerobic treatment or 02 stage extended aeration system in series) followed by tertiary treatment units consisting of filtration system (i.e. Pressure Sand Filter, Activated Carbon Filter followed by Micro-filtration/Ultrafiltration).
  - Explore other advance effluent treatment technologies available like advance oxidation, membrane filtration etc. to ensure consistent compliance with stipulated discharge norms.

ii Sugar

- Implementation of sugar charter in all the sugar units in pan India basis
- Identification of non-performing sugar mills on the basis of annual inspections and action plans for sugar mills for better performance in upcoming crushing seasons
- Technological intervention in government led sugar units.
- Stringent norms for industries bypassing the untreated effluent.
- Encourage the sugar units to utilize the excess condensate by treating the condensate through Condensate Polishing Unit.

iii Distillery

- Finalization of revised Charter and thereafter, the same shall be implemented in the distillery units located in Ganga and Yamuna basin.

- Identification of top-polluting distilleries on the basis of annual inspections carried out in 2023 and preparation of action plans.
- Meetings with various stakeholders for exploring the way to utilize the excess condensate and treated effluent from Sugar mills in the distillery units.

SECTION 3: COMMON EFFLUENT TREATMENT PLANTS (CETPs)

Ms. Reena Satavan, Sh. C. B. Chourasia, Dr. Raj Kishore Singh, Mr. Vipin Kumar, Ms. Shivangi Goswami, Dr. Vivek Rana, Ms. Anubha Agarwal

3.1 Common Effluent Treatment Plants (CETPs) located on main stem of river Ganga or its tributaries

Eight Common Effluent Treatment Plants (CETPs) are located on main stem of river Ganga or its tributaries. Out of 8 CETPs, 3 are located in tannery-clusters at Jajmau, Banthar and Unnao in Kanpur (Uttar Pradesh), 2 CETPs in textile-clusters at Rooma, Kanpur and Pilakhua, Hapur in Uttar Pradesh and 3 CETPs in mixed industrial clusters at Pantnagar, Sitarganj and Haridwar in Uttarakhand. The geographical locations of these CETPs are shown in **Fig. 3.1**.

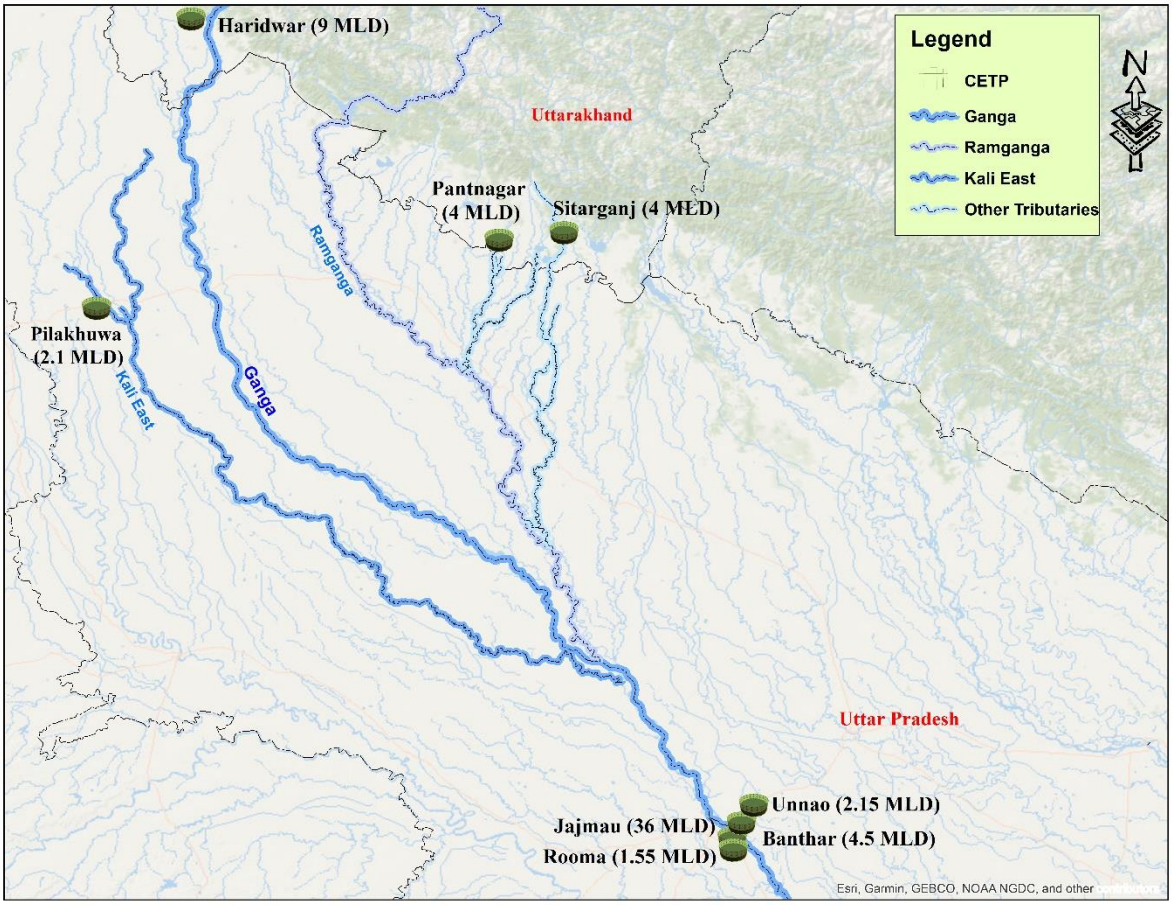


Fig. 3.1 Geographical locations of CETPs

3.1.1 Work accomplished during 2023

During 2023, twenty-two number of inspections of eight CETPs were conducted for their compliance verification and performance evaluation. During 2023, CETP Pantnagar and Sitarganj were monitored twice whereas all other CETPs were monitored thrice. The monitoring of each CETP takes 1-2 days. A team consisting of 2-3 officials comprising of Scientist/Research Associate, Senior Research Fellow, and Field Assistant from CPCB Head Office/Regional Directorate Lucknow carried out the monitoring as per the following plan:

- Wastewater sampling at CETP Inlet & Outlet for the analysis of parameters as per the consent/industrial sector specific parameters or as notified under Environment (Protection) Act, 1986 or mode of discharge of treated effluent of CETPs,
- Wastewater sampling for MLSS/MLVSS from aeration tank of the aeration based biological treatment processes,
- Groundwater sampling from the campus or vicinity of the CETP, and
- Collection of documents such as CTO, NOC for groundwater abstraction, logbooks, etc.

After sampling, the collected samples were transferred to the laboratory at HO Delhi/RD Lucknow and analyses were carried out following standard procedures. The laboratory analysis reports were received by the division and the inspecting team then prepared the report and submitted to the processing officer for further action.

3.1.2 Data generation and salient findings

3.1.2.1 Tannery cluster

There are 03 tannery clusters on the main stem of river Ganga located at Jajmau, Banthar and Unnao. Each cluster has its CETP and member tanneries have installed primary effluent treatment plants (PETPs). PETP treated effluent of member tanneries is collected through network of piping system and further treated at the respective CETPs.

Out of total 367-member tannery units, 325 are connected to CETP Jajmau in Kanpur, 27 units located in Leather Technology Park (LTP) to CETP Banthar, and 15 units located in Site-II Unnao to CETP Unnao. Also, there are 14 individual tannery units (Unnao-10, Kanpur-2 and Bihar-2) having their own Effluent Treatment Plants (ETPs). These units are located outside the CETP network.

(a) CETP Jajmau

There are 325-member tannery units connected to CETP Jajmau. Treated effluent from PETPs of member tanneries is collected through network of piping system & pumping stations and is further treated at 36 MLD CETP (9 MLD tannery wastewater and 27 MLD raw sewage). The treatment scheme of CETP comprises of screens, mixing of raw sewage in buffer tank, UASB followed by aeration for DO enhancement and settling. The treated effluent after mixing with treated sewage (from STPs located within the same premises) is discharged through a concrete channel for irrigation into the fields.

A common chrome recovery plant (CCRP) of capacity 70 KLD, operated by the Kanpur Nagar Nigam, is located at Jajmau, Kanpur. The exhausted chrome tanned liquor collected from various tanneries is transported through tankers to the CCRP and regenerated chrome is to be sold to tanneries for reuse. A new 20 MLD capacity CETP project and a CCRP of capacity 900 KLD for Jajmau Tannery Cluster, Kanpur, are under commissioning stage.

During the year 2023, the CETP was inspected three times in March, May and October months. The CETP operated at a utilized capacity of 32-33.9 MLD which is 88.9-94.2% of the designed capacity (36 MLD) of the CETP. Out of three inspections, the CETP exhibited non-compliance

with treated effluent quality standards on all occasions for BOD, COD, TSS, FDS, Chloride, Oil & Grease, Total Nitrogen, Sulphide, Total Chromium and Chromium (III). Non-compliance of CETP w.r.t. discharge standards may be attributed to inadequate capacity and existing treatment scheme of the CETP.

CCRP Jajmau was also inspected three times in March, May and October months. The CCRP was found non-functional on all three inspections and no raw chrome liquor was found at CCRP for treatment.

(b) CETP Banthar

There are 27-member tannery units connected to 4.5 MLD capacity CETP located at LTP Banthar. The treated effluent of CETP Banthar is discharged into the City Jail drain. The treatment scheme of CETP comprises of physico-chemical, Activated Sludge Process, and dual media filtration. The upgradation of treatment units of CETP Banthar is being carried out.

During the year 2023, the CETP was inspected three times in April, June and November months. Due to restrictions in production capacity of member tannery units, the CETP operated at a utilized capacity of 1.075-1.164 MLD which is 23.9-25.9% of the designed capacity (4.5 MLD) of the CETP. Out of three inspections, the CETP exhibited non-compliance with treated effluent quality standards on all occasions for BOD, COD, Chloride and FDS. Non-compliance of CETP w.r.t. discharge standards may be attributed to improper operation and inadequate treatment technology of the CETP.

(c) CETP Unnao

There are 15-member tannery units connected to 2.15 MLD capacity CETP located at Site-II Unnao. The treated effluent is discharged into Loni River (drain). The treatment scheme of CETP comprises of physico-chemical, Activated Sludge Process, and media filtration. As per report of the latest inspection conducted on 06/11/2023, the CETP was found non-operational.

During the year 2023, the CETP was inspected three times in April, June and November months. Due to restrictions in production capacity of member tannery units, the CETP operated at a utilized capacity of 0.82-0.87 MLD which is 38.1-40.5% of the designed capacity (2.15 MLD) of the CETP. Out of three inspections, the CETP exhibited non-compliance with treated effluent quality standards on all occasions for BOD, COD, Chloride and FDS. Non-compliance of CETP w.r.t. discharge standards may be attributed to improper operation and inadequate treatment technology of the CETP.

3.1.2.2 Textile cluster

(a) CETP Pilakhuwa

CETP Pilkhuwa is located at the Textile Centre Scheme Premises, Pilkhuwa, Hapur, UP and is involved in textile effluent treatment which was initially operated by the Hapur Pilkhuwa Development Authority (HPDA) as a Concessioning Authority. The CETP is now handed over to CETP Textile Centre Pilkhuwa Association (a SPV formed by CETP member units) by HPDA for further execution and administration. The installed capacity of CETP Pilkhuwa is 2.1 MLD. CETP is designed based on physico-chemical treatment, secondary biological

treatment followed by tertiary filtration. Presently, 25 textile units are connected to CETP which discharge around 900 KLD (43% of CETP design capacity) of effluent, generated in textile wet processes i.e. scouring, bleaching, dyeing, washing, etc., in to underground conveyance system feeding the CETP for treatment & disposal. The treated effluent of CETP, having BOD load of approximately 18-20 Kgs/day, is discharged in to local drain which is finally discharged in to River Kali-East via Kadrabad drain.

During the year 2023, the CETP was inspected three times in March, July and November months. Out of three inspections, the CETP exhibited non-compliance with treated effluent quality standards w.r.t. BOD & COD on one occasion, i.e., in March, 2023. However, on other two occasions, viz. July and November, 2023, the CETP was found to be compliant with the discharge standards.

(b) CETP Rooma

CETP Rooma, located at UPSIDC textile zone Kanpur, is a textile effluent CETP having 18-member textile units. CETP is run & operated by Rooma Pollution Control Association (RPCA), a SPV of member units. The capacity of CETP has been reduced to 50% of its design capacity (1.55 MLD) by CPCB due to the under-capacity design of its aeration tank. The CETP Rooma is designed based on physico-chemical treatment, secondary biological treatment followed by tertiary filtration. Presently, 11 textile units are connected to CETP which discharge around 450 KLD (58% of CETP consented capacity i.e. 775 KLD) of effluent, generated in textile wet processes i.e. scouring, bleaching, dyeing, washing etc., in to underground conveyance system for treatment in the CETP and disposal. The treated effluent of CETP, having BOD load of approximately 20-25 Kgs/day, is discharged in to local drain which, via UPSIDC drain, is finally discharged in to the irrigation canal (reaching to Ganga river through breaches in the canal). Recycling of treated used water is not being performed by CETP.

During the year 2023, the CETP was inspected three times in March, June and October months. The CETP operated at a utilized capacity of 486.8-544 KLD which is 31.4-35.1% of the designed capacity (1.55 MLD) of the CETP. The capacity of the CETP is poorly utilized because since September, 2018, its capacity has been reduced to 50% of its design capacity (1.55 MLD) by the CPCB, attributed to the under-capacity design of its aeration tank. Out of three inspections, the CETP exhibited non-compliance with treated effluent quality standards on all occasions for BOD, COD and FDS. Industrial effluent received at the inlet of the CETP was not meeting the inlet effluent quality standards prescribed by UPPCB for BOD, COD, FDS, SAR and Sulphide.

3.1.2.3 Mixed cluster

(a) CETP Haridwar

In Haridwar district of Uttarakhand, a CETP of capacity 9 MLD is designed to treat effluent (industrial effluent and sewage) generated from mixed type of industrial units located in the Integrated Industrial Estate, Haridwar. The CETP is owned by the State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIIDCUL) and operated by M/s

SK UEM Water Projects Pvt. Ltd. The CETP was commissioned in two phases: Phase-I of 4.5 MLD was commissioned in February, 2008 and Phase-II of 4.5 MLD was commissioned in February, 2022. The CETP is connected to 549-member industrial units which comprise a mixed type of industries encompassing metal processor/auto parts (75), plastic/rubber moulders (79), pharma (formulation) (84), cosmetics (31), electrical & electronics (100), packaging/warehouse/others (165), food products (11) and textile (4). The CETP is based on Moving Bed Bio-film Reactor technology followed by Activated Sludge Process. The treated effluent is discharged into the Rawli Rao drain which finally meets river Sukhi, a tributary of river Ganga. The treated effluent is also used to prepare dosing chemicals, centrifuge flushing, toilet flushing, gardening and other construction works, etc.

During the year 2023, the CETP was inspected three times in March, July and November months. The CETP operated at a utilized capacity of 7.6-8.8 MLD which is 84.4-97.7% of the designed capacity (9 MLD) of the CETP. Out of three inspections, the CETP exhibited compliance with treated effluent quality standards on one occasion, i.e., in March, 2023. However, on two occasions, viz. July and November, 2023, the CETP was found to be non-compliant with the prescribed standards w.r.t. Fluoride and BOD, respectively. The BOD and COD removal efficiencies of the CETP ranged as 89.6-96.9% and 84.8-91.7%, respectively. The CETP inlet was not meeting the norms prescribed by UKPCB for BOD, COD, Oil & Grease, TDS and Chromium.

(b) CETP Pantnagar

In Udham Singh Nagar district of Uttarakhand, a CETP of 4 MLD capacity is designed to treat effluent generated from mixed type of industrial units located in the Integrated Industrial Estate (Pantnagar, Uttarakhand). The CETP is operated by M/s Pantnagar CETP Pvt. Ltd. (PCETPPL), a SPV of Ramky Infrastructure Pvt. Ltd. and is owned by the State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIIDCUL). The CETP is connected to 290-member industrial units. The CETP is based on activated sludge process followed by filtration. The treated effluent is discharged into river Kalyani via a local drain.

During the year 2023, the CETP was inspected two times in January and July months. The CETP operated at a utilized capacity of 0.45-1 MLD which is 11.3-25% of the designed capacity (4 MLD) of the CETP. The poor capacity utilization of the CETP is attributed to less effluent generation by the member industrial units of the CETP. The CETP was found complying w.r.t. treated effluent discharge norms on one occasion (i.e., January, 2023) whereas non-complying on another (i.e., July, 2023) w.r.t. discharge norms for Fluoride. The BOD and COD removal efficiencies of the CETP ranged as 90.3-95.1% and 92.3-95.5%, respectively. The CETP inlet was not meeting the norms prescribed by UKPCB for Mercury.

(c) CETP Sitarganj

In Udham Singh Nagar district of Uttarakhand, a CETP of 4 MLD capacity is designed to treat effluent generated from industrial units located in the ELDECO SIDCUL Industrial Park (Sitarganj, Uttarakhand). The CETP is owned by M/s ELDECO SIDCUL Industrial Park Ltd. (ESIPL) which is a joint venture of SIDCUL and M/s ELDECO, which has sublet the operation & maintenance work to M/s JITF ESIPL CETP (Sitarganj) Limited. The CETP is connected

with 68-member industrial units. The CETP is based on activated sludge process followed by filtration. The treated effluent is used for irrigation purpose.

During the year 2023, the CETP was inspected two times in January and July months. The CETP operated at a utilized capacity of 1.2-1.25 MLD which is 30-31.25% of the designed capacity (4 MLD) of the CETP. The CETP is designed to treat effluent generated from 210 units however only 68-member units are connected to the CETP resulting in poor capacity utilization of the CETP. The CETP was found non-complying w.r.t. treated effluent discharge norms on both the monitoring occasions i.e., January, 2023 w.r.t. discharge norms for BOD, TSS, FDS & Fluoride & July, 2023 w.r.t. BOD, COD, Fluoride, Total Kjeldahl Nitrogen and Ammoniacal Nitrogen. The CETP inlet was not meeting the norms prescribed by UKPCB for TDS and ammoniacal nitrogen.

3.1.3 Issues and action taken

Based on the monitoring data during 2023, the major issues identified in the CETPs and action taken by CPCB are shown in **Table 3.1.**

Table 3.1 Major issues identified in the CETPs and action taken by CPCB

S. no.	Name of CETP	Issues	Action taken
Tannery cluster			
1.	CETP Jajmau	• Inadequate CETP (in terms of effluent treatment capacity and treatment technology at Jajmau and in terms of treatment technology at Banthar and Unnao, resulting in non-compliance w.r.t. discharge standards. • Use of obsolete technologies and machinery with more chemical consumption and sludge generation by the member tannery units. • High concentration of BOD, COD and TDS in effluent; due to use of salts and inorganic chemicals in processing. • Salt-based preservation of raw hides, being perishable. • Tanneries units belong to MSME category, need technical and financial support such as training upgradation of obsolete process machines and PETP operation maintenance.	• CPCB forwarded the inspection reports of all three CETPs to UPPCB for necessary action. • Upgradation of existing CETPs is under progress. • Workshops for review/ vetting of individual action plans submitted by units were held at Kanpur on 7-8th Feb, 2023 and 18-19th May, 2023. • Follow-up meetings with tannery sector stakeholders were held on 25th Jul, 2023 at CPCB, Delhi, 6th Aug, 2023 at Kanpur and 6th Dec, 2023 through video conferencing. • Action plans submitted by tannery units were reviewed by CPCB and follow-up letters were issued to tannery units.
2.	CETP Banthar		
3.	CETP Unnao		

S. no.	Name of CETP	Issues	Action taken
		• Lack of maintenance and capacity augmentation of PETP over a period of time. • Lack of trained man power for PETP operation and laboratory facility for on-site testing.	
Textile cluster			
4.	CETP Rooma	• Non-compliance w.r.t. discharge standards. • Improper operation and maintenance • Recycling of treated used water is not being performed by CETP. • CETP found operating at around 40-45 % of its design capacity (2.1 MLD).	CPCB imposed Environmental Compensation on RPCA, CETP Rooma for the non-compliance.
5.	CETP Pilakhuwa	• Compliance w.r.t. discharge standards. • Member units not operating their Primary effluent treatment plant (PETP) properly • Biological system is not stabilised. • Continuous non-compliance w.r.t CETP inlet norms prescribed by UPPCB	-
Mixed cluster			
6.	CETP Haridwar	• Non-compliance w.r.t. discharge standards. • Improper operation and maintenance. • Member units discharging effluent not meeting the CETP inlet norms prescribed by UKPCB • Disrupted connectivity along with improper calibration of Online Continuous Effluent Monitoring System (OCEMS) for data transmission to CPCB server.	• CPCB issued directions under section 5 of E (P) Act, 1986 to SIIDCUL. • CPCB issued directions under section 18 (1) (b) of Water Act, 1974 to UKPCB.

S. no.	Name of CETP	Issues	Action taken
7.	CETP Pantnagar	• Non-compliance w.r.t. discharge standards. • Improper operation and maintenance. • Member units discharging effluent not meeting the CETP inlet norms prescribed by UKPCB. • Improper function of OCEMS for data transmission to CPCB server.	• CPCB levied environmental compensation on the CETP operator, i.e., ESIPL. • CPCB issued directions under section 18 (1) (b) of Water Act, 1974 to UKPCB.
8.	CETP Sitarganj	• Non-compliance w.r.t. discharge standards. • Improper operation and maintenance. • Member units discharging effluent not meeting the CETP inlet norms prescribed by UKPCB.	• CPCB levied environmental compensation on the CETP operator, i.e., ESIPL. • CPCB issued directions under section 18 (1) (b) of Water Act, 1974 to UKPCB.

3.1.4 Way forward

S. No.	Name of CETP	Way forward	Executing agency
Tannery cluster			
1.	CETP Jajmau, Banthar & Unnao	Regular operation of Chrome Recovery Plant and PETP/ETP installed at units by trained man-power.	Member tannery units
		Regular operation of Common Chrome Recovery Plant installed at Jajmau.	Kanpur Nagar Nigam
		CETPs up-gradation in terms of treatment technology and effluent treatment capacity as per requirement.	Concerned SPVs
		Setting up of common facilities & procurement of chilled/ green/ brine cures hides as raw material.	Tannery associations
		Implementation of medium & long term measures as per the Charter for tannery ***(Appendix 3.2)***.	Member tannery units
Textile cluster			

S. No.	Name of CETP	Way forward	Executing agency
2.	CETP Rooma	Ensure proper O&M of the CETP and PETPs by member units	Rooma Pollution Control Association (RPCA)
3.	CETP Pilakhuwa	Formulation of a surveillance team to monitor member industries to ensure their compliance with the CETP inlet effluent quality standards	UPPCB, CETP Textile Centre Pilakhuwa Association and District Administration
Mixed cluster			
4.	CETP Haridwar	Action against the non-complying CETP at Haridwar or member industries that do not have adequate treatment facilities to comply with the norms	UKPCB
		Formulation of a surveillance team to monitor member industries to ensure their compliance with the CETP inlet effluent quality standards including compliance of effluent discharge standards by CETP	UKPCB, State Infrastructure And Industrial Development Corporation Of Uttarakhand Ltd. (SIIDCUL) and District Administration
		Ensure proper O&M of the CETP	SIIDCUL
		To ensure that the CETP undertakes regular calibration & maintenance of the OCEMS to assure continuous and reliable generation of data	SIIDCUL
5.	CETP Pantnagar	Ensure proper O&M of the CETP	SIIDCUL
		Formulation of a surveillance team to monitor member industries to ensure their compliance with the CETP inlet effluent quality standards including compliance of effluent discharge standards by CETP	UKPCB, SIIDCUL and District Administration
		Ensure regular calibration & maintenance of the OCEMS to assure continuous and reliable generation of data	SIIDCUL

S. No.	Name of CETP	Way forward	Executing agency
6.	CETP Sitarganj	Ensure proper O&M of the CETP	SIIDCUL
		Formulation of a surveillance team to monitor member industries to ensure their compliance with the CETP inlet effluent quality standards including compliance of effluent discharge standards by CETP	UKPCB, SIIDCUL and District Administration

3.2 Common Effluent Treatment Plants (CETPs) of main stem of river Yamuna & its tributaries

There are 34 Common Effluent Treatment Plants (CETPs) located in main stem of river Yamuna & its tributaries. Out of 34 CETPs, 19 are located in the state of Haryana, 13 are located in NCT-Delhi and 02 are located in Uttar Pradesh.

Out of 19 CETPs of Haryana, 02 are located in Ambala (both in mixed industrial clusters), 02 are located in Faridabad (one in mixed industrial cluster and one in electroplating industrial cluster), 02 are located in Gurugram (one in mixed industrial cluster and one in electroplating industrial cluster), 01 in Jind (in mixed industrial cluster), 01 in Panchkula (in mixed industrial cluster), 03 are located in Panipat (two in textile industrial clusters and one in mixed industrial cluster, which is non-operational since 2019 due to lack of industrial effluent at the CETP inlet) , 01 in Rewari (in mixed industrial cluster), 03 in Rohtak (in mixed industrial clusters) and 04 in Sonipat (in mixed industrial clusters).

All the 13 CETPs of NCT-Delhi are designed for treatment of mixed type of effluent.

Both CETPs of Uttar Pradesh are designed for treatment of effluent generating from textile industries.

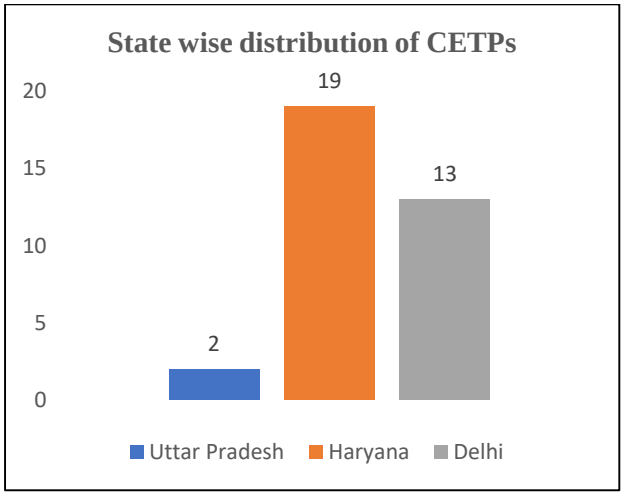


Fig. 3.2 State wise distribution of Yamuna CETPs

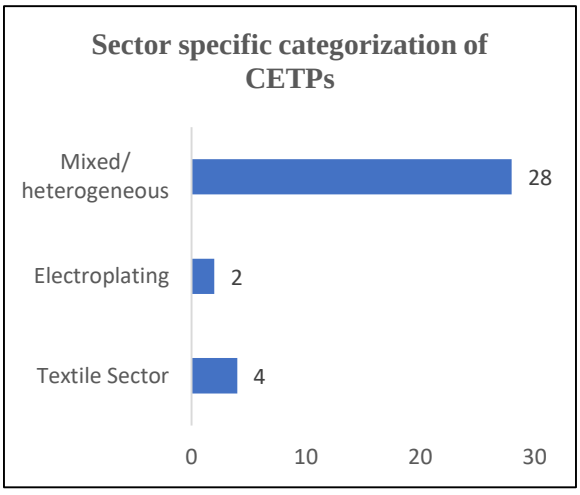


Fig. 3.3 Sector wise categorization of Yamuna CETPs

The geographical locations of these CETPs are shown in **Fig. 3.4**.

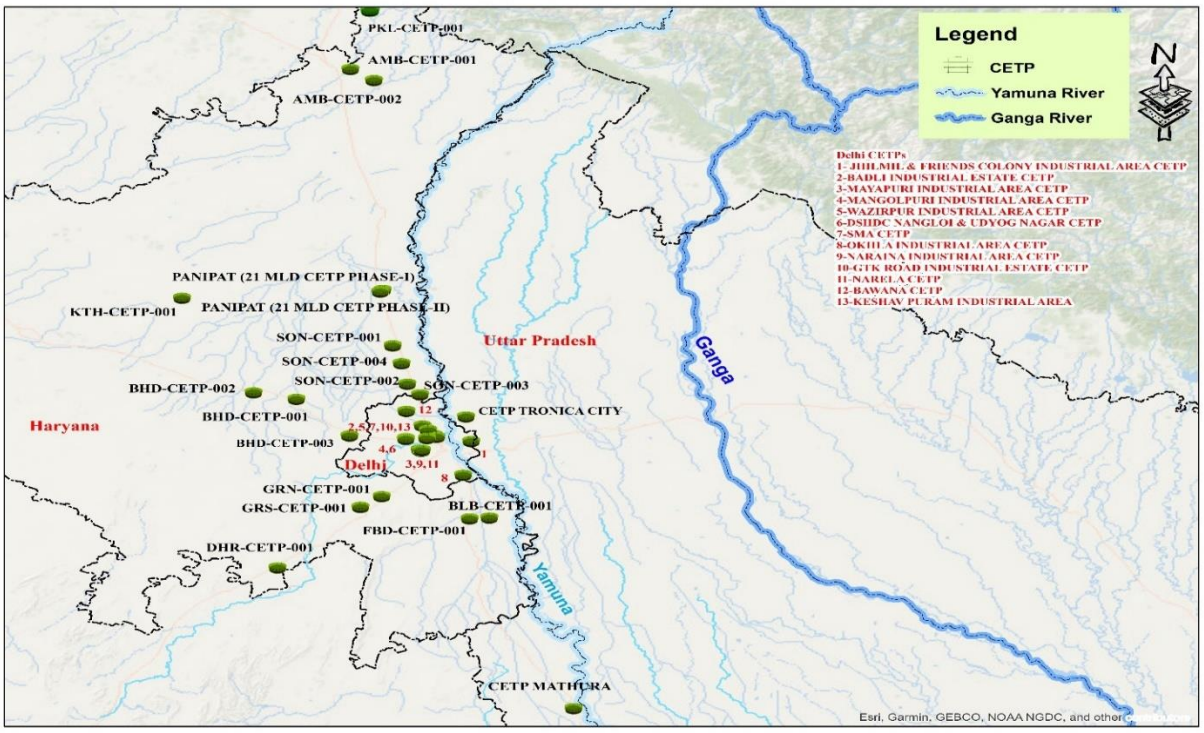


Fig. 3.4 Geographical locations of CETPs located in main stem of River Yamuna & it's tributaries

Under PIAS project, monitoring of these CETPs are carried out on surprise basis by CPCB authorized third party technical institutes (one faculty member and one Research Scholar) and concerned SPCBs/PCC. During 2023, for monitoring of 34 CETPs, two technical institutes namely IIT-Delhi and NEERI were engaged.

During monitoring, out of 34 CETPs, 33 were found operational and 01 (2.5 MLD CETP, HSIIDC Refinery Road, Panipat) was found non-operational (this CETP is non-operational since 2019 due to lack of industrial effluent at the CETP inlet).

Out of 33 operational CETPs, 11 were found complying and 22 were non-complying w.r.t standards prescribed by concerned SPCB/PCC. Installed capacity of these 33 CETPs was found as 425.75 MLD, however utilized capacity was found as 219.85 MLD (51.64% capacity). Out of 33 operational CETPs, only 3 CETPs (in Haryana) were found working at full capacity whereas remaining 30 were working under capacity. State wise details of CETPs showed in **Table 3.2**.

Table 3.2 State wise details of CETPs located in main stem of River Yamuna & its tributaries

State	Operational CETP (No.)	Installed capacity (MLD)	Utilized Capacity (MLD)	Complying	Non-Complying
Haryana	18	201.25	142.5 (70.8 %)	08	10
Delhi-NCT	13	212.3	71.95 (33.8 %)	2	11

State	Operational CETP (No.)	Installed capacity (MLD)	Utilized Capacity (MLD)	Complying	Non-Complying
Uttar Pradesh	2	12.2	5.4 (44.26%)	1	1
Total	**33**	**425.75**	**219.85 (51.63%)**	**11**	**22**

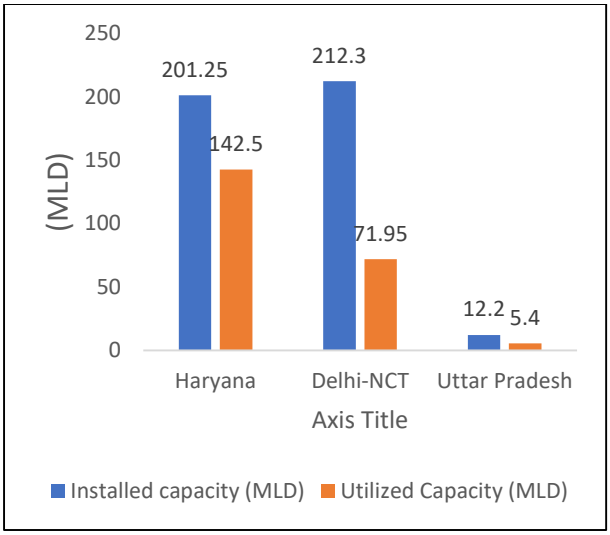


Fig. 3.5 State wise Installed & Utilized capacity of Yamuna CETPs

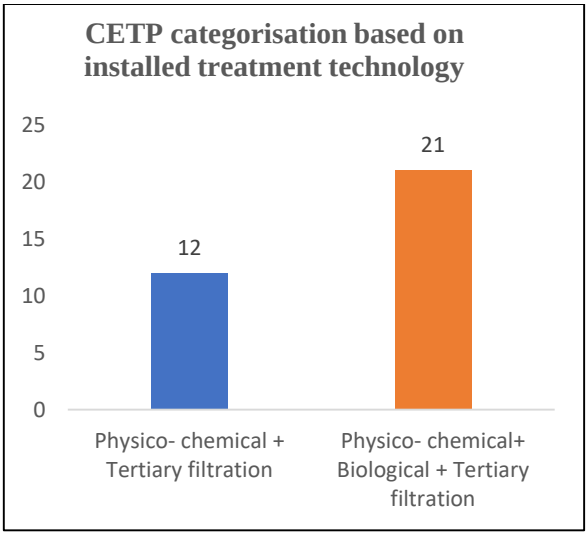


Fig. 3.6 Categorization of installed treatment technology of Yamuna CETPs

3.2.1 Cluster wise performance of CETPs

A. Textile Cluster:

On the main stem of river Yamuna, 04 textile clusters have its CETP and member textile industries have installed primary effluent treatment plants (PETPs). PETP treated effluent of member textile units is collected through network of piping system and further treated at the respective CETPs. Out of these 04 CETPs, two are located in Haryana and two are located in Uttar Pradesh.

Out of total 456-member textile units, 200 are connected to CETP Panipat Phase-I (Haryana), 200 textile units are connected to CETP Panipat Phase-II (Haryana), 38 are connected to CETP Ghaziabad (Uttar Pradesh) and 18 are connected to CETP Mathura (Uttar Pradesh).

CETPs of Haryana

In Haryana, there are two CETPs in textile clusters for treatment of industrial effluent generating from textile industries. One is located at Phase-I, Panipat and another is located at located at Phase-II, Panipat.

1. CETP Phase-I, Panipat have 200 textile member units. Design capacity of this CETP is 21 MLD, however operating capacity was found 19 MLD.
    - Treatment scheme of this CETP is comprises of physico-chemical followed by biological treatment (ASP) followed by tertiary filtration treatment units (DMF) and Disinfection.

- Treated effluent is discharged into drain (Dadula drain) and then finally discharged into River Yamuna.
- During 2023, this CETP was found complying w.r.t standards prescribed by Haryana State Pollution Control Board (HSPCB).

2. CETP Phase-II, Panipat have 200 textile member units. Design capacity of this CETP is 21 MLD, however operating capacity was found 15.61 MLD.
    - Treatment scheme of this CETP is comprises of physico-chemical followed by biological treatment (ASP) followed by tertiary filtration treatment units (DMF) and Disinfection.
    - Treated effluent is discharged into drain (Dadula drain) through closed pipeline and then finally discharged into River Yamuna.
    - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

CETPs of Uttar Pradesh

In Uttar Pradesh, there are two CETPs in textile clusters for treatment of industrial effluent generating from wet processing of textile industries. One is located in Ghaziabad and another is located in Mathura.

3. Ghaziabad CETP is located at Apparel Park Tronica City Phase-I, Ghaziabad. Design capacity of Ghaziabad CETP is 6 MLD, however operating capacity was found 2 MLD (33 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units (DMF & ACF) followed by Disinfection (Chlorination).
    - Treated effluent is discharged into industrial drain (Jawali drain) through closed pipeline and then to River Yamuna.
    - During 2023, this CETP was found complying w.r.t standards prescribed by Uttar Pradesh Pollution Control Board (UPPCB).
4. Mathura CETP is located at Audhyogic Pradushan Nivaran Co Ltd., Industrial area, Site-A, Mathura. Design capacity of Mathura CETP is 6.2 MLD, however operating capacity was found 3.48 MLD (56 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary treatment units (DMF).
    - 60 % of the treated effluent is recycled in member industrial units and balance treated effluent is discharged into industrial drain and then to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by UPPCB for BOD (48 mg/l against prescribed norm of 30 mg/l), COD (280 mg/l against prescribed norm of 250 mg/l) and pH (6.40 against prescribed norm of 6.5-8.5).

B. Mixed Industrial Cluster:

On the main stem of river Yamuna, there are 28 mixed industrial clusters having its CETP and member industrial units have installed primary effluent treatment plants (PETPs). PETP treated effluent of member textile units is collected through network of piping system and further

treated at the respective CETPs. Out of these 28 CETPs, 15 are located in the state of Haryana and 13 are located in the state of NCT-Delhi.

CETPs of Haryana

In Haryana, there are 15 CETPs in mixed industrial clusters for treatment of industrial effluent generating from mixed type of industries. Out of 15, 02 are located in Ambala, 01 in Faridabad. 01 in Gurugram, 01 in Jind, 01 in Panchkula, 01 in Panipat, 01 in Rewari, 03 in Rohtak and 04 in Sonipat.

Ambala

5. One CETP is located at Ambala, Cantt. (AMB-CETP-001) and 130-member industrial units are connected to this CETP. Design capacity of this CETP is 0.5 MLD, however operating capacity was found 0.485 MLD (97 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (PVA gel followed by extended aeration) followed by Tertiary filtration treatment units followed by disinfection
    - Treated effluent is discharged into Municipal Sewer line through closed pipe to Tangari River to Markanda River and then finally discharged into River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t non-availability of hazardous waste authorization.

6. One CETP is located at IDC Saha, Ambala (AMB-CETP-002) and 300-member industrial units are connected to this CETP. Design capacity of this CETP is 5 MLD, however operating capacity was found 2.9 MLD (58 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units followed by disinfection.
    - Treated effluent is discharged into drain through closed pipe and then finally discharged into River Yamuna. Treated effluent is also utilized for irrigation purpose.
    - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

Faridabad

7. One CETP is located at IMT, Faridabad SEC-68, (Ballabgarh Region) (BLB-CETP-001) and 410-member industrial units are connected to this CETP. Design capacity of this CETP is 10.5 MLD, however operating capacity was found 9.9 MLD (94 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units followed by disinfection.
    - Treated effluent is discharged into Agra canal (closed drain), then to River Sukhi and then finally to River Yamuna.

- During 2023, this CETP exhibited non-compliance (trivial violation) w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for BOD (68 mg/l against prescribed norm of 30 mg/l).

Gurugram

8. One CETP is located at IMT, Manesar Gurgaon HSIIDC (GRS-CETP-001). Design capacity of this CETP is 55 MLD, however operating capacity was found 47.2 MLD (86 % utilization).
   - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units.
   - Treated effluent is discharged through local drain to Badshahpur drain and then it is divided into two parts i.e., 1. Jhajjar irrigartion canal and 2. Nazafgarh drain, which finally meets river Yamuna. However, during summer season, it gets stored at wet land area located at badshahpur i.e., badshahpur jheel.
   - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

Jind

9. One CETP is located at I. E. Jind (KTH-CETP-001). Design capacity of this CETP is 0.1 MLD and operating capacity was found 0.1 MLD (100 % utilization).
   - Treatment scheme of this CETP is comprises of Physico-chemical, Biological (MBBR based) followed by Tertiary filtration treatment units.
   - Treated effluent is used for irrigation purpose.
   - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

Panchkula

10. One CETP is located at IE, Barwala, Panchkula (PKL-CETP-001) and 302 member industrial units are connected to this CETP. Design capacity of this CETP is 0.5 MLD, however operating capacity was found 0.4 MLD (80 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological treatment (Extended aeration) followed by Tertiary filtration treatment units.
    - In this CETP, 20% of sewage is being mixed in Industrial effluent.
    - Treated effluent is utilized for construction purposes at Industrial Estate, Barwala. Remaining treated effluent is discharged into local drain through closed pipeline, then to River Tangari and then finally to River Yamuna.
    - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

Panipat

11. One CETP is located at HSIIDC Refinery Road, Panipat. Design capacity of this CETP is 2.5 MLD.
    - Treatment scheme of this CETP is comprises of physico-chemical followed by biological treatment (ASP) followed by tertiary filtration treatment units (DMF).

- This CETP is non-operational since 2019 due to lack of industrial effluent at the CETP inlet.

Rewari

12. One CETP is located at IMT, Bawal, Rewari (HSIIDC) (DHR-CETP-001) and 492-member industrial units are connected to this CETP. Design capacity of this CETP is 22.5 MLD, however operating capacity was found 3.7 MLD (16 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological treatment (Extended aeration) followed by Tertiary filtration treatment units followed by Disinfection.
    - Treated effluent is utilized in horticulture.
    - During 2023, this CETP exhibited non-compliance w.r.t non-availability of air consent, water consent and hazardous waste authorization.

Rohtak

13. One CETP is located at IMT, Rohtak (Bahadurgarh) (BHD-CETP-001). Design capacity of this CETP is 10 MLD, however operating capacity was found 5 MLD (50 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological treatment (ASP) followed by Tertiary filtration treatment units followed by Disinfection.
    - Treated effluent is discharged into nearby drain (Gandhara drain) through closed pipeline and then finally to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for TDS (8580 mg/l against prescribed norm of 2100 mg/l) and Chloride (4652 mg/l against prescribed norm of 600 mg/l).

14. One CETP is located at IE, HSIIDC, Kutana, Rohtak, (Bahadurgarh) (BHD-CETP-002) and 190-member industrial units are connected to this CETP. Design capacity of this CETP is 3 MLD, however operating capacity was found 1.3 MLD (43 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological treatment (ASP) followed by Tertiary filtration treatment units.
    - Treated effluent discharged in to the Industrial Drain and then finally to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for TDS (7320 mg/l against prescribed norm of 2100 mg/l) and Chloride (3210 mg/l against prescribed norm of 600 mg/l.
    - At the time of designing only pH, BOD. COD, TSS, TDS were considered, while there are lot of electroplating industries operating in industrial area and these

industries effluent contains less pH and lot of heavy metals, which cannot be treated with the existing CETP.

15. One CETP is located at IE, Sector 16-17, HSIIDC, Bahadurgarh (BHD-CETP-003) and 400-member industrial units are connected to this CETP. Design capacity of this CETP is 12.5 MLD, however operating capacity was found 2.5 MLD (20 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological treatment (ASP) followed by Tertiary filtration treatment units followed by Disinfection.
    - Treated effluent is utilized for irrigation purpose.
    - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

Sonipat

16. One CETP is located at IE, Barhi, Sonepat (SON-CETP-001). Design capacity of this CETP is 16 MLD and operating capacity was found 16 MLD (100 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (SBR) followed by Tertiary filtration treatment units (DMF) followed by Chlorination.
    - Around 2000 KLD of treated effluent is utilized in horticulture inside CETP area and Green belts in Industrial area. Remaining treated effluent is discharge into drain and then to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for BOD (176 mg/l against prescribed norm of 30 mg/l), COD (582 mg/l against prescribed norm of 250 mg/l) and TDS (2860 mg/l against prescribed norm of 2100 mg/l).
    - 10 MLD CETP was found under construction.

17. One CETP is located at IE, Rai, Sonepat (SON-CETP-002) and 1600-member industrial units are connected to this CETP. Design capacity of this CETP is 10 MLD, however operating capacity was found 8.5 MLD (85 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units (DMF & ACF) followed by Chlorination.
    - Treated effluent is discharged into drain through closed pipeline and then to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for TDS (2990 mg/l against prescribed norm of 2100 mg/l) and non-availability of valid hazardous waste authorization.

18. One CETP is located at IE, Kundli, Sonepat (SON-CETP-003) and 1000-member industrial units are connected to this CETP. Design capacity of this CETP is 10 MLD, however operating capacity was found 9 MLD (90 % utilization).

- Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by biological treatment (ASP) followed by tertiary filtration treatment units.
- Treated effluent is discharged into drain and then to River Yamuna.
- During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for TDS (2280 mg/l against prescribed norm of 2100 mg/l) and non-availability of valid hazardous waste authorization.

19. One CETP is located at IE, Murthal, Sonepat (SON-CETP-004). Design capacity of this CETP is 2 MLD and operating capacity was found 2 MLD (100 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by biological treatment (ASP) followed by tertiary filtration treatment units.
    - Treated effluent is discharged into drain and then to River Yamuna.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for BOD (292 mg/l against prescribed norm of 30 mg/l), COD (790 mg/l against prescribed norm of 250 mg/l) and TDS (3220 mg/l against prescribed norm of 2100 mg/l).

CETPs of NCT-Delhi

In NCT-Delhi, there are 13 CETPs in mixed industrial clusters for treatment of industrial effluent generating from mixed type of industries. Out of 13 CETPs, 01 is located in East Delhi, 02 are located in West Delhi, 01 is located in South Delhi, 08 are located in North West Delhi and 01 is located in South West Delhi.

East Delhi

20. One CETP is located at Jhilmil & Friends Colony Industrial Area CETP, B-Block (Opp. B-43), Jhilmil Industrial Area, Delhi-110095. Design capacity of this CETP is 16.8 MLD, however operating capacity was found 4.5 MLD (27 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by tertiary filtration treatment units (DMF & ACF).
    - Around 75-100 KLD of treated effluent is recycled for horticulture purpose and remaining treated effluent is discharged into drain and then finally to River Yamuna.
    - During 2023, this CETP was found non-complying w.r.t marginal high concentration of TSS against the consented standards prescribed by Delhi Pollution Control Committee (DPCC).

West Delhi

21. Mayapuri Industrial Area CETP is located opposite Govt. Of India Press, Phase-I, Mayapuri Industrial Area, New Delhi-110064. Design capacity of this CETP is 12 MLD, however operating capacity was found 3.7 MLD (31 % utilization).

- Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by tertiary filtration treatment units (DMF & ACF).
- Treated effluent is partially used for DDA parks for development of green belt, spraying on roads surface etc. and partially discharged to drain.
- During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for TDS (2114 mg/l against prescribed norm of 2100 mg/l) and Phosphate (9.50 mg/l against prescribed norm of 5 mg/l).
- Augmentation of the CETP was found in the planning stage.

22. DSIIDC Nangloi & Udyog Nagar CETP is located behind DTC Nangloi Depot, Rohtak Road Delhi-110041. Design capacity of this CETP is 12 MLD, however operating capacity was found 3.5 MLD (29 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by tertiary filtration treatment units (DMF & ACF).
    - Some amount of treated effluent is reused for gardening and remaining effluent is discharged into the drain (Najafgarh Drain).
    - During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for TDS (2212 mg/l against prescribed norm of 2100 mg/l) and Chloride (1193 mg/l against prescribed norm of 1000 mg/l).

South Delhi

23. Okhla Industrial Area CETP is located at C-141 Phase-I, New Delhi-110020. Design capacity of this CETP is 24 MLD, however operating capacity was found 2 MLD (8 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary treatment units (ACF & MGF).
    - Around 1000 litre/day of treated effluent passes through UV filtration and used for multiple purposes within the industrial cluster and remaining effluent is discharged into Indrakalyan Drain through local drain.
    - During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for Total Nitrogen (52 mg/l against prescribed norm of 50 mg/l) and Phosphate (5.62 mg/l against prescribed norm of 5 mg/l).
    - Augmentation of the CETP was found in the proposal stage.

North West Delhi

24. Badli Industrial Estate CETP is located behind Suraj Park, Rohini, Sector-18, Delhi-110042. Design capacity of this CETP is 12 MLD, however operating capacity was found 4 MLD (33 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is partially used for Horticulture purposes and balance is discharged to drain.
    - During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for nitrate (10.12 mg/l against prescribed norm of 10 mg/l) and phosphorus (8.11 mg/l against prescribed norm of 5 mg/l).

- Augmentation of the CETP was found in the proposal stage.

25. Mangolpuri Industrial Area CETP is located at Mangolpuri Industrial Area, Phase-I Delhi-110083. Design capacity of this CETP is 2.4 MLD, however operating capacity was found 1.75 MLD (73 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is partially used for horticulture purposes & roads sprinkling and the balance treated effluent is discharged to CETP drain.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by DPCC for BOD (93 mg/l against prescribed norm of 30 mg/l) and COD (289 mg/l against prescribed norm of 250 mg/l).
    - Augmentation of the CETP was found in the planning stage.

26. Wazirpur Industrial Area CETP is located at Adarsh Complex (2nd Floor), Plot No. 3, Community Centre, Wazirpur Industrial Area, Delhi-110052. Design capacity of this CETP is 24 MLD, however operating capacity was found 4 MLD (17 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical treatment followed by tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is discharged to CETP drain.
    - During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for Iron (3.581 mg/l against prescribed norm of 3.0 mg/l).
    - Augmentation of the CETP was found in the proposal stage.

27. North West Industrial Area CETP (SMA CETP) is located at 119 SMA Co-Operative Industrial Area, Gt Karnal Road, Delhi-110033. Design capacity of this CETP is 12 MLD, however operating capacity was found 3 MLD (25 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by tertiary filtration treatment units (DMF & ACF) followed by Disinfection.
    - During 2023, this CETP was found complying w.r.t standards prescribed by DPCC.
    - Treated effluent is partially used for road sprinkling, gardening & preparation of dosing chemical etc. and partially discharged to local drain through underground pipeline.
    - Augmentation of the CETP was found in the planning stage.

28. GTK Road Industrial Estate CETP is located at CETP Complex Society Building, B-Block, GTK Road Industrial Area, Delhi-110033. Design capacity of this CETP is 6 MLD, however operating capacity was found 1.5 MLD (25 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary treatment units (DMF & ACF).
    - Treated effluent is partially used for gardening and partially discharged to local drain and then to Shakti nagar drain.
    - During 2023, this CETP was found complying w.r.t standards prescribed by DPCC.

29. One CETP namely PNC Delhi Industrial Infra Pvt. Ltd, Narela CETP is located opposite H Block (H-1348), Narela Industrial Area, Delhi-110040. Design capacity of this CETP is 22.5 MLD, however operating capacity was found 10.5 MLD (47 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration (DMF & ACF).
    - Treated effluent is partially used for multiple purposes i.e., agricultural land, DDA Parks, industrial use and partially discharged to CETP Drain.
    - During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for Phosphate (8.8 mg/l against prescribed norm of 5 mg/l) and Chloride (1491 mg/l against prescribed norm of 1000 mg/l).
    - Augmentation of the CETP was found in the proposal stage.

30. Bawana CETP is located at Sector-5, Bawana Industrial Area, New Delhi-110039. Design capacity of this CETP is 35 MLD, however operating capacity was found 26 MLD (74 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Biological (ASP) followed by Tertiary filtration (Rapid Gravity Sand Filter).
    - Treated effluent is distributed to industrial units through tankers, used for horticulture purposes & roads sprinkling and remaining treated effluent is discharged to CETP drain.
    - During 2023, this CETP was found non-complying w.r.t marginal high concentration of TSS against the consented standards prescribed by Delhi Pollution Control Committee (DPCC).
    - Augmentation of the CETP was found in the planning stage.

31. One CETP namely Keshav Puram Industrial Area (KESPIA) CETP Society is located near Indian Oil Petrol Pump, Ring Road, Delhi-110035. Design capacity of this CETP is 12 MLD, however operating capacity was found 1.5 MLD (13 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is discharged to local drain and then to Ranibagh drain.
    - During 2023, this CETP exhibited non-compliance w.r.t. surface water body (drain) discharge standards prescribed by DPCC for BOD (138 mg/l against prescribed norm of 30 mg/l) and COD (416 mg/l against prescribed norm of 250 mg/l).
    - Augmentation of the CETP was found in the proposal stage.

South West Delhi

32. Naraina Industrial Area CETP is located at Naraina Industrial Area, Phase-II, New Delhi-110028. Design capacity of this CETP is 21.6 MLD, however operating capacity was found 6 MLD (28 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary filtration treatment units (DMF & ACF).

- Treated effluent is partially used for gardening purposes and partially discharged to CETP drain.
- During 2023, this CETP was found non-complying w.r.t. effluent standards prescribed by DPCC for Total Nitrogen (53 mg/l against prescribed norm of 50 mg/l) and Phosphate (8.9 mg/l against prescribed norm of 5 mg/l).
- Augmentation of the CETP was found in the planning stage.

C. Electroplating Industrial Cluster:

On the main stem of river Yamuna, there are 02 electroplating industrial clusters having its CETP and member industrial units have installed primary effluent treatment plants (PETPs). PETP treated effluent of member textile units is collected through network of piping system and further treated at the respective These both CETPs are located in the state of Haryana.

CETPs of Haryana

In Haryana, there are two CETPs in electroplating industrial clusters for treatment of industrial effluent generating from electroplating industries. One is located in Faridabad and another is located in Gurugram.

Faridabad

33. Faridabad CETP is located at Faridabad, Electroplaters Association, Sec-58, Faridabad, (Ballabgarh) (FBD-CETP-001) and 210-member industrial units are connected to this CETP. Design capacity of this CETP is 0.650 MLD, however operating capacity was found 0.635 MLD (98 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is discharged to closed industrial drain.
    - During 2023, this CETP exhibited non-compliance (trivial violation) w.r.t. surface water body (drain) discharge standards prescribed by HSPCB for BOD (78 mg/l against prescribed norm of 30 mg/l) and pH (6.29 against prescribed norm of 6.5-8.5).

Gurugram

34. Gurugram CETP is located at Sector-37, Gurgaon (GRN-CETP-001) and 29-member industrial units are connected to this CETP. Design capacity of this CETP is 0.3 MLD, however operating capacity was found 0.065 MLD (29 % utilization).
    - Treatment scheme of this CETP is comprises of Physico-chemical followed by Tertiary filtration treatment units (DMF & ACF).
    - Treated effluent is discharged to industrial drain.
    - During 2023, this CETP was found complying w.r.t standards prescribed by HSPCB.

3.2.2 CETP Gap Analysis

During 2023, preliminary investigation was made for following 27 industrial clusters for feasibility of CETPs, to decrease capital & operating cost of individual ETP and for effective treatment of the effluent. List is as below:

Table 3.3 List of industrial clusters for feasibility of CETPs

Sr. No.	Area	Region
1	Saraswati Kund	Mathura
2	Shivaji Nagar	
3	Gaur Kendra	
4	Rania	Kanpur Dehat
5	Growth Centre Jainpur	
6	Surajpur	Greater Noida
7	Chapraula	
8	Hoisery Complex	Noida
9	Talanagri (Sector- 1 & Sector-2)	Aligarh
10	Sahibabad	Ghaziabad
11	Arya Nagar	
12	Roop Nagar	
13	Loni	
14	Tronica City	
15	Janta Road	Saharanpur
16	Dehradun Road	
17	Bhopa Road	Muzaffarnagar
18	Anand Parbat Industrial area	Delhi
19	Nazafgarh Industrial area	
20	Sector 29	Panipat
21	Old Industrial area	
22	Industrial area	Sonipat
23	DLF	Faridabad
24	Gurukul Industrial area	
25	Ballabhgarh	
26	Industrial area	Yamunangar
27	Industrial area	Karnal

3.2.3 Major Issues and Remedial measures

Based on the monitoring data during 2023, the major issues identified in the CETPs and remedial measures suggested by CPCB are shown in **Table 3.4.**

Table 3.4 Major issues identified during monitoring in 2023 and Remedial measures suggested

Type of CETP	Issues	Remedial measures
Textile Sector (Mathura & Panipat)	✓ Consistence non-compliance of CETP with respect to prescribed norms ✓ Poor operation and maintenance of CETP ✓ Poor operation and maintenance of Primary effluent treatment plant (PETP) by member units ✓ Use of toxic chemicals & high salt dye that affects microbial growth ✓ Less recycling of treated effluent	✓ PETP to be operated properly ▪ Regular monitoring of PETP outlet quality to be ensured ▪ Wise use of chemicals in industrial processing via adopting chemical management system (CMS) ▪ Use of eco-friendly non-toxic chemicals & low salt dyes ✓ Implementation of cleaner technology via. adopted CPCB Charter ✓ Recycling of the treated effluent shall be done at maximum level
Electroplating Sector (Faridabad & Gurugram)	✓ High influent organic load (BOD - 910 mg/l, COD – 2468 mg/l) at FBD-CETP-001, Faridabad ✓ No biological treatment system for removal of organic load ✓ Poor operation and maintenance ✓ Less recycling of treated effluent	✓ CETP without biological systems shall be upgraded as per influent waste water quality ✓ CETP shall be operated properly. ✓ Recycling of the treated effluent shall be done at maximum level
Mixed/ Heterogenous (Delhi, Sonipat, Ambala, Panchkula, Panipat, Rohtak, Gurugram, Ballabhgarh, Jind, Rewari)	✓ Non-compliance of CETPs w.r.t notified norms ✓ Inadequate treatment technology, 7 no. without biological system in spite of BOD load > 100 mg/l) ✓ Poor operation and maintenance of CETP ✓ Less recycling of treated effluent	✓ All possible efforts to be made for consistent compliance of CETP with respect to prescribed norms through proper O&M ✓ All 7 CETP without biological system shall be upgraded. ▪ Maintenance of DO & MLSS level in aeration tank at least 2 ppm & 2500-3000 mg/l, respectively. ▪ Optimization of dosing of coagulant and flocculants as per feed flow condition ✓ Recycling of the treated effluent shall be done at maximum level

3.2.4 Actions taken

1. CPCB issued directions on 02.01.2023 to State Pollution Control Boards (SPCBs) of Delhi-NCT and Haryana regarding augmentation and upgradation of CETPS and display of OCEMS data by CETPs and for compliance of the following:

- To take necessary action against the non-complying CETPs in the state.
- To prepare and submission of action plan for upgradation /augmentation of identified CETPs situated in the state.
- Mandatory to display of OCEMS data of each individual CETP in a conspicuous location.

Delhi Pollution Control Committee (DPCC) vide letter dated 06.02.2023 has submitted action taken report, however no action taken report was received from Haryana SPCB.

2. Implementation of cleaner technology for reduction in fresh water consumption and reduction in effluent load discharging to CETP by textile industries:
   - Workshops were organized by CPCB in Panipat (4 days), Sonipat (1 day), Gurugram (1 day) and Mathura (1 day) for preparation of individual action plans with short term, medium term and long-term goals in textile industries.
   - Technical experts from ICT Mumbai, Solidaridad and NITRA also accompanied these workshops to share their technical knowhow w.r.t wet processing in textile industries.
3. CETP Feasibility study has been carried out by CPCB in textile clusters, which are not having their own CETP.

SECTION 4: SEWAGE TREATMENT PLANTS (STPs)

Dr. Firoz Ahmad, Dr. Swati Singh, Dr. Divya Raghuvanshi

The Central Pollution Control Board (CPCB) conducts tri-annual monitoring of 146 sewage treatment plants (STPs) located in 68 towns situated along River Ganga, to ensure compliance verification and for performance evaluation. This monitoring activity also verifies the status of under construction STPs in these Ganga front towns. The state-wise distribution of STPs located in Ganga front towns are shown in **Table 4.1.**

Table 4.1 State wise distribution of STPs

State	Towns covered/ Total towns	Total STPs monitored	Installed capacity of monitored STP (MLD)
Uttarakhand	18/18	53	343.8
Uttar Pradesh	14/28	40	1303.0
Bihar	5/18	8	233.5
Jharkhand	2/2	3	15.5
West Bengal	29/44	42	693.6
TOTAL	**68/110**	**146**	**2589.3**

4.1 Work Accomplished during 2023

The monitoring of STPs is carried out on surprise basis by a team comprising two officials. A comprehensive inspection of the plant is conducted to assess the status of operation and maintenance of various components such as aeration tank, health of microbial culture, sludge dewatering machine, disinfection system, environmental laboratory, flow records including logbooks and Online Continuous Effluent Monitoring Systems (OCEMS) etc. During monitoring, samples are collected from key points of the plant including the aeration tank, inlet, and outlet. The samples are brought to CPCB within 48 hours and handed over to NABL approved laboratories for the analysis of compliance parameters such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), and Faecal Coliform (FC). All analyses are done using standard procedures outlined by the American Public Health Association (APHA).

A comprehensive data record is maintained, and analysis of the data is conducted for various aspects such as capacity utilization, operational, performance & compliance status. The analysed data is communicated to respective state Government agencies responsible for operation and maintenance of the STPs and other stakeholders for needful action as deemed fit. To ensure transparency and dissemination of information to the public, the data is also published on the CPCB website. This ensures stakeholders and the general-public are kept informed about the performance of STPs and their compliance with respect to existing environmental regulations.

The maps showing locations of STPs along the river Ganga are depicted from **Fig 4.1 to 4.4**.

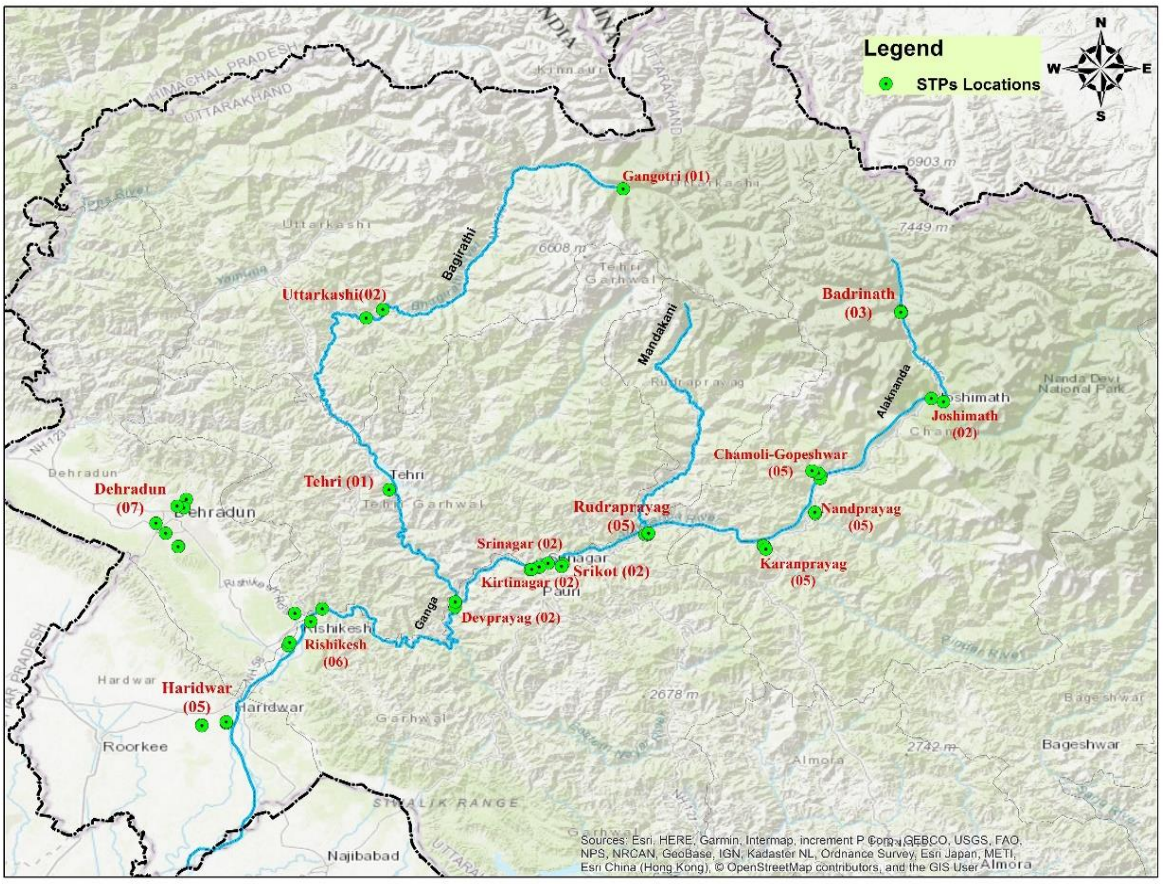


Fig. 4.1 Map showing locations of STPs along the river Ganga in Uttarakhand

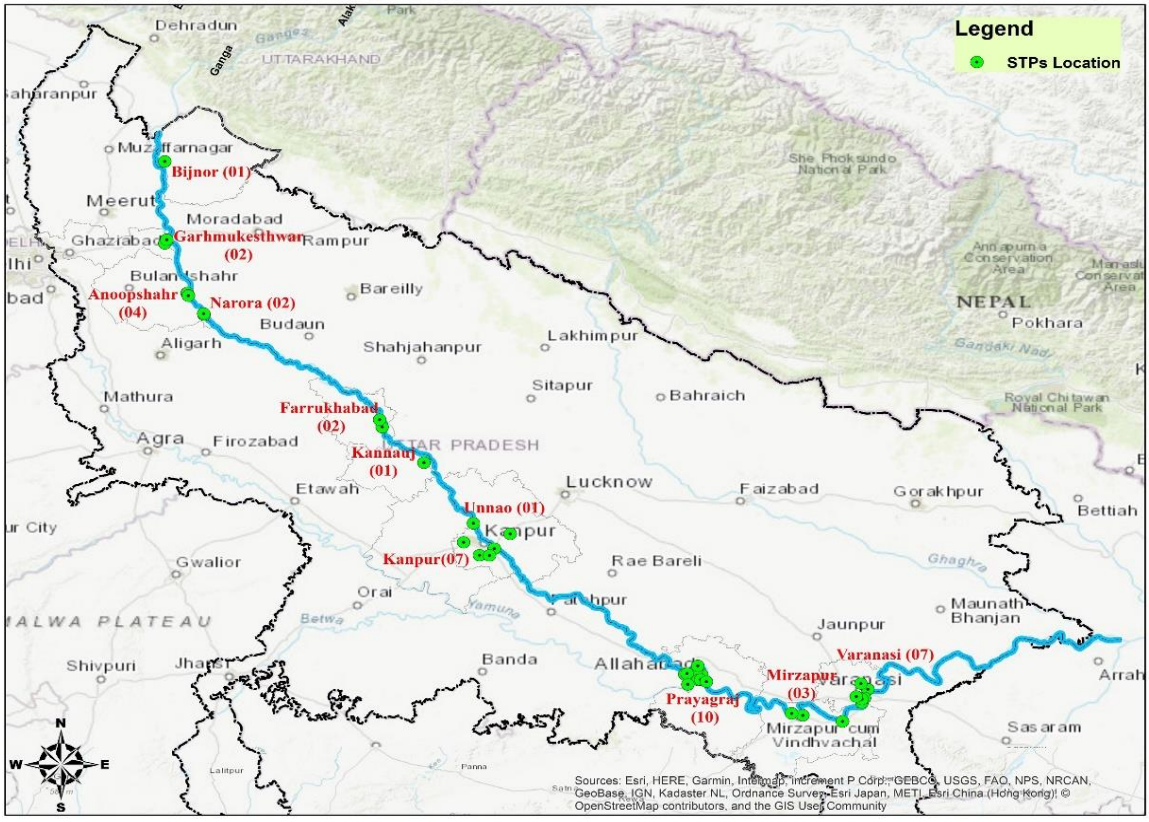


Fig. 4.2 Map showing locations of STPs along the river Ganga in Uttar Pradesh

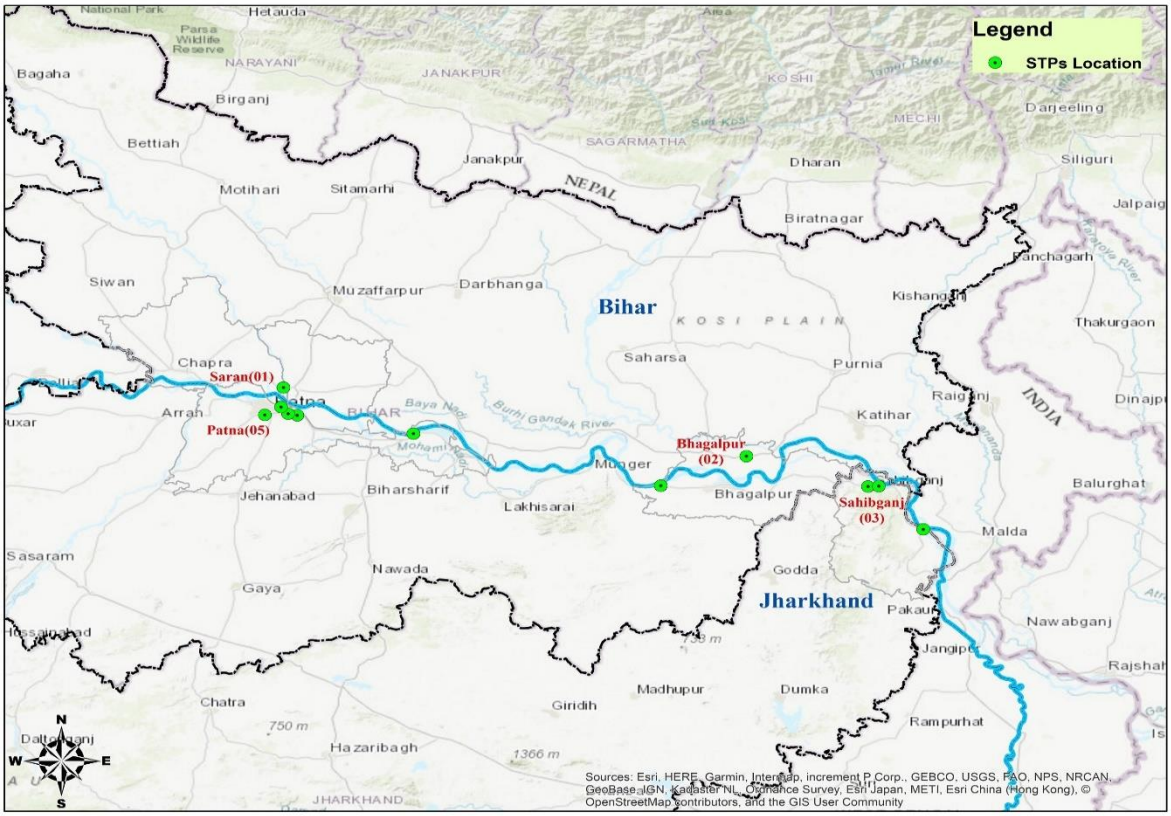


Fig. 4.3 Map showing locations of STPs along the river Ganga in Bihar and Jharkhand

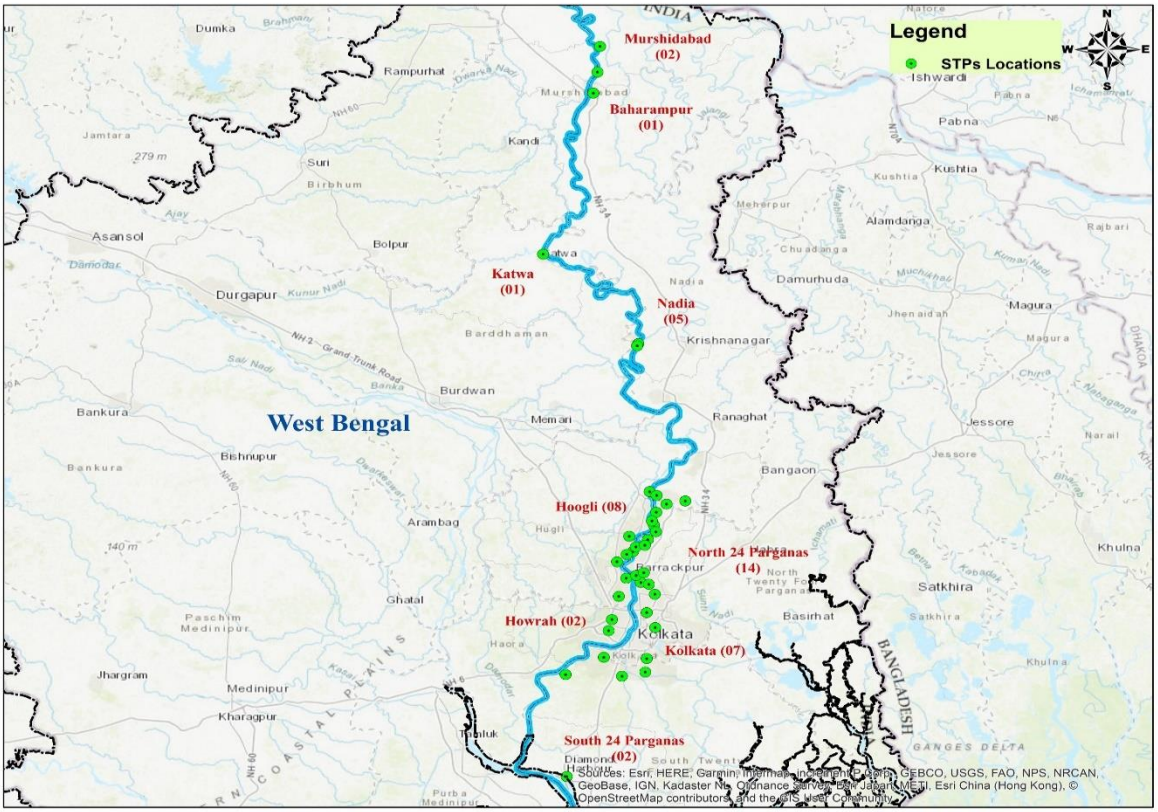


Fig. 4.4 Map showing locations of STPs along the river Ganga in West Bengal

In 2023, three rounds of monitoring were performed and a total of 437-monitoring were carried out, of which 92 STPs were monitored in all three rounds, 43 were monitored in two rounds

and 12 were monitored only once. The status of monitored STPs in the three-rounds is summarized in **Table 4.2**.

Table 4.2 Monitoring carried out during 2023

Monitoring round	Total commissioned STPs monitored (A)	Non-commissioned STPs (B)	Total (A+B)
Jan – Mar	118	14	132
Apr – Jul	101	33	134
Aug – Nov	144	27	171
Total	**363**	**74**	**437**

4.2 Data Generation and salient findings

The operational status of STPs monitored during 2023 (January to March, April to July and August to November,2023) is summarized in **Table 4.3.**

Table 4.3 State-wise operational status of STPs monitored during 2023

State	January – March, 2023			April – July ,2023			August – November ,2023		
	No. of STPs monitored	Operational	Non-operational	No. of STPs monitored	Operational	Non-operational	No. of STPs monitored	Operational	Non-operational
Uttarakhand	48	44	4	21	20	1	53	48	5
Uttar Pradesh	37	34	3	37	34	3	40	35	5
Bihar	0	-	-	7	6	1	8	7	1
Jharkhand	3	3	0	3	3	0	3	3	0
West Bengal	30	26	4	33	25	8	40	30	10
Total	118	107	11	101	88	13	144	123	21

The designed and utilized capacity of STPs monitored during January 2023 to November 2023 is shown in **Fig 4.5**.

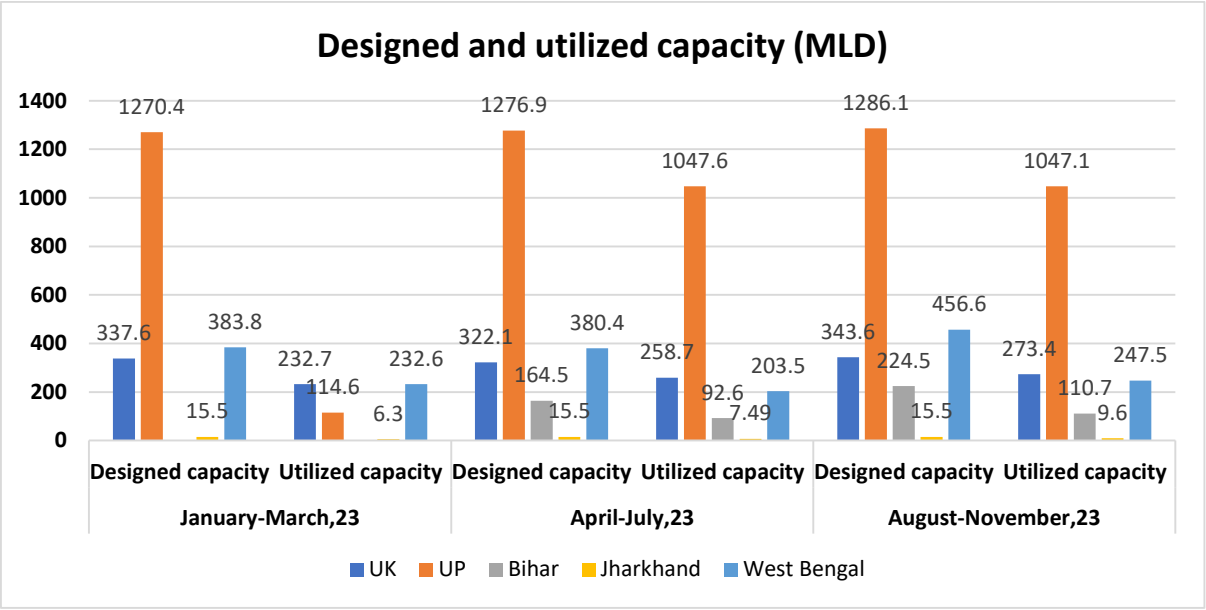


Fig. 4.5 Designed and Utilized capacity (MLD) of STPs monitored during 2023

4.2.1 Compliance Status of STPs

Figure 4.7 shows the status of compliance of operational STPs with respect to standards prescribed by MoEF&CC vide notification dated 13.10.2017.

January-March, 2023 - 45.8 % of the operational STPs were found to be complaint with respect to standards prescribed by MoEF&CC.

April-July, 2023 - Only 30.7% of the operational STPs were found to be complaint during April-July, 2023.

August-November 2023 - 37.4% of the operational STPs were found to be complaint with respect of MoEF&CC standards.

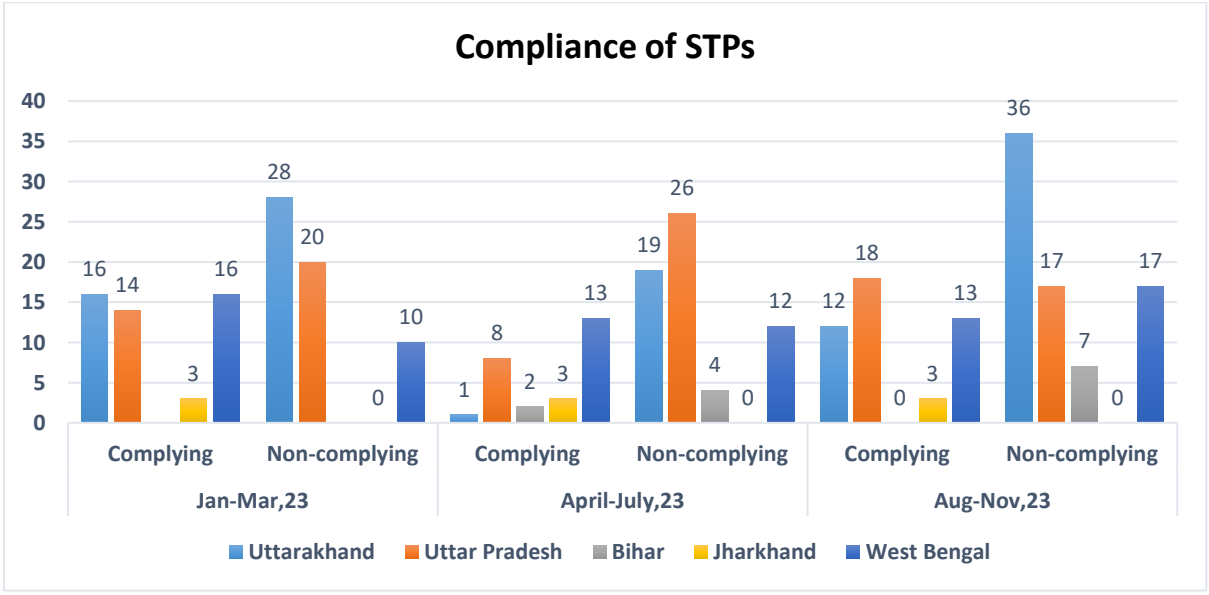


Fig. 4.6 State-wise compliance status of STPs monitored during 2023

Moreover, 16 STPs were consistently found compliant with standards across all monitoring rounds, while 23 STPs were consistently non-compliant throughout (**Table 4.4 and 4.5**).

Table 4.4 List of STPs complying in all rounds of monitoring (16)

State	STPs
Uttarakhand	Salawala STP
Uttar Pradesh	Sajari 42 MLD STP, Numayadahi STP, Goithaha STP
Jharkhand	Rajmahal STP, Talbana STP, Channan STP
West Bengal	Bansberia STP, Gayeshpur STP, Halisahar STP, Jaggadal- Bhatpara STP, Barrackpore (6 MLD) STP, Barrockpore 18 MLD STP, Shayamnagar STP, Budge Budge STP, Nabadwip 9.5 MLD STP

Table 4.5 List of STPs non-complying in all rounds of monitoring (23)

State	STPs
Uttarakhand	Tapovan STP, Lakkarghat STP, Chandreshwarnagar STP, Swargashram STP, Jajeetpur (18 MLD) STP, Jagjeetpur 27 MLD STP, Jagjeetpur 68 MLD STP, Sarai 14 MLD STP
Uttar Pradesh	NAPS township STP, Narora Town STP, Anupshahr (0.81 MLD) STP, Jajmau 5 MLD STP, Jajmau 43 MLD STP, Jajmau 130 MLD STP, Bingawan STP, Ponghat STP, Ramanna STP
West Bengal	Bandipur STP, Panihati STP, Konnagar STP, Garden Reach STP, Baghajatin STP, Hatisur STP

4.2.2 Technology Distribution of STPs

For sewage treatment, different technologies are being utilized in different states along the Ganga riverfront (**Table 4.6**). In Uttarakhand, Sequential Batch Reactor (SBR) technology is predominant, constituting 22 out of 53 total STPs. Uttar Pradesh (U.P.) shows a diverse mix of technologies, with significant implementation of SBR and Upflow Anaerobic Sludge Blanket (UASB) systems, accounting for 7 STPs each out of 37 total. Meanwhile, Bihar (BH) and Jharkhand (JH) primarily relying on SBR. West Bengal (WB) stands out for its extensive use of various technologies, with significant numbers in SBR, Waste Stabilization Ponds/Oxidation Ponds (WSP/OP), and Trickling Filters (TF). Overall, the total count across all technologies reaches 146, underlining efforts towards diversified and efficient sewage treatment solutions in these regions, particularly along the Ganga riverfront.

Table 4.6 Technology wise breakup (number) (2023)

Technology	Uttarakhand	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
SBR (Sequential Batch Reactor)	22	7	7	3	5	44
ASP (Activated Sludge Process)	3	8	0	0	9	20
BTT/TF and ASP (Bio Tower Technology/Trickling Filter)	0	4	0	0	-	4

Technology	Uttarakhand	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
MBBR/FAB (Membrane Bed Biofilm Reactor/Fluidized Aerobic Bioreactor)	9	3	1	-	-	13
EC (Electrocoagulation)	17	-	-	-	-	17
SBT (Soil Bed Technology)	1	-	-	-	-	1
WSP/OP (Waste Stabilization Pond/ Oxidation Pond)	0	3	-	-	23	26
UASB (Upflow Anaerobic Sludge Blanket)	0	7	-	-	-	7
A2O (Anaerobic-Anoxix-Aerobic)	0	1	-	-	-	1
FCR (Food Chain Reaction)		3				3
CWS (Constructed Wetland)	-	1	-	-	-	1
FSTP (Faecal Sludge Treatment Plant)	-	3	-	-	-	3
FBAS (Fixed-Bed Activated Sludge)	-	-	-	-	2	2
TF (Trickling Filter)	-	-	-	-	3	3
Bio-digester	1	-	-	-	-	1
Total	**53**	**40**	**8**	**3**	**42**	**146**

4.2.3 Reduction in organic (BOD) load

- The total capacity of monitored STPs during January-March 2023, stood at 2070.57 MLD, with an actual utilization of 1586.36 MLD, indicating a utilization rate of 76.61%.
- The cumulative capacity of monitored STPs during April-July 2023 amounted to 2427.55 million MLD, with an actual utilization of 1609.94 MLD, indicating a utilization rate of 66.31%.
- During the period August-November 2023, monitored STPs were found to have total capacity of 2570.384 MLD, of which 1688.32 MLD were actually utilized, representing a utilization rate of 76.61%.

During the January-March 2023 round, the pollution load reduction in terms of BOD was 84% as detailed in **Table 4.7.**

Table 4.7 Reduction in BOD load (%age) in 5 Ganga states during Jan-Mar, 2023

States	No.	BOD Load (TPD)		% reduction in BOD load
		Inlet load	Outlet load	
Uttarakhand	48	21.55	1.54	92.86
Uttar Pradesh	37	152.9	24.59	83.92
Bihar	0	0	0	-
Jharkhand	3	0.84	0.0189	97.75
West Bengal	30	12.779	3.303	74.15
Total	**118**	**188.07**	**29.45**	**84.34**

In round April-July 2023, pollution load received at the STP inlet was 132.1 tons per day (TPD), while the discharged BOD load was 17.6 TPD, indicating 86% reduction in pollution load (**Table 4.8**).

Table 4.8 Reduction in BOD load (%age) in 5 Ganga states during Apr-Jul, 2023

States	No.	BOD Load (TPD)		% reduction in BOD load
		Inlet load	Outlet load	
Uttarakhand	21	26.8	2.43	90.93
Uttar Pradesh	37	94.67	12.026	87.30
Bihar	7	1.606	0.406	74.72
Jharkhand	3	0.491	0.015	96.95
West Bengal	33	8.55	2.758	67.74
Total	**101**	**132.117**	**17.635**	**86.65**

During the monitoring round of August-November 2023, the BOD load received at the STPs inlet was 154.07 TPD), whereas the discharged BOD load was 20.43 TPD, demonstrating a reduction of 86.34% in load (**Table 4.9**). Values of Outlet BOD and Faecal Coliform in treated sewage (August-November 2023) are shown in **Table 4.10**.

Table 4.9 Reduction in BOD load (%age) in 5 Ganga states during Aug-Nov, 2023

States	No.	BOD Load (TPD)		% Reduction in BOD load
		Inlet load	Outlet load	
Uttarakhand	53	24.21	2.21	90.87
Uttar Pradesh	40	117.11	14.42	87.68
Bihar	8	0.943	0.44	53.32
Jharkhand	3	0.453	0.033	92.61
West Bengal	40	11.34	3.316	71.88
Total	**144**	**154.056**	**20.419**	**86.75**

Table 4.10 Values of Outlet BOD and FC in treated sewage (Aug-Nov, 2023)

State	**Outlet BOD value (<10mg/L)**	**Outlet BOD value Range (10-20 mg/L)**	**Outlet BOD value Range (20-30 mg/L)**	**Outlet BOD value (> 30 mg/L)**	**Outlet value FC (≤230MPN per 100mL)**	**Outlet BOD value FC (231 - 1000MPN per 100mL)**	**Outlet BOD value FC (>1000MPN per 100mL)**
Uttarakhand	23	11	4	10	12	1	34
Uttar Pradesh#	25	3	2	5	19	1	15
Bihar	7	-	-	-	-	-	7
Jharkhand	3	-	-	-	3	-	-
West Bengal	15	6	6	3	11	3	16
Total	**73**	**20**	**12**	**18**	**45**	**5**	**72**

4 samples for FC could not be analyzed

The above table (**Table 4.10**) shows that the BOD values of treated sewage at outlet of 73 STPs were found to be <10 mg/l and the fecal coliform value of 41 samples were found to be less than 230 MPN/100 ml as directed by Hon'ble NGT for treated sewage discharge.

The range of BOD at inlet and compliance for BOD (August-November 2023) are shown in **Table 4.11.**

Table 4.11 Range of BOD at Inlet and compliance for BOD (Aug-Nov, 2023)

S.No	Inlet BOD (mg/l)	No. of STP	Outlet BOD ≤ 30 mg/l	Overall compliance w.r.t. MOEF&CC Norms
1	BDL - 40	43	40	17
2	40-100	39	35	16
3	100-150	18	17	6
4	150-250	11	7	3
5	>250	11	5	4
Total		**122**	**104**	**46**

BDL – below detection limit

The analysis of BOD of raw sewage at inlet of STPs in the above table (**Table 4.11**) shows that 43 STPs were receiving BOD < 40 mg/l, which indicates weak strength of raw sewage at inlet which may affect the performance efficiency of the STP.

4.2.4 Under-capacity Operation

Under-capacity utilization is one of the major issues observed in STP operation. STPs receiving less than 75% flow of its designed capacity is considered as under-utilized STPs. The status of under-capacity STPs during 2023 is given in **Table 4.12.**

Table 4.12 Summary of STPs working under-capacity during 2023

Rounds of monitoring	No. of STP working under-capacity	Designed Capacity (MLD)	Utilized Capacity (MLD)
January - March, 23	59	837.2	391.2
April - July, 23	45	1175.89	595.9
August - November, 23	69	1400.7	702.23

The issue of under-utilization arises majorly because of i) incomplete sewerage network, ii) broken sewage line due to road construction and other activity, iii) less sewage generation in catchment area, iv) no connection of soak pits, v) less than targeted household connection, vi) deposition of sediments in sewer line and vii) lack of awareness in population. A large number of STPs located in following Ganga Front Towns of five Ganga states (**Table 4.13**) were found working at under-capacity in at least two rounds of monitoring in 2023.

Table 4.13 Summary of STPs working under capacity during 2023

Uttarakhand	:	Gangotri, Dehradun, Devprayag, Rudraparayag, Karanprayag and Chamoli-Gopeshwar
Uttar Pradesh	:	Garhmukteshwar, Narora, Anupshahr, Kannauj, Kanpur, Mirzapur and Varanasi
Bihar	:	Patna, Sonepur, Barh and Sultangaj
Jharkhand	:	Rajmahal and Sahebganj
West Bengal	:	Bandipur, Budge-Budge, Halishahar, Barrackpore, Bhatpara, Bagahajatin, Chandannagar, Garulia, Kacharapara, Kokata and Naihati

4.2.5 Over-capacity Operation

The STPs receiving flow above than their designed capacity are considered as over-capacity STPs. The status of over-capacity STPs during 2023 is given in **Table 4.14**.

Table 4.14 Summary of STPs working over-capacity during 2023

Rounds of monitoring	No. of STP working over-capacity	Designed Capacity (MLD)	Utilized Capacity (MLD)
Jan-Mar,2023	15	440.2	542.7
April-July,2023	18	508.2	590.3
Aug-Nov,23	16	434.2	530.9

A large number of STPs located in following Ganga Front Towns of five Ganga states (**Table 4.15**) were found working at over-capacity during at least two rounds of monitoring in 2023:

Table 4.15 Summary of STPs working over-capacity during 2023

Uttarakhand	:	Srikot, Kirtinagar and Haridwar
Uttar Pradesh	:	Prayagraj and Varanasi
Bihar	:	None
Jharkhand	:	None
West Bengal	:	Bansberia

4.2.6 Performance Efficiency of STPs

Fig. 4.8 illustrates the performance efficiency of STPs in terms of BOD removal, categorized into four ranges: <50%, 50-70%, 70-90%, and >90%. The desired BOD removal efficiency for STPs based on modern technologies is >90%. In Uttarakhand, a significant portion of treatment plants demonstrates higher efficiency, with 19 facilities achieving 70-90% removal and 17 exceeding 90%. Meanwhile, Uttar Pradesh shows a similar trend, with 10 plants falling in the 70-90% range and 14 achieving over 90% efficiency. In Bihar all 7 STPs achieved efficiency less than 70%. Jharkhand one plant achieved 70-90% efficiency and two surpassing 90%. West Bengal exhibits a mixed performance, with 10 plants each in the <50% and 70-90% categories, while only six STPs achieved over 90% efficiency.

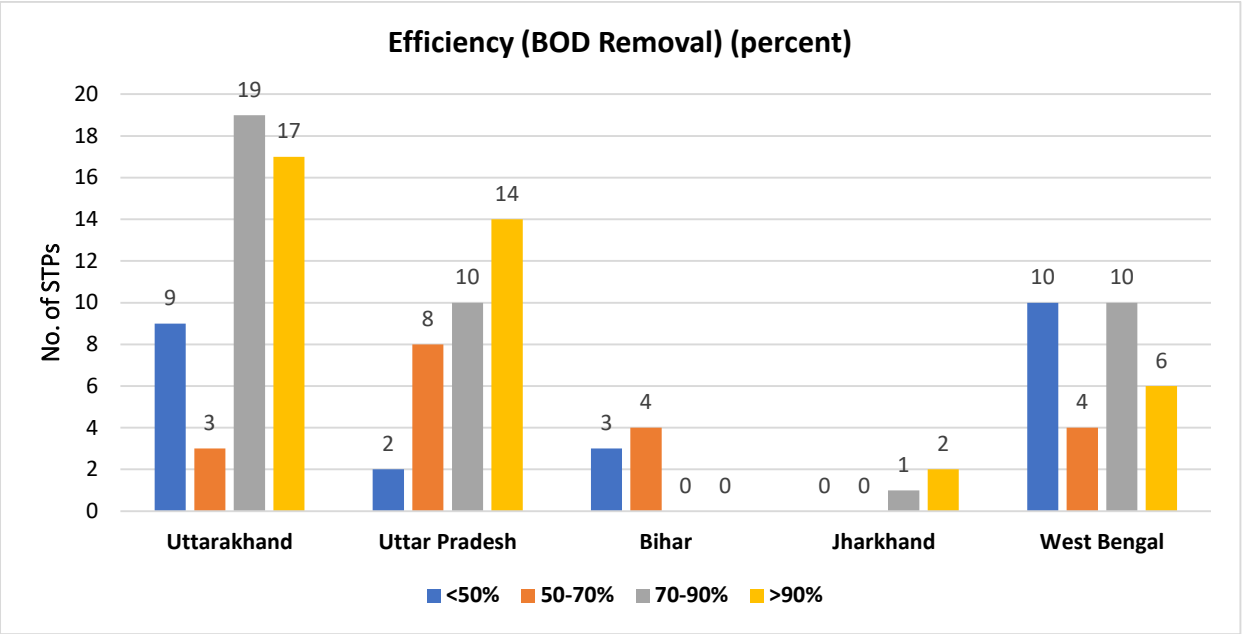


Figure 4.8 BOD removal efficiency (%age) in five Ganga states (Aug-Nov, 2023)

4.2.7 Online Continuous Effluent Monitoring System (OCEMS)

55 STPs have OCEMS installed at their outlet, out of which 54 STPs were operational of each 32 are found connected to CPCB server (**Table 4.16**).

4.2.8 Disinfection of treated sewage

Currently all STPs of Uttarakhand are equipped with disinfection system. In Uttar Pradesh, all except three STPs have a disinfection system in place. Additionally, two STPs in Jajmau, Kanpur are currently in the process of installing a disinfection system. In West Bengal 11 STPs are equipped with disinfection system. Few more are in the phase of installing the facility. In Bihar (07) and Jharkhand (03) all STPs have functional disinfection system. However, a matter of concern is that even with disinfection system many STPs fail to meet compliance for FC. There remains scope to improve in the area of free residual chlorine with varying results being reported at the outlet. The status of disinfection system installed at STPs in five Ganga states is summarized in **Table 4.16**.

Table 4.16 Status of OCEMS installed and Disinfection system installed in five Ganga states

State	OCEMS installed	Disinfection system installed
Uttarakhand	20	50
Uttar Pradesh	29	32
Bihar	2	8
Jharkhand	2	3
West Bengal	2	14
Total	**55**	**107**

4.2.9 Major Issues and Challenges

Non-compliance with respect to Faecal Coliform: It has been observed that most STPs not complying to standards, failed to meet the criteria for Faecal Coliform numbers in treated sewage. Installation and optimization of disinfection system is required to achieve the faecal Coliform count desirable for complying with the standards.

Weak Strength sewage at Inlet of STPs: Typically, STPs are designed to treat the black water generated from household with grey water mixing, receiving at STP inlet, having a BOD of approx. 200-250 mg/l. It has been observed that in many of the Ganga front towns specially in Uttarakhand many STPs are receiving sewage with low BOD levels (low organic load), typically below 40 mg/l are considered as weak strength sewage receiving STPs. During Jan-March, 2023, about 25, during April-July, 2023 33 while during August-November, 2023, 43 of the monitored STPs were found out to be receiving raw sewage of weak characteristic.

Rejuvenation of Non-operational STPs: Some STPs have been found to be non-operational in successive monitoring cycles specially in West Bengal. Many of these STPs were observed to be under rejuvenation or new construction after demolition of defunct STPs. Some of the non-functional STPs are being taken up for fresh DPR preparation in order to erect new STPs, like Serampore, Champdani, Arupara and Kona. Obsolete technologies require upgradation to meet the standards for compliance.

Under-capacity operation of STPs: Under capacity operation (<75% of designed capacity) of STPs have remained a major problem in almost all states. Optimum utilization of designed capacity is also important to treat all the sewage generated in the catchment area of STPs. Augmentation of sewage network including interception, diversion and pumping of sewage, completion of targeted household connections etc. are required to be taken up on priority basis.

Overcapacity operation of STPs: Overcapacity operation of STPs in cities such as Prayagraj, Haridwar, etc. has been observed. In many cities which are centres of tourism, religious importance, educational hubs, medical hub etc. may have significant floating population which may be the cause of overcapacity operation of STPs.

4.3 Action Taken by CPCB

- Review meeting with sewage management and STP operations with state agencies of five Ganga states held on 24.03.2023.
- Operational and compliance status of April-July, 2023 communicated to State Government agencies of 5 Ganga states vide DO letter dated 09.11.2023 for needful action.
- Operational and compliance status of August-November, 2023 communicated to State government agencies of 5 Ganga states vide DO letter dated 06.03.2024 for needful action.
- Letters issued to STP operating agencies of Tekla Biodigester (Uttarkashi), Brijghat-Garhmukteshwar STPs, Pokhri & Marwari STP (Joshimath) and 0.26 MLD Bamni STP

(Badrinath) for needful action for improvement in performance and operation & maintenance.

- Status of previous rounds of monitoring are published on CPCB website (https://cpcb.nic.in/ngrba/reports.php) .

4.4 Way Forward

It is recommended that to ensure proper functioning or operation of STP and to enhance its performance, following actions may be taken:

1. All possible efforts shall be made to ensure consistent compliance of the standards referred.
2. Proper disinfection system should be maintained to regulate the fecal coliform count in the treated sewage.
3. Reason of high/low values of BOD, COD, TSS, and other parameters at inlet to be investigated.
4. Sewerage network to be augmented so that STP capacity may be optimally utilized.
5. OCEMS shall be installed at outlet of STP and connected to CPCB/SPCB servers.
6. Environmental labs and skilled manpower to be made available at all STP for its smooth operation and maintenance.
7. Flowmeters to be installed at inlet and outlet and respective logbooks may be maintained for inlet and outlet.
8. Provision for maximum reuse of treated sewage may be encouraged. Currently, in Kanpur approximately 200 MLD treated sewage from Jajmau STP and CETP is being used in irrigation and provision for reuse of from 56 MLD treated sewage 210 MLD Bingawan STP, Kanpur is proposed for reutilization in Panki Thermal Power Station. Also, approximately 68 MLD of treated sewage from Jagjeetpur STP in Haridwar and about 4 MLD from Narora STP is reutilized in irrigation.
9. Diversion of flow from over-capacity STPs to under-capacity STPs for optimum utilization and performance of STPs.
10. Stopping/minimizing the dilution of sewage by mixing of freshwater from streams or household tap overflow.
11. Stopping of mixing of industrial effluent with sewage in industrial areas/towns for optimum performance of STPs.

SECTION 5: MONITORING OF DRAINS DISCHARGING INTO RIVER GANGA & ITS TRIBUTARIES

Ms. Reena Satavan, Ms. Garima Dublish, Dr. Chandravir Narayan, Dr. Vivek Rana, Mr. Saurabh Garg

Monitoring of drains discharging directly into river Ganga and its tributaries is carried out by CPCB on half yearly basis *i.e.* Pre and Post monsoon seasons in five Ganga main stem states (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal). These drains carry wastewater which comprises sewage, industrial effluent, and surface run off. Inventory of drains is updated in-consultation of SPCBs, Jal Nigam/Jal Sansthan, NMCG and SMCG. Pollution source mapping of highly polluted drains was also conducted.

5.1 Work Accomplished During 2023

1. Monitoring of 609 drains discharging directly into river Ganga and its tributaries in Ganga main stem states (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal) during pre-monsoon, 2023. Monitoring of more than 700 drains was conducted during post-monsoon-2023.
2. Regular monitoring of 29 drains (27 Kanpur & 2 Unnao) and 9 locations on river Ganga and Pandu.
3. Pollution source mapping of Dhandera-Jat Mujheda-Begrajpur drain system, Sheela drain (draining into Kali-West, a tributary of river Hindon) and Laksar drain (draining into Banganga, a tributary of river Ganga).
4. Pollution source mapping of 55 drains discharging into river Hindon (a tributary of river Yamuna) and its tributaries namely Dhamola, Kali-West and Krishni (Status is given in Water Quality section).

5.2 Half Yearly Monitoring of Drains

5.2.1 Data Generation and Key findings

During Pre-Monsoon, 2023, monitoring of 609 drains discharging directly into river Ganga (437) and its tributaries (172) in Ganga main stem states (Uttarakhand: Ganga-81, Banganga & Sukhi-2 & Suswa-Song-4; Uttar Pradesh: Ramganga & tributaries-24, Kali-East-29, Pandu-9, Yamuna-21, Varuna & Moorva-22, Jargo & Ojhala-10, Mansahaita-9, Duar-1; Bihar: Sone-18, Punpun-03, Adari-01, Daha-01, Gandak-01, Budhi-Gandak-06, Panchane-02, Kiul-05 & Gangi-01) was conducted.

Monitoring procedure and Parameters monitored:

During each round of monitoring (usually of 1-5days), a team consisting of two officials (Scientist/Research Associate/Senior Research Fellow) from CPCB HO, Regional Directorate Lucknow and Kolkata monitors drains in the state of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. 48 parameters (Physico-chemical-12, Microbiological-02, Trace Metals-14 and Pesticides-20 (OPPs-08 and OCPs-12) are analysed in drains samples. The monitoring of trace metals and pesticides are conducted in specific drains from Haridwar

onwards. Details of parameters is given in **Table 5.1**. Flow in drains is measured using Ball-float method as described under Central Public Health and Environmental Engineering Organisation (CPHEEO) manual on sewerage and sewage management. After sampling, the collected samples are transferred to the concerned laboratory and analysis is carried out following standard procedures. After receipt of laboratory analysis report, the monitoring report along with data is forwarded by RD Lucknow & Kolkata to HO Delhi. At HO Delhi, the monitoring data is compiled by the processing officer and thereafter, the report is put-up for action such as issuance of letter/direction to concerned state agencies, communication of data to NMCG, publication of data on CPCB website and reply of RTI/Parliament Questions/etc.

Table 5.1 Parameters are monitored in drain monitoring

Physico-chemical (12)	Microbiological (2)	Trace metals (14)	Pesticides	
			Organophosphorus Pesticides (OPPs) (8)	Organochlorine Pesticides (OCPs) (12)
1. Flow 2. pH 3. Colour (Hazen) 4. BOD (mg/l) 5. COD (mg/l) 6. TSS (mg/l) 7. TDS (mg/l) 8. Cl^- (mg/l) 9. NH_3-N (mg/l) 10. NO_3^- (mg/l) 11. SO_4^{2-} (mg/l) 12. PO_4^{3-} (mg/l)	1. Total coliform (MPN/ 100ml) 2. Fecal coliform (MPN/ 100ml)	1. Arsenic (As) mg/l 2. Cadmium (Cd) mg/l 3. Total Chromium (Cr) mg/l 4. Copper (Cu) mg/l 5. Iron (Fe) mg/l 6. Lead (Pb) mg/l 7. Manganese (Mn) mg/l 8. Nickel (Ni) mg/l 9. Zinc (Zn) mg/l 10. Antimony (Sb) mg/l 11. Cobalt (Co) mg/l 12. Selenium (Se) mg/l 13. Vanadium (V) mg/l 14. Mercury (Hg) mg/l	1. Dimethoate (µg/l) 2. Methyl Parathion (µg/l) 3. Malathion (µg/l) 4. Chloropyriphos (µg/l) 5. Ethion (µg/l) 6. Phorate (µg/l) 7. Quinalphos (µg/l) 8. Profenophos (µg/l)	1. α-HCH (µg/l) 2. β-HCH (µg/l) 3. γ-HCH (µg/l) 4. Heptachlor (µg/l) 5. Aldrin (µg/l) 6. Diedrin (µg/l) 7. α-Endosulfan (µg/l) 8. β-Endosulfan (µg/l) 9. o,p'-DDT (µg/l) 10. p, p'-'DDT (µg/l) 11. p, p'-DDD (µg/l) 12. p, p'-DDE (µg/l)

The data given in **Table 5.2** shows that more than 70% BOD Load and flow is discharged into river Ganga from West Bengal.

The flow of 63 drains (Uttarakhand-08, Uttar Pradesh-47, Bihar-03, & West Bengal-05) could not be measured due to non-approachable site, deposition of solid waste, steep terrain, discharge through closed pipeline, less flow/stagnant, flooding/backflow and growth of macrophytes. The sampling was performed in 389 drains however, in 3 drains sampling was not performed due to discharge from closed pipeline. Therefore, total flow and BOD load will

be higher than reported. State-wise status of monitored drains is given in **Table 5.2** and state wise comparison is shown in **Figures 5.1, 5.2 & 5.3**.

Table 5.2: State wise status of drains monitored during Pre-Monsoon 2023

Ganga States	Monitored Drains	Flow (MLD)	BOD Load (TPD)	Tapped Drains	STP Outlet
Uttarakhand	81	220.38	0.64	67	1
Uttar Pradesh	179	673.92	34.19	62	-
Bihar	67	1046.24	18.26	5	-
Jharkhand	6	-	-	6	-
West Bengal	104	7737.87	138.80	8	-
Total-A	**437**	**9678.41**	**191.89**	**148**	**1**
States (Tributaries)					
Uttarakhand (Banganga, Suswa-Song & Sukhi)	6	1618.3	7.50	-	-
Uttar Pradesh (Ramganga-Gagan & Kosi)	24	443.41	36.16	-	-
Uttar Pradesh (Kali East)	29	1393.32	321.66	4	-
Uttar Pradesh (Pandu)	9	78.64	5.28	5	-
Uttar Pradesh (Yamuna)	21	14.20	0.33	8	-
Uttar Pradesh (Varuna & Moorwa)	22	224.86	11.46	10	-
Uttar Pradesh (Jargo & Ojhala)	10	4.34	0.05	-	-
Uttar Pradesh (Duar & Mansahaita)	13	26.70	1.10	6	-
Bihar (Sone, Punpun, Adari, Daha, Gandak, Budi-Ghandak, Panchane, Kiul & Gangi)	38	615.31	9.74	1	-
Total-B	**172**	**4419.08**	**393.28**	**34**	**0**
Grand Total (A+B)	**609**	**14097.48**	**585.17**	**182**	**1**

MLD -Millions Litre Per Day, TPD -Tonnes Per Day

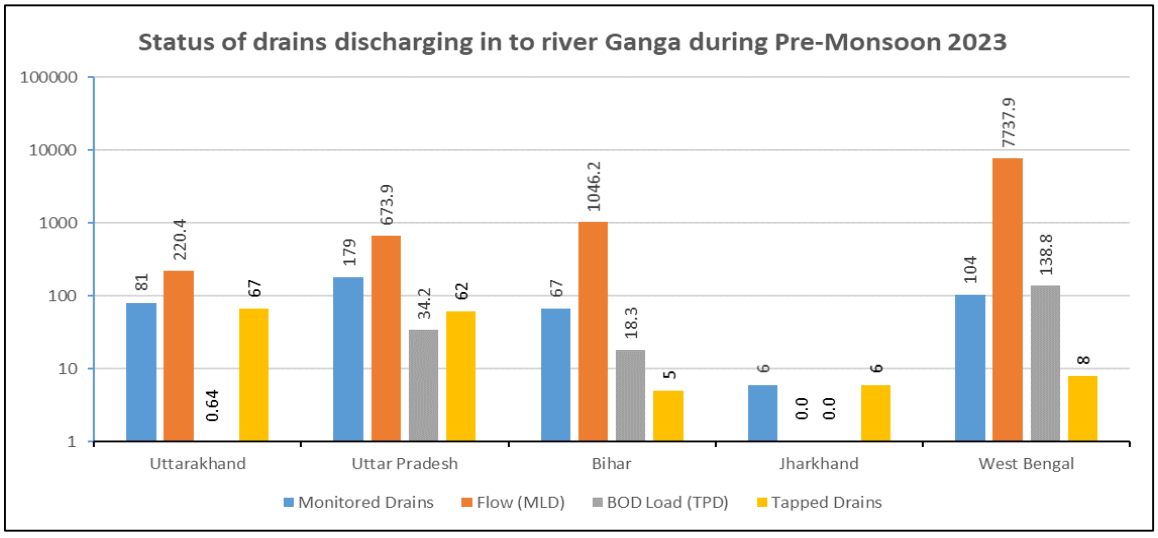


Figure 5.1. Status of drains draining into river Ganga during Pre-monsoon 2023

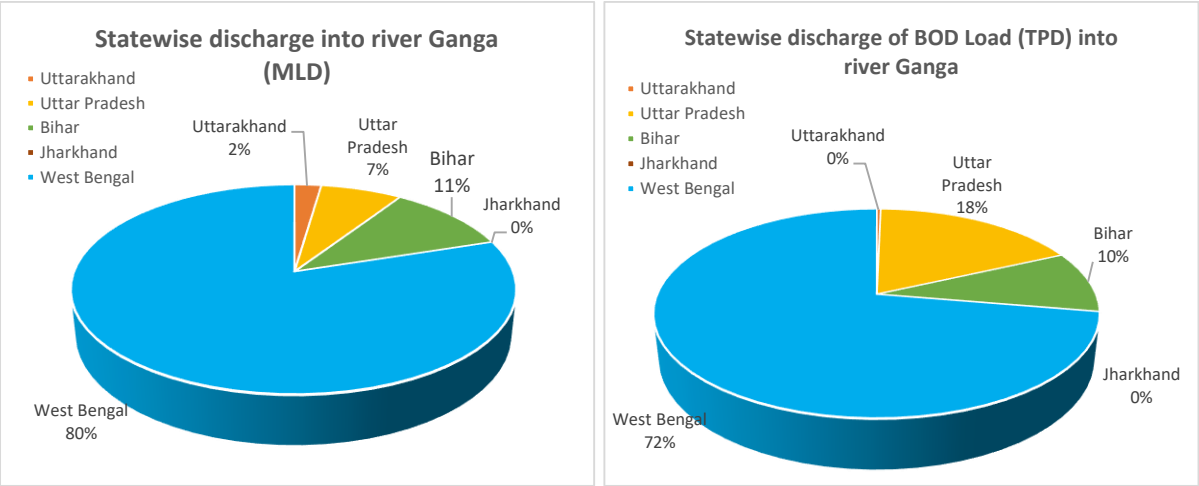


Figure 5.2. State wise distribution of flow and pollution load discharged into river Ganga

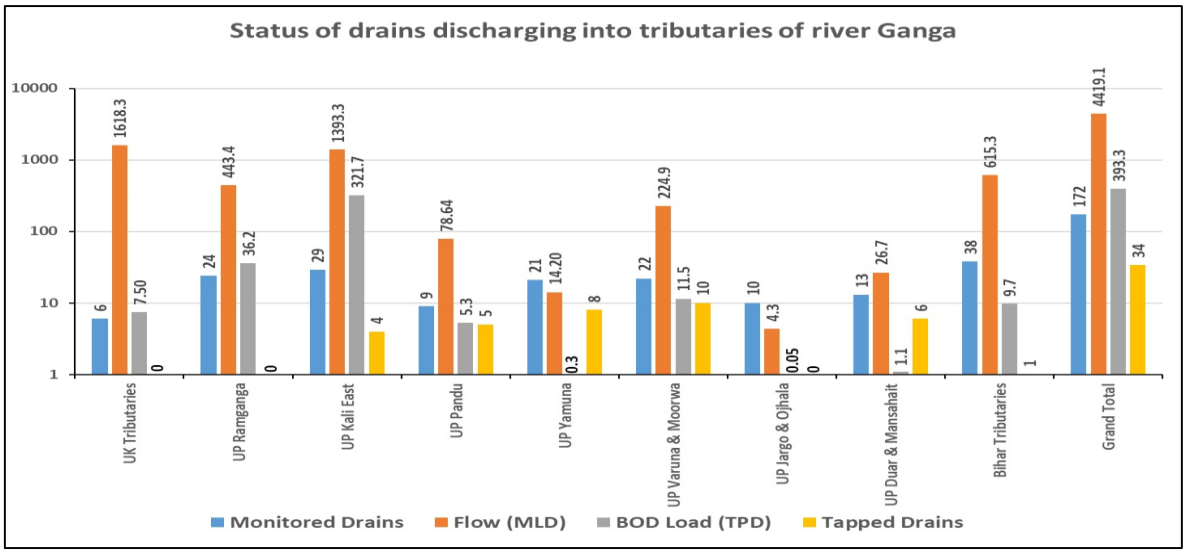


Figure 5.3. Status of drains discharging into tributaries

The monitored drains are also categorized based on BOD and COD values and the status is as follows:

- **Numbers of drains w.r.t., range of BOD (≤50 mg/l, >50 to 100 mg/l and >100 mg/l to 250 mg/l and >250 mg/l) is given below:**

Ganga States	Number of Drains			
	BOD 0-50 mg/l	BOD >50 - 100 mg/l	BOD >100 -250 mg/l	BOD > 250 mg/l
Uttarakhand	19	-	-	1
Uttar Pradesh	111	34	29	4
Bihar	85	7	-	1
West Bengal	77	18	3	-
Total	292	59	32	6

- **Numbers of drains w.r.t., range of COD (≤ 250 mg/l, COD > 250 - 500 mg/l, > 500-1000 mg/l and > 1000 mg/l) is given below:**

Ganga States	Number of Drains			
	COD ≤ 250 mg/l	COD > 250 - 500 mg/l	COD > 500-1000 mg/l	COD > 1000 mg/l
Uttarakhand	19	-	1	-
Uttar Pradesh	143	27	7	1
Bihar	84	8	-	1
West Bengal	96	2	-	-
Total	342	37	8	2

5.2.1.1 State wise observations

Uttarakhand

In Uttarakhand, total 87 drains were monitored (Ganga-81, Sukhi- Banganga-2 and Suswa-Song (4). 67 drains discharging into river Ganga were found tapped and diverted to treatment facilities. Overflow was observed in 09 tapped drains. Sampling was performed in 20 drains (untapped-11 & tapped-9). Untapped drains (9) where sampling was not performed were either found dry (8) or flooded due to backflow of river (1). High value of BOD was observed in Kailash Ashram drain discharging in to river Ganga from Uttarkashi. However, in remaining drains it ranged from 2.0 - 23 mg/l. In Uttarakhand, significant flow (1606.7 MLD) and BOD load (7.36 TPD) is observed in 4 drains of River Suswa-Song carrying domestic wastewater of Dehradun city along with surface run off. Monitoring locations of drains in the state of Uttarakhand are shown in **Fig. 5.4.**

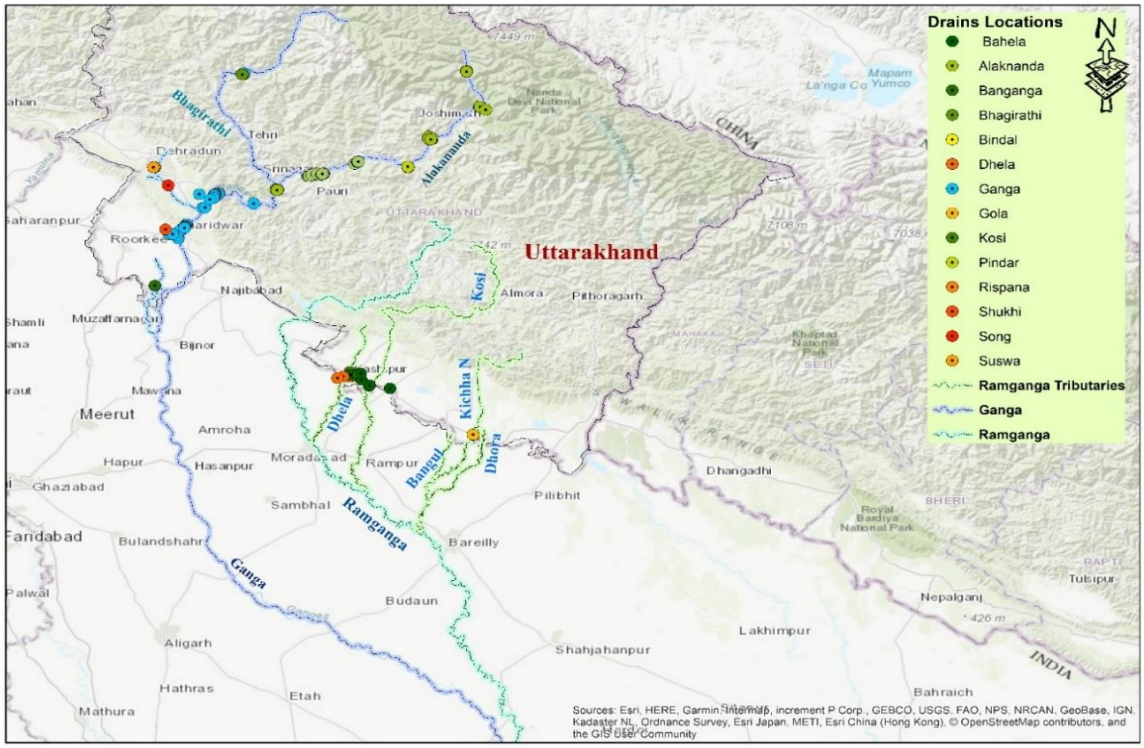


Fig. 5.4 Drains monitoring locations in Uttarakhand

In upper stretches of river Ganga (Alaknanda) from Badrinath-Gangotri to Devprayag, 79 drains were found discharging into river Alaknanda and Bhagirathi. During pre-monsoon, 2023 monitoring of drains from Nandprayag to Devprayag (51 drains) was not conducted due to road closure/land slide. However, during post-monsoon, 2022, out of 51, 41 drains were found tapped. Status of tapped and untapped drains in upper stretch of Uttarakhand, based on Post monsoon 2022 and Pre-Monsoon 2023 is as follows:

Towns	Tapped	Untapped
Drains discharging into river Alaknanda		
Badrinath	6	-
Joshimath	5	1
Chamoli	7	3
Nandprayag	3	-
Karanprayag	7	-
Rudraprayag	7	1
Kirtinagar	2	1
Srikot	2	3
Srinagar	17	2
Drains discharging into river Bhagirathi		
Uttarkashi	5	1
Devprayag	3	3
TOTAL	**64**	**13**

Uttar Pradesh

In Uttar Pradesh 307 drains were monitored, out of which 179 drains were discharging into river Ganga and 128 into different tributaries (Ramganga & its tributaries-24, Kali East-29, Panu-09, Yamuna-21, Varuna & Moorwa-22, Jargo & Ojhla-10, Duar-1 & Mansahaita-12).

95 drains were found tapped to various sewage treatment plants (Ganga-62 and tributaries -33 drains). Overflow was observed in 20 tapped drains (Ganga -11 and tributaries-9). Sampling was performed in 178 drains (untapped – 158 & tapped – 20). Out of 213 untapped drains, in 55 drains wherein sampling was not performed were observed dry (25), stagnant (09), flooded due to backflow (2), meagre/lean flow (15), discharge through underground pipeline (3) and unapproachable site (1).

Values of BOD and COD in wastewater of drains were ranged from 5.58-401 mg/l and 18.5-1218 mg/l, respectively. High values of BOD & COD were observed in Dabka drain, Kanpur (212 mg/l & 476 mg/l), Maniya drain, Prayagraj (368 mg/l & 582 mg/l), Ramnagar drain, Varanasi (240 mg/l & 382 mg/l), Tehri Bazar, Ghazipur (336 mg/l & 935 mg/l) discharging in to river Ganga and Lalbagh drain (401 mg/l & 1218 mg/l), Nawabpura drain-1 (244 mg/l & 572 mg/l), Nawabpura drain-2 (246 mg/l & 569 mg/l) discharging into river Ramganga and Slaughter house drain (355 mg/l & 882 mg/l) discharging into river Kali-East.

Significant Flow and BOD load is observed in drains carrying domestic wastewater of Meerut (Flow 1153.79 MLD & BOD Load 301.79 TPD, through 4 drains), Kanpur (Flow: 254.4 &

BOD Load 10.41 TPD, through 11 drains), Prayagraj (Flow 160.38 MLD & BOD Load 8.10 TPD, through 25 drains) & Varanasi (Flow: 223.41 & BOD Load 14.75 TPD, through 13 drains) city. Monitoring locations of drains in the state of Uttar Pradesh are shown in **Fig. 5.5.**

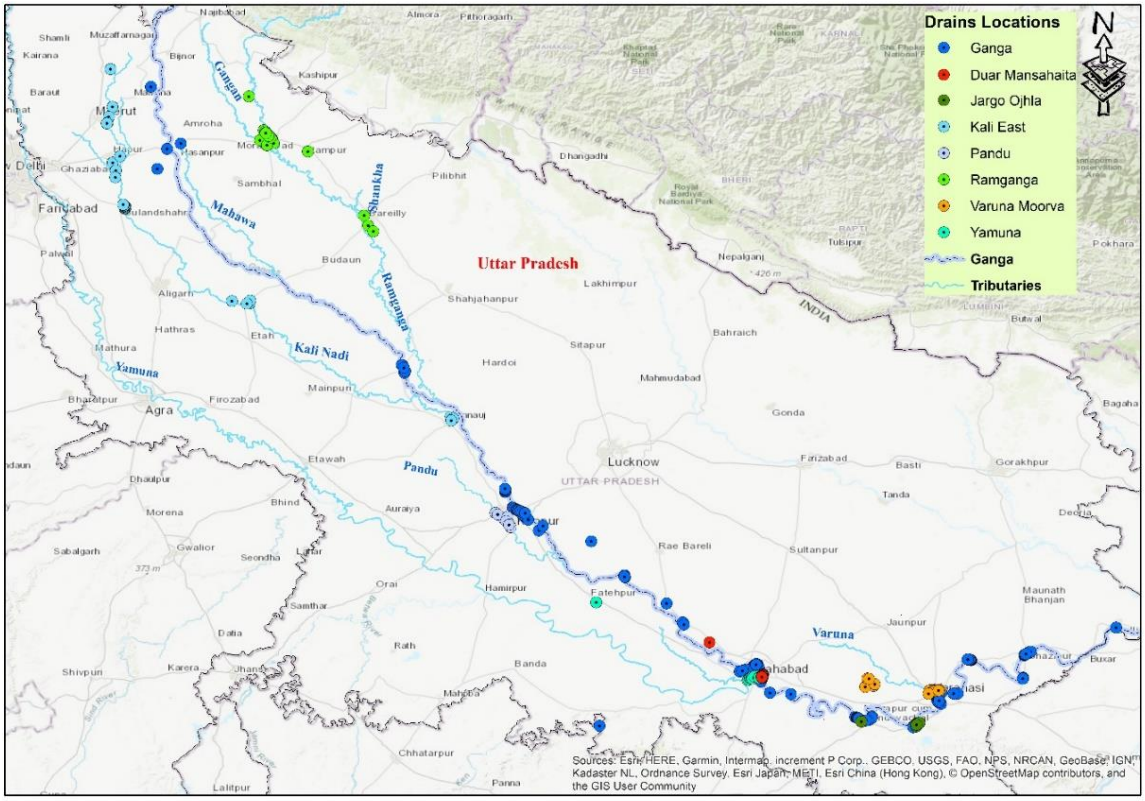


Fig. 5.5 Drains monitoring locations in Uttar Pradesh

Bihar

In Bihar, total 105 drains were monitored, out of which 67 were discharging into river Ganga and 38 in tributaries (Sone, Punpun, Adari, Daha, Gandak, Budi-Ghandak, Panchane, Kiul & Gangi)**.** Six drains (Ganga - 5 and Punpun – 1) were found tapped to sewage treatment plant. Overflow was observed in one tapped drain. Sampling was performed in 93 (Untapped-92 & tapped-1). Out of 99 untapped drains, 07 drains were observed dry (2) or stagnant (5) wherein sampling was not performed.

High value of BOD & COD was observed in Balu Ghat drain (320 mg/l & 1280 mg/l) discharging in to river Ganga from Patna. However, in remaining drains (Ganga & tributaries both) BOD and COD ranged from 4.0-85 mg/l & 12-380 mg/l respectively. In Bihar, significant flow (793 MLD) and BOD load (17.06 TPD) is observed in 20 drains (Ganga-19 & Punpun-1) carrying domestic wastewater of Patna along with surface run off. Monitoring locations of drains in the state of Bihar are shown in **Fig. 5.6.**

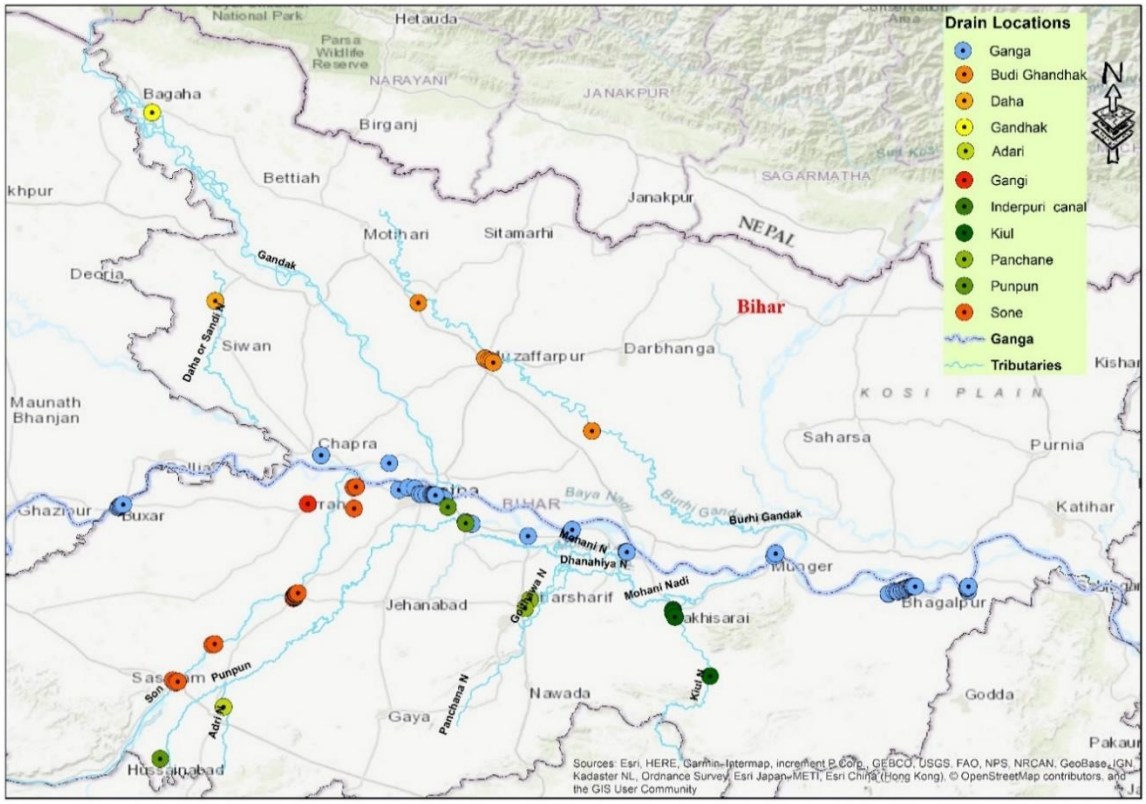


Fig. 5.6 Drains monitoring locations in Bihar

Jharkhand

In Jharkhand, 06 drains monitored, all six were discharging into river Ganga and found tapped.

West Bengal

In West Bengal, total 104 drains discharging into river Ganga were monitored. 08 drains were found tapped to various sewage treatment plants. Overflow was observed in 7 tapped drains. Sampling was not performed in 5 drains which were observed dry (2), stagnant (2) or having high tide (1).

BOD and COD ranged from 2.75-160 mg/l & 8-481 mg/l respectively. BOD value <10 mg/l was observed in 31 drains. Significant Flow and BOD load is observed in drains carrying domestic wastewater of Kolkata (Flow 1553.39 MLD & BOD Load 25 TPD, through 14 drains), Uluberia (Flow: 604.8 MLD & BOD Load 2.08 TPD, through 05 drains), Howrah (Flow 2237.85 MLD & BOD Load 32.76 TPD, through 12 drains) & Haldia (Flow 601.7 MLD & BOD Load 4.5 TPD, through 3 drains). Monitoring locations of drains in the state of Jharkhand and West Bengal are shown in **Fig. 5.7.**

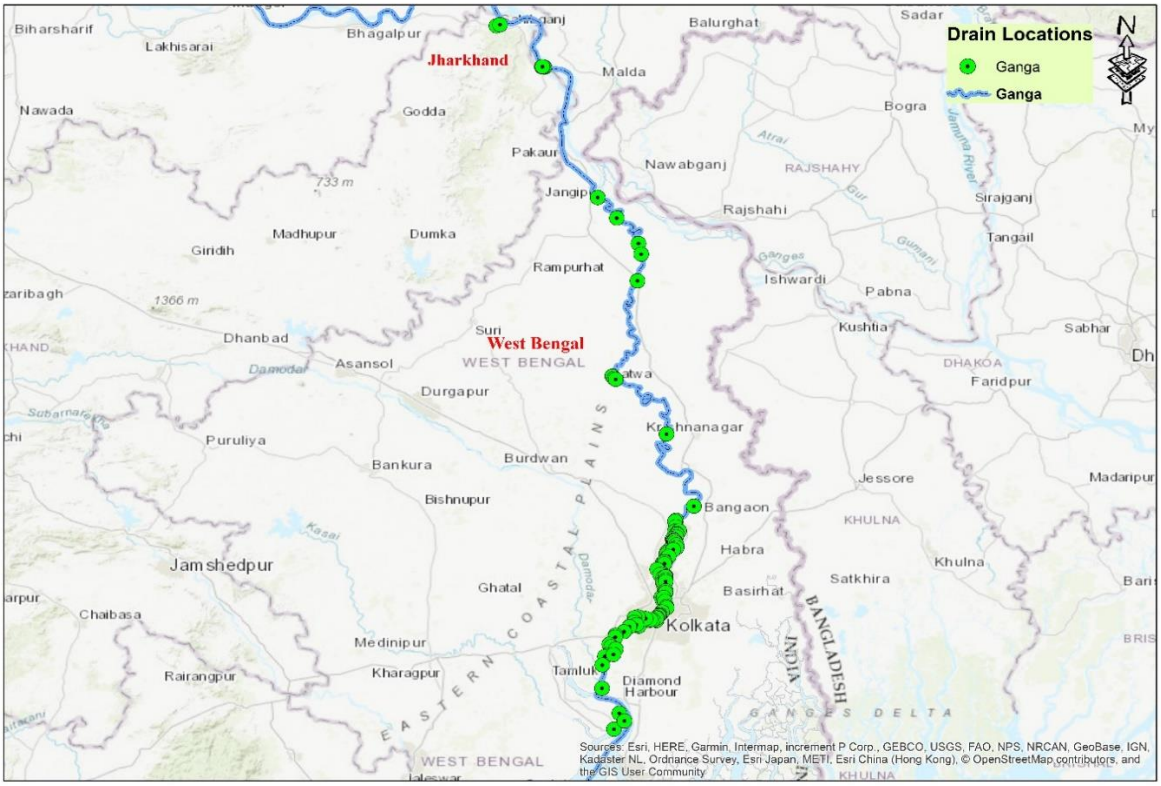


Fig. 5.7 Drains monitoring locations in Jharkhand and West Bengal

5.2.1.2 Other Observations

a) Status of Domestic and Mixed Drains:

Out of 609 drains, 535 drains are domestic i.e. carrying domestic sewage and surface runoff and 74 are mixed i.e. carrying industrial effluent along with domestic sewage and surface runoff. The state and river wise status is shown in **Figure 5.8**.

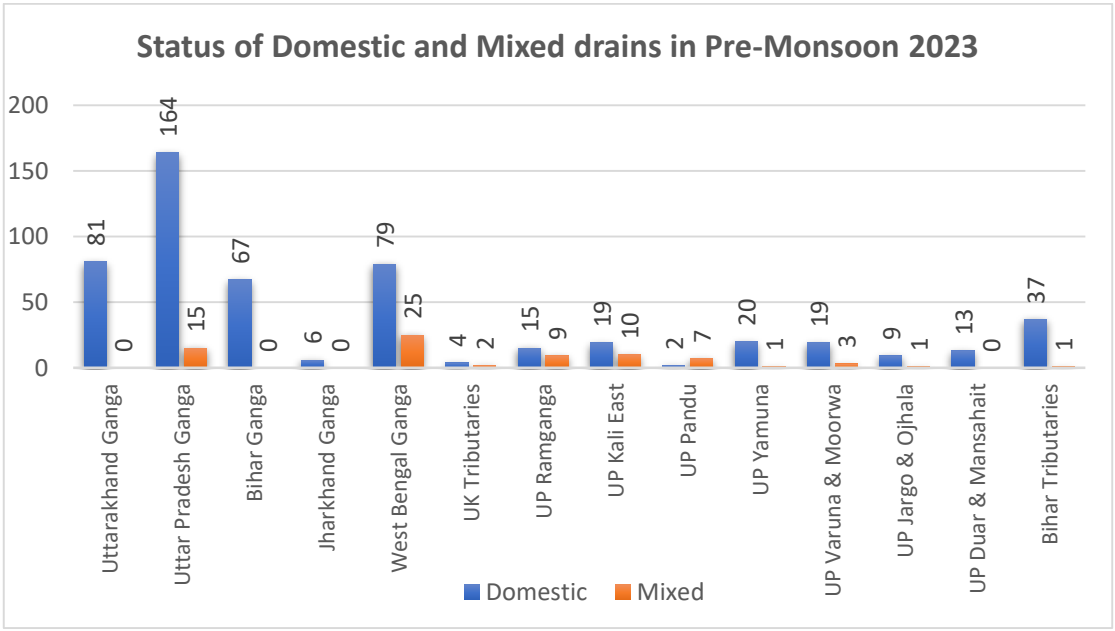


Fig. 5.8 Status of Domestic and Mixed drains during Pre-Monsoon 2023

b) Interim remedial measures or alternate treatment technology adopted in Drains

Some of the drains are diverted to Sewage Treatment Plant (STP) for the treatment of wastewater whereas many drains are discharging domestic sewage or mixed effluent to river Ganga and its tributaries directly without any treatment. In absence of conventional treatment (STP), interim remedial measure can be strategically helpful as a provisional measure until domestic sewage treatment plant is constructed or become functional. Interim remedial measure includes in-situ **remediation techniques- bio-remediation, phytoremediation, constructed wetland and ex–situ remediation techniques- Waste Stabilization Pond** and **Mechanically Aerated Lagoons.** In-situ treatment methods such as constructed wetland system, phytoremediation and bio remediation are most favourable methods for alternative biological treatment technology of drains.

Advantage of interim measures

- Alternative biological treatment technology methods such as phytoremediation or wetland systems are efficient in terms of nutrient removal such as removal of nitrogen and phosphorous.
- All alternative biological treatment technologies are low in energy incentive and not only reduces carbon footprint thereby minimizing climate change impact but also contributes to carbon sequestration.
- The technologies provide benefits like increase in the biodiversity and biomass production apart from habitat conservation.
- Constructed Wetlands may attract migratory birds, as well as provide aesthetic and recreational services to the public. It also contributes to groundwater recharge as well as results in buffering of ambient temperature and odor.
- Studies indicate that there is massive reduction in pathogenic microbes in alternative biological treatment technology as compared to conventional treatment.
- In-situ remediation is more efficient in restoring self-purification system of river and also immobilization of heavy metals.
- In-situ remediation technique does not require much energy, its maintenance cost is relatively low, it is easy to develop, operate and manage as compared to conventional technology.
- Besides high reduction efficiency of BOD, different alternative treatment technologies are efficient in increasing Dissolve Oxygen (DO) and reducing Fecal Coliform (FC) e.g. Phytoremediation technique can reduce FC by 50% and increase DO from 0 to 5 mg/l; Oxidation Pond can reduce FC by more than 95% and increase DO from 0 to 5mg/l; similarly, lagoons are efficient in reduction of FC by 50-70%.
- The cost of alternative biological treatment technology is extremely low.

Status of interim remedial measures adopted in drains discharging into river Ganga and tributaries

- Interim measures adopted in 102 drains (Ganga-81 and tributaries -21) in Uttar Pradesh (101) and West Bengal (01). Interim measures were not adopted in most of the untapped drains in West Bengal due to tidal effects.
- Bio-remediation (microbial) is the most common in-situ remediation measures adopted in drains discharging into river Ganga and its tributaries. However, in few drains Constructed Wetland and Phyto-remediation is also adopted.

- Interim measures were found non-functional/defunct, bypass, poorly maintained and installed at inappropriate location in 27 drains in Uttar Pradesh (Ganga-22, Yamuna-01, Kali-03 and Ramganga -01).
- Ineffective remedial measure in terms of BOD reduction (increase in BOD value at downstream of interim measure in comparison of upstream value) was observed in 15 drains (Ganga-14 and Mansahaita-01) in Uttar Pradesh. However, in 14 drains reduction in terms of BOD (>40%) was observed in 14 drains. The details are given in **Table 5.4 & 5.5**.
- The detailed status of ineffective, non-function and poorly maintained interim remedial measure is given in **Table 5.3.**

Table 5.3 Interim remedial measure observed non-operational/defunct, bypass, poorly maintained and installed at inappropriate location in drains

Sl. No.	Name of drain	Towns/City in Catchment	Type of interim measure	Status of interim remedial measures
River Ganga				
1.	Phuldhera drain	Simbhawoli (Hapur)	Constructed wetland	Installed but yet not made operational
2.	Collector Ghat Drain	Ghazipur	Bioremediation	Poorly maintained
3.	Maksud Ghat Drain	Ghazipur	Bioremediation	Poorly maintained
4.	Balughat Kaccha Drain	Mirzapur	Bioremediation	Poorly maintained
5.	Baswariya Drain	Mirzapur	Bioremediation	Poorly maintained
6.	Pathvari Mata Temple drain	Dalmau, Raebareli	Bioremediation	non-operational
7.	Raja Hela drain, Manikpur,	Manikpur, Pratapgarh	Bioremediation	Poorly maintained
8.	Mallahan tola drain	Manikpur, Pratapgarh	Bioremediation	Poorly maintained
9.	Luv Kush Drain	Bithoor, Kanpur	Constructed wetland	Bypass observed
10.	Bhannu Nala	Bithoor, Kanpur	Constructed wetland	Bypass observed
11.	Peshwa Nala	Bithoor, Kanpur	Constructed wetland	Bypass observed
12.	Laxman Ghat Drain	Bithoor, Kanpur	Constructed wetland	Bypass observed
13.	Kalwari Ghat Drain	Bithoor, Kanpur	Constructed wetland	Bypass observed
14.	Nehru Drain/Nehru Park Nala	Prayagraj	Bioremediation	non-operational
15.	Ganda/Local Drain,	Mughalsarai, Chandauli	Bioremediation	non-operational
16.	Kot Ghat Drain	Saidpur, Ghazipur	Bioremediation	non-operational
17.	Pakka Ghat Drain	Saidpur, Ghazipur	Bioremediation	non-operational
18.	Sangat Ghat Drain	Saidpur, Ghazipur	Bioremediation	non-operational
19.	Ganga Vishnu Drain	Shuklaganj	Bioremediation	not installed at appropriate place.
20.	Indra Nagar Drain	Shuklaganj	Bioremediation	not installed at appropriate place.
21.	Ravidas Nagar drain,	Shuklaganj, Unnao	Bioremediation	not installed at appropriate place.
22.	Srinagar drain,	Shuklaganj, Unnao	Bioremediation	not installed at appropriate place.
Tributaries of river Ganga				
1.	Ghaghar Nala- 1A/ Sadiyapur Drain	Prayagraj	Bioremediation	non-functional
2.	Deharia Drain, Moradabad	Moradabad	Bioremediation	non-functional

3.	Maman Road Drain, Bulandshahr	Bulandshahr	phytoremediation	non-functional
4.	Aadil Drain, Bulandshahr	Bulandshahr	Bioremediation	non-functional
5.	Behind Chamunda Mandir Drain	Bulandshahr	Bioremediation & phytoremediation	non-functional

Table 5.4 Significant improvement (> 40%) in terms of BOD reduction has been observed in the following drains

S. No.	Name of Drain	Town/City	Type of interim measure	BOD (downstream of interim measure)	BOD (Upstream of interim measure)	Percentage reduction
1.	Mamdevpur Drain	Bhadohi	Bioremediation	31.8	143	77.8
2.	Dhinapur Drain	Farrukhabad	Bioremediation	15.6	69.7	77.6
3.	Kashi Ram Awas Drain	Chunar	Bioremediation	16.1	54.6	70.5
4.	Posta Ghat Drain	Ghazipur	Bioremediation	43.4	126	65.6
5.	Railway Drain	Mughalsarai	Bioremediation	24.4	66	63.0
6.	Shankar ghat Colony drain	Prayagraj	Bioremediation	24.6	66.2	62.8
7.	Roohi Mandi Drain	Ghazipur	Bioremediation	47.6	125	61.9
8.	Budhava Mahadeva Drain	Ghazipur	Bioremediation	28.4	73.8	61.5
9.	Brahamawat Ghat	Bithoor	Phyto-remediation (Constructed Wetland)	9.65	25	61.4
10.	Rangmahal Ghat Drain	Saidpur	Bioremediation	9.3	20.5	54.6
11.	Dadri Ghat Drain	Ghazipur	Bioremediation	37.6	81.6	53.9
12.	Santoshi Mata Mandir Drain	Chunar	Bioremediation	22.4	44.2	49.3
13.	Mahaveer Ghat Drain	Saidpur	Bioremediation	16.3	29.4	44.6
14.	Ghaghar Nala 1-A1	Prayagraj	Bioremediation	36.5	66.3	44.9

Table 5.5 Inefficient interim remediation measures (in terms of BOD increase) observed in the following

Sl. No.	Name of drain	Towns/City in Catchment	Type of interim measure	BOD deterioration from upstream to downstream		Percentage increase in BOD value
				Upstream BOD (mg/l)	Downstream BOD (mg/l)	
River Ganga						
1.	Dabka drain	Kanpur	Bioremediation	41.2	212.0	414.6

2.	Chilla drain	Prayagraj	Bioremediation	17.8	84.4	374.2
3.	Balughat/Balbeer drain	Chunar, Mirzapur	Bioremediation	14.4	61.0	323.6
4.	Sadak Ghat drain	Dalmau, Raebareli	Bioremediation	7.4	20.7	179.7
5.	Chaura Mata Mandir drain	Chunar, Mirzapur	Bioremediation	18.2	31.0	70.3
6.	Karpurimai drain	Zamania, Ghazipur	Bioremediation	15.6	23.2	48.7
7.	Chhuhara Mandir-02 drain	Prayagraj	Bioremediation	22.6	31.6	39.8
8.	Nagwa drain/ Assi Nala	Varanasi	Bioremediation	104	134	28.8
9.	Gorwa drain	Zamania, Ghazipur	Bioremediation	23.6	28.6	21.2
10.	Sadar Bazar drain	Prayagraj	Bioremediation	25.0	30.2	20.8
11.	Bada Mahadev Adarsh Bazar drain	Ghazipur	Bioremediation& phytoremediation	31.5	37.4	18.7
12.	Golaghat drain	Kanpur	Bioremediation	48.0	56.0	16.7
13.	Kankarwa drain	Zamania, Ghazipur	Bioremediation	39.7	46.0	15.9
14.	Budhenath Mahadev Ghat drain	Saidpur, Ghazipur	Bioremediation	21.6	24.0	11.1
River Mansahaita						
15.	Shastri Bridge Nala	Jhusi, Prayagraj	Bioremediation	5.75	7.60	32.2

c) High concentration of Trace Metals:

High concentration of trace metal (more than general discharge standard) was observed in 28 drains of river Ganga and its tributaries in Uttar Pradesh (**Manganese** 2.28-3.56 mg/l, **Lead** 0.91-4.035 mg/l, **Mercury** 0.0124 mg/l, **Total Chromium** 3.84-6.22 mg/l, **Cadmium** 6.40 mg/l**, Zinc-**5.18 mg/l and **Iron** 3.50-69.19 mg/l). The details of drains in which high metal concentration observed is given **Table 5.6.**

Table 5.6 High trace metal concentration observed in drains

River Ganga	Tributaries of river Ganga
1. Dabka-1, 2 & 3 Drain, Kanpur (**Cr-3.84 mg/l**)	16. Chatnag Drain, Prayagraj (**Fe-3.85 mg/l**) of R. Manshita
2. Maniya Drain, Prayagraj (**Hg- 0.0124 mg/l**)	17. Karela Bagh Drain, Prayagraj (**Fe-7.6 mg/l**) of R. Yamuna
3. Allenganj Nala/Buxi Bund Nala, Prayagraj (**Cr-6.22 mg/l**)	18. GhagharNala1-A/Sadiyapur Drain, Prayagraj (**Fe-8.18 mg/l**) of R. Yamuna
4. Rasulabad-4 Drain, Prayagraj (**Fe-6.32 mg/l**)	19. Durga/ Daniyal/Lohtha Drain, Varanasi (**Fe-4.74 mg/l**) of R. Varuna
5. Salori Drain, Prayagraj (**Fe-57 mg/l**)	20. Halwakhanda Drain, Kanpur (**Mn-2.28 mg/l**) of R. Pandu
6. NTPC Drain, Raebareli (**Fe-3.50 mg/l**)	

7. Gode Shaheed Drain, Mirzapur (**Fe-3.99 mg/l**) 8. Lift Canal Drain, Mirzapur (**Fe-8.30 mg/l**) 9. Shivpur Drain, Mirzapur (**Fe-3.60 mg/l**) 10. Balughat Drain/Belbeer Ghat Drain, Chunar, Mirzapur (**Fe-4.88 mg/l**) 11. Post Office North Drain Chunar, Mirzapur (**Fe-8.32 mg/l**) 12. Kathal Drain, Balia (**Fe-5.66 mg/l**) 13. DM Banglo Drain, Ghazipur (**Fe-6.57 mg/l**) 14. Theri bazar Drain, Ghazipur (**Fe-4.04 mg/l**) 15. Varuna River/Drain, Varanasi (**Pb-0.91 mg/l**)	21. Ganda Drain, Kanpur (**Mn-3.56 mg/l**) of R. Pandu 22. Slaughter House/Odean Nallah (**Fe-5.137 mg/l**) of R. Kali East 23. Ghosiyan Drain (**Fe-69.19 mg/l**) of R. Ramganga 24. Jhabbu Ka Nala (**Fe-66.89 mg/l & Pb-4.035 mg/l**) of R. Ramganga 25. Kasai Bada Drain (**Cd- 6.40 mg/l, Zn-5.18 mg/l and Fe-47.84 mg/l**) of R. Kali East 26. Gulaothi Drain drains (**Fe-4.81 mg/l)** of R. Kali East 27. Maman Road Drain **(Fe-4.77 mg/l**) of R. Kali East 28. Aadil Drain (**Fe-3.51 mg/l**) of R. Kali East

Note: *Samples of trace metals in Bihar & West Bengal are not analysed yet.*

d) Solid waste deposition observed in drains

Solid waste was found dumped along 89 drains in Uttar Pradesh, 73 drains in Bihar and 73 drains in West Bengal. The list of drains is attached as ***Appendix-5.1***. The **Fig. 5.9** shows solid waste disposal long drains:

Maman Road Drain, Bulandsahar: solid waste dumping along drain

Aadil Drain, Bulandsahar: covered by solid waste

Chakkar ki Milak drain, Moradabad: Solid waste disposal along drain (a) and Clogged and non-functional tapping arrangement (b)

e) Status of drains tapped to various STPs

State wise status of drains tapped to various sewage treatment plants is given in **Table 5.7.**

Table 5.7 Status of drains tapped to various STPs

Ganga States	Name of STP	No. of Drains Tapped
Uttarakhand	1 MLD STP Badrinath	5
	0.26 MLD STP Badrinath	1
	Pokhri Bend STP	3
	Marwari STP	3
	Chamoli Ghat STP	4
	Old Suspension Bridge STP	1
	Deendayal Upadhyay STP	1
	02 MLD STP Gyansu,	5
	Tapovan STP	3
	Swargashram STP	12
	Chandreshwarnagar STP	7
	Lakkarghat STP	3
	14 MLD Sarai Jawalapur STP	1
	18 MLD Sarai Jawalapur STP	1
	Jagjeetpur STP Complex, Haridwar (27 MLD STP, 18 MLD STP & 68 MLD STP)	17
Uttar Pradesh	2.7 MLD STP Fatehgarh	2
	80 KLD Constructed Wetland Treatment system, Bithoor	1
	Jajmau STP & CETP Complex (232 MLD), Kanpur	12
	210 MLD STP Bingawan, Kanpur	1
	60 MLD STP Rajapur, Prayagraj	7
	42 MLD Salori STP, Prayagraj	2
	14 MLD Phaphamau STP, Prayagraj	1
	10 MLD STP Ponghat, Prayagraj	1
	25 MLD STP Kodra, Prayagraj	1
	14 MLD STP, Mirzapur	3
	7 MLD Vindyachal STP, Mirzapur	4
	50 MLD STP Ramanna, Varanasi	2
	80 MLD Dinapur STP, Varanasi	21
	10 MLD Ramnagar STP, Varanasi	4
Bihar	Barh STP (11MLD), Barh	5
Jharkhand	5 MLD STP Sahibgunj	1
	7 MLD STP Sahibgunj	1
	3.5MLD Rajmahal STP	4
West Bengal	9.5MLD Nabadwip STP	1
	6.5MLD Ramaghat WSP	1
	11.56 MLD Naihati STP	1
	31 MLD Bhatpara STP	1
	Chandan Nagar STP (18.5 MLD & 4.54 MLD)	2

	Garulia STP (4.10MLD)	1
	Panihati STP 12 MLD	1
Total-A		**148**
Uttar Pradesh (Kali East)	13 MLD Amara Jalalpur STP, Kannauj	2
	15 MLD Kasganj STP	2
Uttar Pradesh (Pandu)	210 MLD Bingawan STP	3
	30 MLD Pankha STP	2
Uttar Pradesh (Yamuna)	42 MLD New Naini	2
	50 MLD STP Numayadahi	2
	80 MLD Naini STP	4
Uttar Pradesh (Varuna)	140 MLD STP Dinapur	9
	120 MLD Goithaha	1
Uttar Pradesh (Mansahaita)	16 MLD STP Jhusi, Prayagraj	6
Bihar (Punpun)	Karmalichak STP 37 MLD, Patna	1
Total-B		**34**
Grand Total (A+B)		**182**

f) Comparison Pre-monsoon 2023 drain monitoring data with previous years' data:

- In the year 2016, CPCB monitored 210 drains discharging into River Ganga and its tributaries draining about 10,492 MLD of wastewater having 520.6 TPD of pollution load.
- In 2016, 3% (6 drains) of monitored drains were found tapped and diverted to sewage treatment plants for treatment of wastewater. However, the number of tapped drains increased from 3% to 30% (182 out of 609 monitored drains) during Pre-monsoon 2023.
- Monitoring status of drain from 2016 onwards is shown in **Fig. 5.9**:

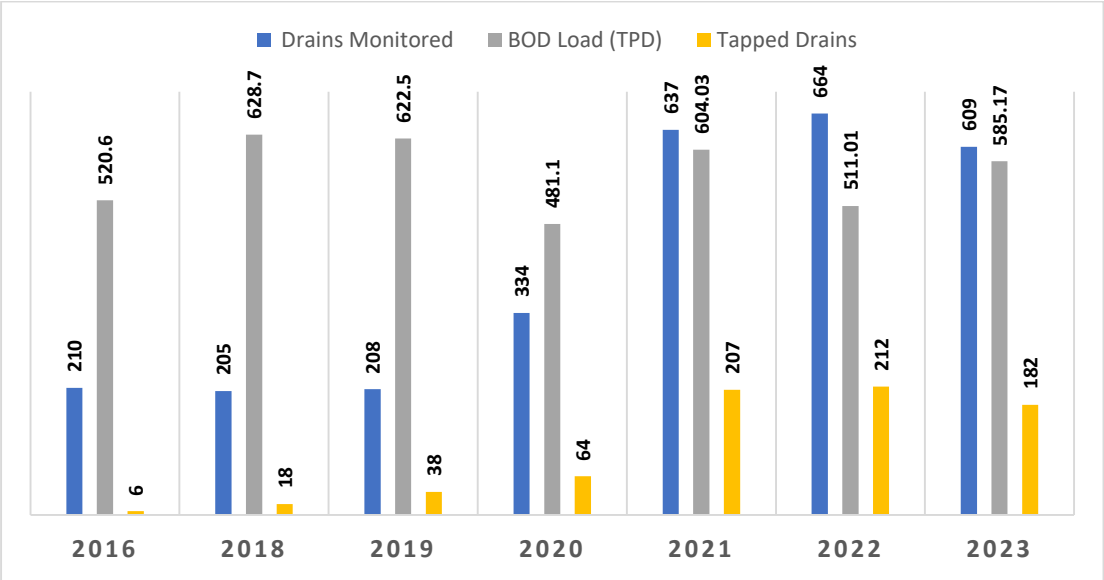


Fig. 5.9 Monitoring status of drains from 2016 onwards

From 2016-2022, post-monsoon monitoring data was used & for 2023 pre-monsoon monitoring data used.

g) Towns identified for immediate action:

Drains discharging waste water into river Ganga and its tributaries from 11 cities namely Dehradun, Meerut, Moradabad, Kanpur, Prayagraj, Varanasi, Patna, Kolkata, Uluberia, Haldia and Howrah drains 66% of the total flow and 75% of the total BOD load. The contribution of BOD load and flow from drains discharging from11 identified cities is given in **Table 5.8**.

Table 5.8 Contribution of BOD load and flow from drains discharging from 11 identified cities

State	Town/City	Flow (MLD)	BOD Load (TPD)
Uttarakhand	Dehradun	1606.7	7.36
Uttar Pradesh	Meerut	1153.79	301.79
	Moradabad*	220.9	17.37
	Kanpur	254.4	10.41
	Prayagraj	160.38	8.1
	Varanasi	223.41	14.75
Bihar	Patna	793	17.06
West Bengal	Kolkata	1553.39	25
	Uluberia	604.8	2.08
	Haldia	601.7	4.5
	Howrah	2237.85	32.76
TOTAL		**9401.32**	**441.18**

***** *5 drains were not monitored; therefore, flow & load could be higher.*

5.2.2 Action taken by CPCB

CPCB issued letters to the Uttar Pradesh Pollution Control Board, Uttarakhand Pollution Control Board and Bihar State Pollution Control Board

- To identify the source of pollution in drains and take appropriate action against contributing source/industrial unit.
- To direct concerned authorities to ensure that drains having broken/damaged/temporary tapping provisions shall be repaired immediately and sewage pumping stations shall be operated regularly so that no wastewater is discharged through tapped drains.
- To direct concerned authorities to remove solid waste dumped along identified drains and dispose it safely.

5.3 Monitoring of Rivers and Drains in Kanpur-Unnao Region

In Kanpur, CPCB jointly with UPPCB carried out regular monitoring of rivers at 9 locations (Ganga-8 & Pandu-01) and 29 adjoining drains. The map showing the monitoring locations on river Ganga and Pandu along with adjoining drains is shown in **Fig. 5.10**.

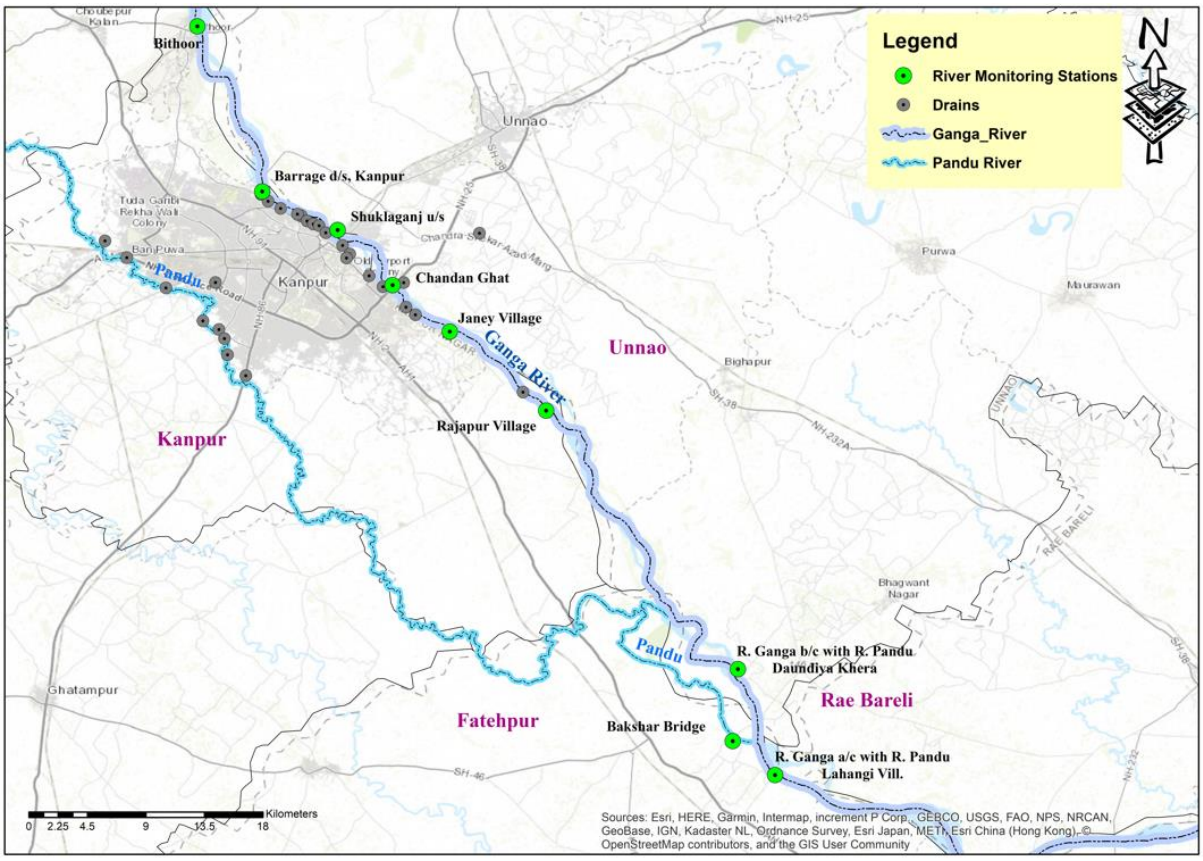


Fig. 5.10 Monitoring locations on river Ganga and Pandu along with adjoining drains

5.3.1 Work accomplished during 2023

During 2023, total 20 rounds of monitoring have been carried out. During each round of monitoring (usually of 1-2 days), a team consisting of two officials (Research Associate/Senior Research Fellow/Field Assistant) from CPCB Regional Directorate Lucknow monitors the rivers and drains in Kanpur & Unnao. During monitoring, grab samples of water/wastewater were collected from rivers/drains for physico-chemical (pH, Colour, BOD and COD), microbiological (Total Coliform and Faecal Coliform) and trace metal (Total Chromium) parameters. Flow in drains adjoining rivers was also measured using ball-float method as described under Central Public Health and Environmental Engineering Organisation (CPHEEO) manual on sewerage and sewage management. After sampling, the collected samples were transferred to the laboratory at RD Lucknow and analysis was carried out following standard procedures. After receipt of laboratory analysis report, the monitoring report along with data is forwarded by RD Lucknow to HO Delhi. At HO Delhi, the monitoring data is compiled by the processing officer and thereafter, the report is put-up for action such as issuance of letter/direction to concerned state agencies, communication of data to NMCG, etc.

5.3.2 Data generation and salient findings

Drain management

Kanpur

The wastewater generated in Kanpur city is discharged through 27 drains in to rivers Ganga on the north-east side of the city and Pandu on its south-west side. Based on the monitoring data for the year 2023 (**Table 5.9**), following observations are made:

- Out of 27 drains of Kanpur city, 18 drains have gradient towards river Ganga and 9 drains have gradient towards river Pandu. In Kanpur, out of 18 drains discharging wastewater into river Ganga, 12 drains were tapped. Out of 12 tapped drains, overflow was observed in 7 tapped drains namely Bhagwatdas Ghat (7.5 MLD), Budhiya Ghat (1.1-8.3 MLD), Permiya (20.4-86.4 MLD), Sheetla Bazar (7.9-35.8 MLD), Satti Chaura Drain (0.03-0.3 MLD), Sisamau and Parmath drain.
- High levels of BOD (924-1845 mg/l), COD (1348-3139 mg/l), Total Chromium (33.2-34.6 mg/l) and Color (375-500 Hazen) were observed in Sheetla Bazar drain and Budhiyaghat drain which indicate discharge of untreated/partially treated wastewater from tannery units located in Jajmau area of Kanpur.
- Presence of total Chromium was also observed in the Dabka drain (Cr (T)-5.93 mg/l), which indicates discharge from tanneries located in the Chabileypura area of Kanpur.
- High levels of Total Chromium (5.4 mg/l) and Color (250 Hazen) were observed in Rooma drain (Rooma drain is a channel of irrigation canal originated from Jajmau CETP & STP complex and later Rooma drain from CETP Rooma joins this channel) which indicate discharge of untreated/partially treated wastewater from textile units located in Rooma industrial cluster of Kanpur.
- High levels of BOD (326 mg/L), COD (961 mg/L) and Total Chromium (10.45 mg/l) were observed in Sewage Pumping Station (SPS) Jajmau drain due to fault in sewage line at the SPS.
- Out of 9 drains having gradient towards river Pandu, 6 drains were tapped and overflow was observed in all tapped drains. High BOD (285-333 mg/l) and COD (526-813 mg/l) were observed in Halwakhanda, Ganda, COD, ICI, Panki and Sagarpuri drains. High color (500 Hazen) was observed in Shiv Nagar-Pipauri drain and high total chromium concentration (8.91 mg/l) was observed in Sagarpuri drain.

Table 5.9 Monitoring data of drains discharging into rivers Ganga (20) & Pandu (9) in Kanpur & Unnao during 2023

S. No.	Name of Drain	Flow (MLD)	BOD (mg/l)	COD (mg/l)	Colour (Hazen)	T. Cr. (mg/l)
DRAINS DISCHARGING INTO RIVER GANGA IN KANPUR (18)						
Tapped and dry drains (5)						
1.	Jail Drain	Tapped	-	-	-	-
2.	Police Line Drain	Tapped	-	-	-	-
3.	Wazidpur Drain	Tapped	-	-	-	-
4.	TAFCO Drain	Tapped	-	-	-	-
5.	Muir Mill Drain	Tapped	-	-	-	-

S. No.	Name of Drain	Flow (MLD)	BOD (mg/l)	COD (mg/l)	Colour (Hazen)	T. Cr. (mg/l)
Tapped drains with overflow (7)						
6.	Bhagwat Das Drain	Tapped (Overflow: 7.5 MLD)	53.3-174	140-359	30-100	< 0.003-0.3
7.	Budhiya Ghat Drain	Tapped (Overflow: 1.1-8.3 MLD)	**307-1845**	**566-3139**	50-**500**	**2.3-33.2**
8.	Permiya Drain	Tapped (Overflow: 20.4-86.4 MLD)	5.8-118	35.5-310	15-75	< 0.003-**2.55**
9.	Sheetla Bazar Drain	Tapped (Overflow: 7.9-35.8 MLD)	**255-924**	**696-1348**	**50-375**	**7.6-34.6**
10.	Satti Chaura Drain	Tapped (Overflow: 0.03-0.3 MLD)	30.2-152	114-227	25-75	<0.003-0.07
11.	Sisamau Drain	Tapped (Lean flow which could not be measured)	83.2	179	40	0.02
12.	Parmath Drain	Tapped (Flow could not be measured due to unapproachable site condition)	73	274	50	0.04
Untapped drains (6)						
13.	Air force Drain	Untapped (0.1-0.4 MLD)	32.2-75	118-233	50-75	<0.2
14.	Dabka Drain	Untapped (3-46.7 MLD)	19.3-212	69.5-476	40-150	< 0.003-**5.93**
15.	Ranighat Drain	Untapped (0.4-4 MLD)	7.46-236	19.8-424	30-100	< 0.003-0.03
16.	Golaghat Drain	Untapped (0.4-1.4 MLD)	24.2-191	100-470	25-75	< 0.003-0.07
17.	Rooma Drain	Untapped (7.8-112.2 MLD)	14.2-**251**	38.5-**520**	25-**250**	<0.003-**5.4**
18.	SPS Jajmau Drain	Untapped (8.6-138.2 MLD)	29.1-**326**	71.9-**961**	20-150	0.67-**10.45**
DRAINS DISCHARGING INTO RIVER GANGA IN UNNAO (2-Both untapped)						
19.	City Jail Drain	Untapped (6.6-36.4 MLD)	26.7-**440**	82.3-**1333**	30-**500**	<0.2-**2.5**
20.	Loni Drain	Untapped (16.4-150 MLD)	5.3-76	26.9-240	20-100	<0.003-0.03
DRAINS DISCHARGING INTO RIVER PANDU (09)						
Tapped drains with overflow (6)						
21.	Halwakhanda Drain	Tapped (Overflow: 20.9-194.1 MLD)	36.1-**313**	62.3-**629**	40-150	< 0.003 – 0.04
22.	Ganda Drain	Tapped (Overflow: 52.1-270.7 MLD)	41.6-174	129-**526**	50-75	< 0.003-1.6
23.	COD Drain	Tapped (Overflow: 18.3-155.5 MLD)	31.4-**324**	97.1-**580**	50-100	< 0.003-0.06
24.	Ratanpur Drain	Tapped (Overflow: 13.8-84.7 MLD)	54.6-97.2	76.5-209	40-50	0.03-2
25.	ICI Drain	Tapped (Overflow: 15.6 MLD)	54-**285**	180-**813**	25-40	0.05-1.1
26.	Panki Drain	Tapped (Overflow: 0.1-41.3 MLD)	44.7-141	94.2-**555**	50-125	< 0.2 – 0.03
Untapped drains (3)						
27.	Shiv Vihar Colony Drain	Untapped (2-28.5 MLD)	11.7-158	48.5-365	40-80	< 0.003-0.5
28.	Shiv Nagar-Pipauri Drain	Untapped (0.5-18.5 MLD)	7.2-136	28.5-385	30-**500**	0.02-0.05

S. No.	Name of Drain	Flow (MLD)	BOD (mg/l)	COD (mg/l)	Colour (Hazen)	T. Cr. (mg/l)
29.	Sagarpuri Drain	Untapped (1.5-2.6 MLD)	46.7-**333**	103-**661**	50-125	<0.2-**8.91**

Unnao

In Unnao there are two drains- the City Jail drain and Loni drain and both are untapped, have their gradients towards river Ganga, and carry industrial wastewater besides sewage. The City Jail drain passes through the industrial areas of Magarwara and Banthar. The treated effluent of the Banthar CETP (all member units are tanneries) is discharged into this drain. The treated effluent of CETP located at Site-II, Unnao (all member units are tannery) is discharged into the Loni drain.

Based on the monitoring data of the year 2023, high levels of BOD (440 mg/L), COD (1333 mg/L), color (500 Hazen) and total chromium concentration (2.5 mg/L) were observed in City Jail drain, which indicate discharge of untreated/partially treated tannery effluent into the drain.

River water quality

The water quality of river Ganga and river Pandu was also monitored. The water quality monitoring locations on rivers Ganga and Pandu are shown in **Table 5.10.**

Table 5.10 Water quality monitoring locations on rivers Ganga and Pandu

S. no.	Monitoring location
1.	River Ganga at Bithoor
2.	River Ganga at downstream (d/s) Kanpur Barrage
3.	River Ganga at upstream Shuklaganj Bridge
4.	River Ganga at Chandan Ghat, Jajmau
5.	River Ganga at Janey village
6.	River Ganga at Rajapur village
7.	River Ganga at Daundiakheda Village before confluence (b/c) with river Pandu
8.	River Pandu at Bakshar Bridge
9.	River Ganga after the confluence (a/c) with river Pandu, near Lahangi village

The river water quality is assessed for ascertaining the water quality vis-a-vis the primary water quality criteria notified for outdoor bathing in terms of pH (6.5-8.5), Dissolved Oxygen (DO) (≥5 mg/L), Biochemical Oxygen Demand (BOD) (≤ 3 mg/L) and Faecal Coliform (FC) (≤ 2500 MPN/100 mL).

River Ganga

Based on the monitoring data of year 2023 (**Table 5.11**), in river Ganga from Bithoor to Fatehpur, pH ranged as 6.62-9.23, DO ranged as 5.5-12.2 mg/l, BOD ranged as 1.4-**10** mg/l & FC ranged as < 1.8 - **5.4×10^6** MPN/100 ml. Water quality of river Ganga was meeting the primary water quality criteria for bathing w.r.t. DO at all monitoring locations in the stretch from Bithoor to Fatehpur. However, in terms of pH, BOD & FC, the water quality of River Ganga was not meeting bathing water quality criteria at all monitoring locations.

Table 5.11 Monitoring data of rivers Ganga and Pandu during 2023

S. no.	River Location	BOD (mg/l)	DO (mg/l)	COD (mg/l)	pH	Colour (Hazen)	FC (MPN/100 ml)
Primary water quality criteria for bathing water		≤ 3 mg/l	≥ 5 mg/l	-	6.5-8.5	-	< 2500 MPN/100 ml
1.	River Ganga, Bithoor, Kanpur	1.4-**6.2**	6-11.8	7.2-24.2	6.62-**8.63**	5-30	<1.8 - **1.4×10^{6}**
2.	River Ganga, Barrage d/s, Kanpur	1.5-**9**	6.2-10.7	7.7-36.1	7.24-**8.78**	5-20	< 1.8 - **1.4×10^{5}**
3.	River Ganga, Shuklaganj u/s, Kanpur	1-**7.1**	6-11.3	5.48-27.8	7.27-**8.54**	5-20	< 1.8 - **1.4×10^{6}**
4.	River Ganga, Chandan Ghat, Jajmau	1.6-**5.5**	5.5-10.4	9.8-19.2	7.51-**8.54**	5-15	2×10^{3} - **2.4×10^{6}**
5.	River Ganga, Janey Village, Kanpur	1.9-**7.3**	5.7-11	8.7-30.2	7.47-**8.89**	5-20	2×10^{3} - **1.1×10^{6}**
6.	River Ganga, Rajapur Village, Kanpur	1.7-**8.7**	5.8-11.1	10.5-29.8	7.48-**8.89**	5-20	1.3×10^{3} - **5.4×10^{6}**
7.	River Ganga b/c with River Pandu, Dhondhiya Khera	2.5-**9.5**	6.3-11.1	9.5-38.6	6.66-**8.58**	5-25	2×10^{3} - **1.7×10^{6}**
8.	River Pandu, Bakshar Bridge	2.6-**34.8**	**2**-9.7	13.4-72.6	6.93-8.37	10-40	< 1.8 - **1.4×10^{7}**
9.	River Ganga a/c with River Pandu, Lahangi Village	1.7-**10**	6-12.2	10-39.9	7.24-**9.23**	5-20	< 1.8 - **3.5×10^{6}**

River Pandu

River Pandu passes through Kanpur district and receives wastewater through 9 drains. Water quality of River Pandu was monitored before confluence with river Ganga at Bakshar Bridge. Based on the monitoring data, in river Pandu, pH ranged as 6.93-8.37, DO ranged as **2**-9.7 mg/l, BOD ranged as 2.6-**34.8** mg/l & FC ranged as < 1.8 - 1.4×10^{7} MPN/100 ml. The highest BOD observed in river Pandu was 34.8 mg/l (on 24.04.2023). Based on BOD criteria, river Pandu is a priority I polluted stretch (>30 mg/l), wherein the river water quality was meeting the primary water quality criteria for bathing w.r.t. pH. However, in terms of DO, BOD & FC, the water quality of River Pandu was not meeting the bathing water quality criteria.

Exceedance of river water quality parameters with respect to primary water quality criteria

The percent exceedance of parameters namely pH, DO, BOD and FC in Rivers Ganga and Pandu with respect to primary water quality criteria is shown in **Fig. 5.11**. In River Ganga, the maximum percent exceedance w.r.t. pH was 16.7% at Chandan Ghat, Jajmau, BOD was 83.3% at Janey village and FC was 91.7% at Chandan Ghat, Jajmau. In River Pandu, the percent exceedance w.r.t. DO was 64.7%, BOD was 94.1% and FC was 41.2%.

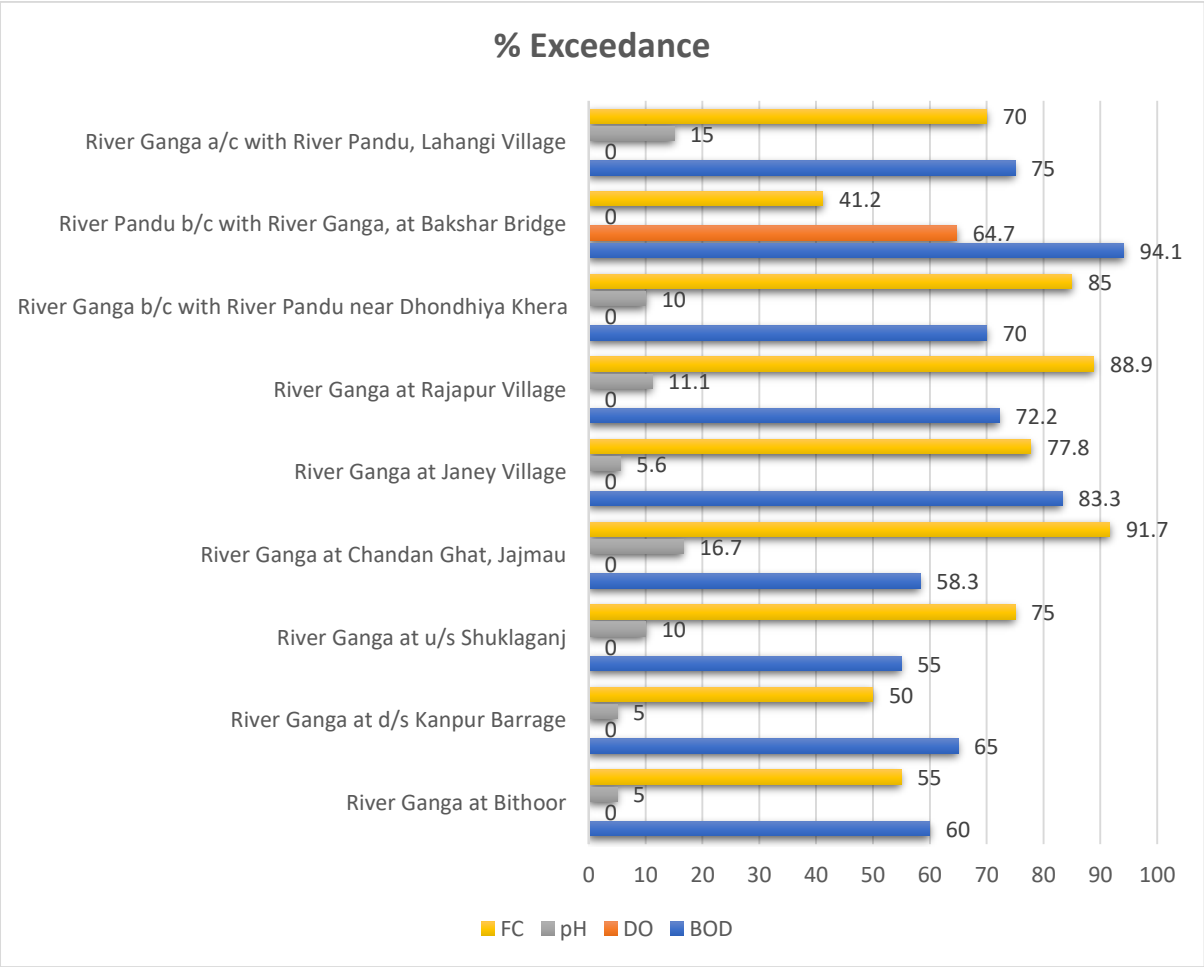


Fig. 5.11 Percent exceedance of parameters pH, DO, BOD and FC in rivers Ganga and Pandu w.r.t. primary water quality criteria

5.3.3 Action taken by CPCB

i. CPCB issued letters (8 nos.) to the Uttar Pradesh Pollution Control Board (UPPCB):

- To identify the sources of industrial pollution in drains and take appropriate action against contributing industrial units and operating agencies of CETPs.
- To direct concerned authorities to ensure that drains having broken/damaged/temporary provisions shall be repaired immediately and sewage pumping stations shall be operated regularly so that no wastewater is discharged through tapped drains.
- To direct concerned authorities to remove solid waste dumped along identified drains and dispose it safely.

ii. A DO letter to District Magistrate, Kanpur & UPPCB to deliberate upon the issues related with sewage management and industrial pollution with the concerned state agencies and to prepare a time-bound action plan.

5.3.4 Issues and way forward

S. No.	Issues	Way Forward	Concerned Agency
Water Quality River Ganga and Pandu in Kanpur			
1.	• Water quality of River Ganga was not meeting bathing water quality criteria in terms of pH, BOD and FC. • River Pandu is not meeting bathing water quality criteria in terms of DO, BOD & FC.	• Action plan(s) to control pollution in river Ganga and Pandu. • Action plan for rejuvenation of polluted stretch(s) via in-situ/ex-situ low-cost, decentralized wastewater treatment systems such as oxidation ponds, constructed wetlands, etc. • Tapping & diversion of untapped drains discharging into river Ganga	Municipal Corporation, UPPCB, CPCB and UP Jal Nigam
Drains of Kanpur			
2.	**Discharge of untapped drains into river Ganga and Pandu** • Deterioration in water quality of Rivers Ganga and Pandu in terms of BOD, COD and fecal coliform • Non-compliance of water quality of River Ganga for bathing norms in Kanpur stretch • Non-availability of sewage network • Interception and diversion of drains • Lack of sewage pumping stations and sewage treatment facility • Illegal discharge and mixing of industrial waste in drains • Non-commissioning of under construction STPs (30 MLD Pankha STP and 15 MLD Baniyapur STP) in Kanpur town	• Sewerage network to be laid down in newly developed areas • Suitably designed interception and diversion structures and pumping stations to be built for tapping of drains • Adequately designed STPs to be installed • Expedite the construction of new STPs and commissioning to be ensured within the time frame • Discharge of industrial effluent in drains shall be stopped immediately by identifying the industrial unit responsible for the same.	Municipal Corporation, Uttar Pradesh Pollution Control Board, Development Authority UP Jal Nigam
3.	**Overflow from the tapped drains** • Inadequate capacity of pumping station	• Design capacity of pumping stations to be reviewed by experts	Municipal Corporation, Uttar Pradesh Pollution Control

S. No.	Issues	Way Forward	Concerned Agency
	• Irregular operation of sewage pumping station • Mixing of storm water with sewerage network • Breakage or lack of maintenance of interceptor structures • Accidental leakages in fresh water supply line • Lack of cross-verification of water supply data with respect to sewage pumped from pumping stations • Generation of excess flow with respect to the designed capacity of pumping station and unregulated water usage • Unprecedented residential/ commercial growth in the area	• Sewage pumping stations to be operated properly • Separate dedicated network for carrying sewage and storm water to be laid down • Regular maintenance of interceptors and diversion structures • Capping of leakage points and regular monitoring • Regular maintenance of pumping houses (motors/pumps/electromechanical units/backup power arrangements/standby machinery) with provision of logbook for all operations • Vigilance to ensure round the clock operation of pump houses • Accelerated resolution of all complaints/ breakdowns • Regulated water usage to be ensured	Board, Development Authority UP Jal Nigam

5.4 Pollution Source Mapping of Dhandera, Jat Mujhera & Begrajpur drain system

The Dhandhera drain originates in Kanamheri village (29.476284, 77.790211), near M/s Tehri pulp and paper (**Figure 5.12**). It has two second-order/ tributaries drains: Jat Mujhera and Begrajpur Industrial drain. Both of these drains receive effluents from industries along Bhopa Road, Jolly Road, Jansath Road, and the Begrajpur industrial area.

5.4.1 Dhandhera drain from origin to before confluence with Begrajpur drain

The Dhandhera Drain carries both domestic sewage and effluent discharge from industrial units located along Bhopa Road, Jolly Road, and Jansath Road. It was found dry at the origin and flow was observed in the drain downstream of Tehri Pulp and Paper unit. Before merging with Jatt Mujehra drain, it transverses a distance of about seven kilometers and 15 industries in this stretch discharge their waste water into Dhandhera drain. Wastewater samples collected from the Dhandhera drain before confluence of Jat Mujhera drain exhibit high color (60-100 Hazen), BOD (38 to 224 mg/l), and COD (113 to 664.8 mg/l). At the upstream of M/s S K Paper, the flow of the drain was measured as 16.21 MLD with a BOD of 192 mg/l, contributing a pollution load of 3.2 TPD at this point.

The Jat Mujhera drain originates at coordinates 29.475030, 77.808448, where it was found dry. Flow in the drain begins near the outlet of M/s Bindlas Duplex Ltd. at Bhopa Road. It covers a

total length of approximately 8.02 km before merging with the Dhandera drain. Industries within the catchment area of Jat Mujhera drain include 4 Pulp & Paper establishments at Bhopa Road, 3 at Jolly Road, and 2 Distilleries. High pollution load was observed in Jat Mujhera drain with BOD ranging from 56 to 1480 mg/l and COD ranging from 268 to 2951 mg/l.

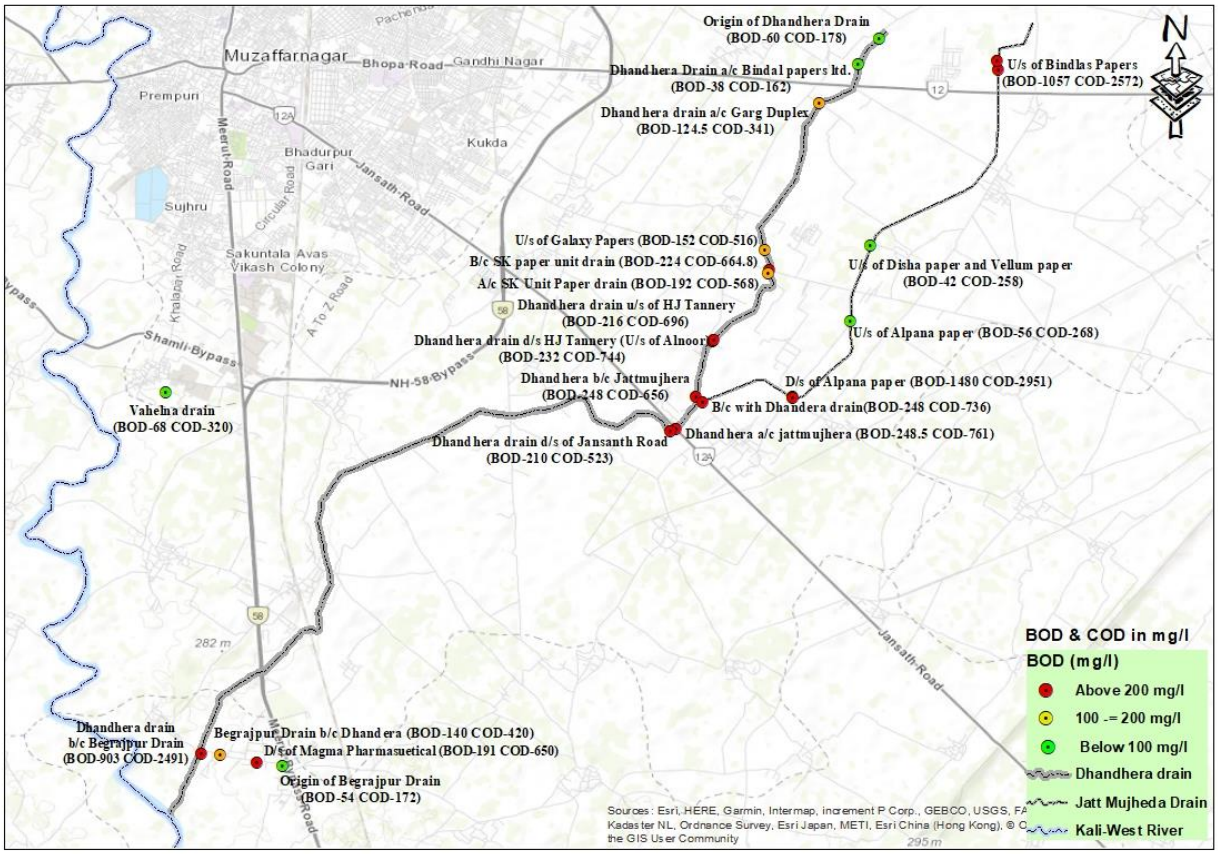


Figure 5.12 Sampling locations of Dhandera Drain System

After merging with Jat Mujhera drain, the Dhandhera drain continues its course until discharging into the River Kali-West at coordinates 29.364904, 77.688793. It covers a distance of around 15 km after confluence with Jat Mujhera drain. Waste water samples of Dhandhera drain were collected at various places from its confluence with Jat Mujera till before its confluence with Begrajpur drain, show high levels of color (50-100 Hazen), BOD (42-903 mg/l), and COD (258-2491 mg/l). As per available information, there are a total of 31 industries located within the catchment area of the Dhandhera-Jat Mujhera drain from origin to its confluence with River Kali-West. The monitoring location of samples and catchment of Dhandera drain system is shown in **Figure 5.12**. The Jat Mujhera drain and Dhandera drain are shown in **Figure 5.13.**

Photograph-1: Jat Mujhera drain before confluence to Dhandera drain

Photograph-2: Dhandera drain before confluence of Begrajpur drain

Figure 5.13 Sampling locations of Dhandera Drain System

5.4.1.1 Action plan for rejuvenation of Dhandera & Jat Mujhera drain

The industrial cluster has four major drains: Dhandhera drain, Jat Mujhera drain and Begrajpur industrial drain, spanning lengths of 21 km, 8 km and 1.5 km respectively. Notably, both the Jat Mujhera and Begrajpur drains discharge into the Dhandhera drain. These drains do not have freshwater and carries partially treated industrial effluents along with episodic purging from industries engaged in zero liquid discharge (ZLD) practices and legacy solid waste.

To address the pressing need for rejuvenation, it is imperative to adopt zero-energy, zero-chemical use technologies requiring minimal maintenance and handling. The Central Pollution Control Board (CPCB) has formulated guidelines on "Alternative Treatment Technologies for Wastewater Treatment in Drains,". The guidelines advocate for the implementation of Constructed Wetland Systems (CWS), recognized globally as an effective and environmentally sustainable approach for wastewater treatment. Constructed wetlands utilize diverse plant species and microbial communities to biodegrade pollutants without the need for external energy sources.

The efficacy of CWS has been demonstrated at Neela Hauz Lake near Sanjay Van in New Delhi, where a collaboration between the Centre for Environmental Management of Degraded Ecosystems (CEMDE), Delhi University, and the Delhi Development Authority (DDA) has led to a remarkable 90% reduction in biochemical oxygen demand (BOD) and the restoration of the once-degraded lake. Survey was made of Dhandera and Jat Mujhera drain and seven locations were identified for the establishment of CWS. It is estimated that the CWS will require 1-2 years to become fully operational once implemented.

Details of possible locations selected based on the topology of drain for setting up Constructed wetland system during survey is given **Table 5.12** and shown in **Figure 5.14.**

Table 5.12 Details of possible location for setting up Constructed Wetland Systems (CWS)

Particulars	Drain	Co-ordinate	Location	Flow condition	Ecological condition	Remarks
CWS-1	Dhandera	29.468285 77.785053	Bhopa road d/s for industrial cluster	Flow around 3.5 MLD Flow width-4 mtr. Flow depth- 0.2 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted
CWS-2	Jat Mujhera	29.467504 77.807097	Bhopa road d/s for industrial cluster	Flow around 1 MLD Flow width-4 mtr. Flow depth- 0.2 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted, observed dry u/s of industrial area
CWS-3	Dhandera	29.442093 77.774533	Jolly road d/s for industrial cluster	Flow around 5 MLD Flow width-4 mtr. Flow depth- 0.1 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted
CWS-4	Jat Mujhera	29.439301, 77.786020	Jolly road d/s for industrial cluster	Flow around 4 MLD Flow width-4 mtr. Flow depth- 0.2 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted
CWS-5	Dhandera	29.422672 77.757466	Jansath road d/s for industrial cluster	Flow around 5 MLD Flow width-4 mtr. Flow depth- 0.2 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted
CWS-6	Dhandera	29.387939, 77.704233	u/s of national highway	Flow around 15 MLD Flow width-25 mtr. Flow depth- 0.2 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted
CWS-7	Dhandera	29.373186, 77.692426	d/s of confluence of Begrajpur drain	Flow around 20 MLD Flow width-25-30 mtr. Flow depth- 0.3 mtr.	Wetland plants like Phragmites, Typha observed	Highly silted

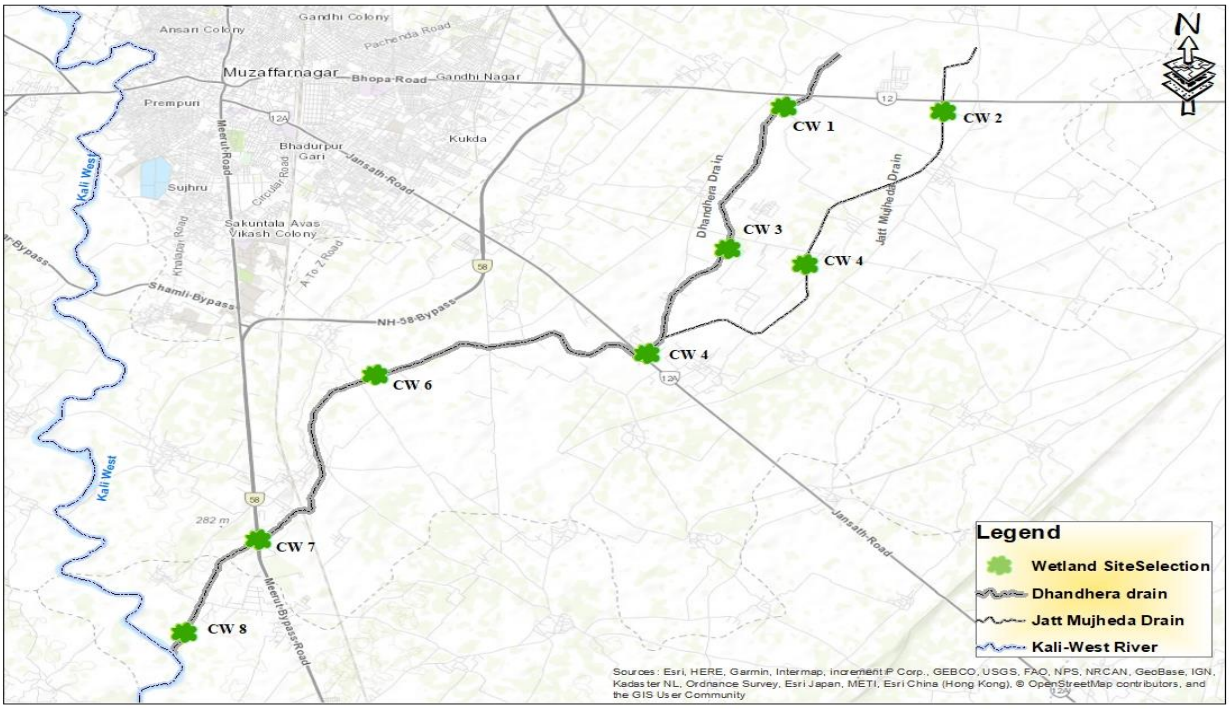


Figure 5.14 Catchment area of drains showing possible locations for setting up CWS

5.4.2 Begrajpur Drain up to confluence with Dhandera drain

The Begrajpur originated from Begrajpur industrial area (29.37664, 77.70382), established by UPSIDC in Khatauli block of Muzaffarnagar district of Uttar Pradesh on NH 334 (previously NH 58) between Muzaffarnagar and Meerut near to Ghasipura village and Begrajpur village.

The drain was monitored on 30.12.2023 and two samples were collected one at d/s of Megma pharmaceutical & one b/c to Dhandera drain and pH in both samples was observed acidic (2.2-4.2). Further, preliminary survey of Begrajpur industrial area and sampling of Begrajpur drain & its subsidiary channels was conducted on 29th-30th January 2024.

5.4.3 Observations

Industrial Units

There are about 51 industries located in industrial area. Mostly industries are of small scale (fall in MSME category) and not included in the GPI category so far. Majorly battery recycling, engineering fabrication, metal surface finishing/processing, chemical and other waste recycling such as E-waste, plastic moulding, Bone processing and tyre pyrolysis are operating in the industrial area (43 units). Others are pharmaceutical (1), fertilizer manufacturing/formulation units (1), pesticide/insecticide (1), Textile (4), distillery (1). Certain units were observed not having information board on unit gate, therefore the list provided by UPPCB would not be verified.

Ambient air quality

- Acidic fumes and volatile organics were felt in the ambient air in industrial area.
- Fugitive emissions with obnoxious odour were observed during evening hours.
- No monitoring system exist for ambient air quality, in industrial area.

Major recipient Drain

Main drain of the industrial area is Begrajpur drain (i.e. Channel 1) which starts from (Latitude 29.376107, Longitude 77.703984) near Muzaffarnagar Highway. Subsidiary drains (Channel 2 & 1A, 1B, 1C,.....etc.) receive trade effluent and domestic wastewater from the industries located in industrial area and join to main Begrajpur drain which finally meets to Dhandhera drain ((Lat: 29.373993, Long: 77.692937). Few industries also discharge directly into Dhandera drain.

Most of the units in industrial area are doing batch process. Therefore, intermittent flow of various coloured effluent and nature (acidic as well alkaline) was observed in subsidiary and main channel. Location of samples collected from Begrajpur industrial area is shown in **Figure 5.15.** Dumped sludge in Begrajpur industrial area and discharge of coloured effluent in Begrajpur drain from industrial units is shown in **Figure 5.16.**

Figure 5.15 Sampling locations of Begrajpur drain and its catchment

Characteristics of waste water/ industrial effluent of Begrajpur drain:

Based on analysis results following observations are made:

- Values of parameters in sample of main drain channel outside of industrial area (Lat: 29.376107, Long: 77.703984) were observed as pH: 7.7, BOD: 29 mg/l, COD: 114 mg/l, TSS:17 mg/l. Trace metals were observed either BDL or in traces.
- High fluctuation in pH was observed at different times, in wastewater of Begrajpur drain before confluence to Dhandera and onsite nature of pH was observed acidic and alkaline both. However, in samples collected before confluence to Dhandera drain pH ranged 2.0 - <2 (acidic) and other parameters were ranged as BOD (82-263 mg/l), COD (302-711 mg/l), TSS (172-252 mg/l) and TDS (2988-5460 mg/l).
- pH (9.6-2), Color (upto 308 Hazen), BOD (upto 687 mg/l), COD (upto 2654 mg/l), TSS (upto 2736 mg/l), TDS (upto 35004 mg/l), Sulphide (upto 55.0 mg/l), Nitrate (upto 21.5 mg/l), Sulphate (456 mg/l), Chloride (1722 mg/l) and metal concentration of Copper (upto 215.1 mg/l), Total Chromium (9.59 mg/l), Iron (upto 3325 mg/l), Manganese (upto 1175 mg/l), Nickel (upto 26.49 mg/l), lead (upto 8.9 mg/l) and Zinc (upto 2403 mg/l) were observed in samples of various channels of industrial area joining to main channel.
- High concentration of metals (Zinc, Manganese, Nickel, Iron, Copper, chromium) was observed in samples collected during morning and evening hours.

Sludge disposal along Dhandera drain and in Vacant plots in Begrajpur Industrial area

Drain upstream of industrial area carrying clear water (sampling bottle)

Discharge of untreated effluent from industrial units

Acidic pH before confluence with Dhandera drain

Figure 5.16 Dumped sludge in Begrajpur industrial area and Begrajpur drain

Un-authorized disposal of Sludge, Hazardous and other wastes

Waste sludge and ash were found dumped in un-scientific manner on open land at various locations in industrial area, along Dhandera drain and also being used for landfilling in vacant plots. Two samples of dumped sludge were collected for analysis.

Very high concentration of metals namely Antimony, Chromium, Copper, Iron, Manganese, Nickel, Lead and Zinc have been found in sludge samples. Analysis results show Arsenic (upto 10.1 mg/kg), Cadmium (6.2 mg/kg), Copper (upto 7112 mg/kg), Chromium (584 mg/kg), Iron (upto 311860 mg/kg), Manganese (upto 3173 mg/kg), Nickel (upto 245.4 mg/kg), Lead (upto 12380 mg/kg), Antimony (54.9 mg/kg) and Zinc (upto 7069 mg/kg).

5.4.4 Action Plan and Way Forward

1. UPPCB along with the district administration to carry out inspection of all industries for assessment of existing effluent treatment, emission control infrastructure, Hazardous waste management facility.
2. Various CPCB's SOPs such as for recycling of lead scrap and lead acid battery, recycling of waste tyre and checklist of minimum requisite facilities for utilization of hazardous

waste under rule 9 of Hazardous Waste Management Rules-2016 for metal & metal bearing waste for recovery of metal salts alloys may be referred for inspection of metal processing units.

3. UPPCB may carry out 24-hour monitoring of flow & waste water characteristics (composite sampling) of Begrajpur drain to assess the actual potential of discharging pollution load.
4. Operation of unit discharging acidic/ alkaline effluent without proper neutralization shall be immediately stopped.
5. Industries operating without adequate infrastructure of effluent treatment & emission control shall be stopped.
6. Stored legacy hazardous waste shall be transferred to the TSDF site for scientific disposal to rule out possibility of illegal disposal in to the drain in to rainy season.
7. Possibility of transfer of effluent through tanker to the nearest Common Effluent Treatment Plant (CETP) for proper treatment may be explored under controlled supervision.
8. UPPCB/UPSIDC may install ambient air quality monitoring station in industrial area and real time effluent monitoring system of Begrajpur drain.
9. UPPCB may also carry out feasibility study (Effluent characteristics & load, topography of industrial area, land availability etc.) for requirement of CETP with advance technologies in Begrajpur industrial area in consensus with the operating industries in the area.
10. Facilitation programme for industrial units for adoption of cleaner technology, waste minimization practices and water conservation. Implementation of sector specific charter in Textile and distillery sector units.
11. Health impact study of workers and nearby villagers exclusively lung and metal toxicity study by district administration.

5.5 Pollution Source Mapping of River Banganga & Solani and Adjoining Drain

The objectives of the pollution source mapping were**:**

- Tracing and mapping the course of the river.
- Characterization of water quality of river at various locations.
- Identification, quantification and characterization of major tributaries /drains joining the river.
- Impact on water quality of River Banganga b/c and a/c with River Solani.
- Impact on water quality of River Banganga b/c and a/c with Laksar drain.
- Assessment of sewage management in catchment area of Solani river.

The monitoring locations of samples and catchment area of River Banganga and Saloni is shown in **Fig. 5.17.**

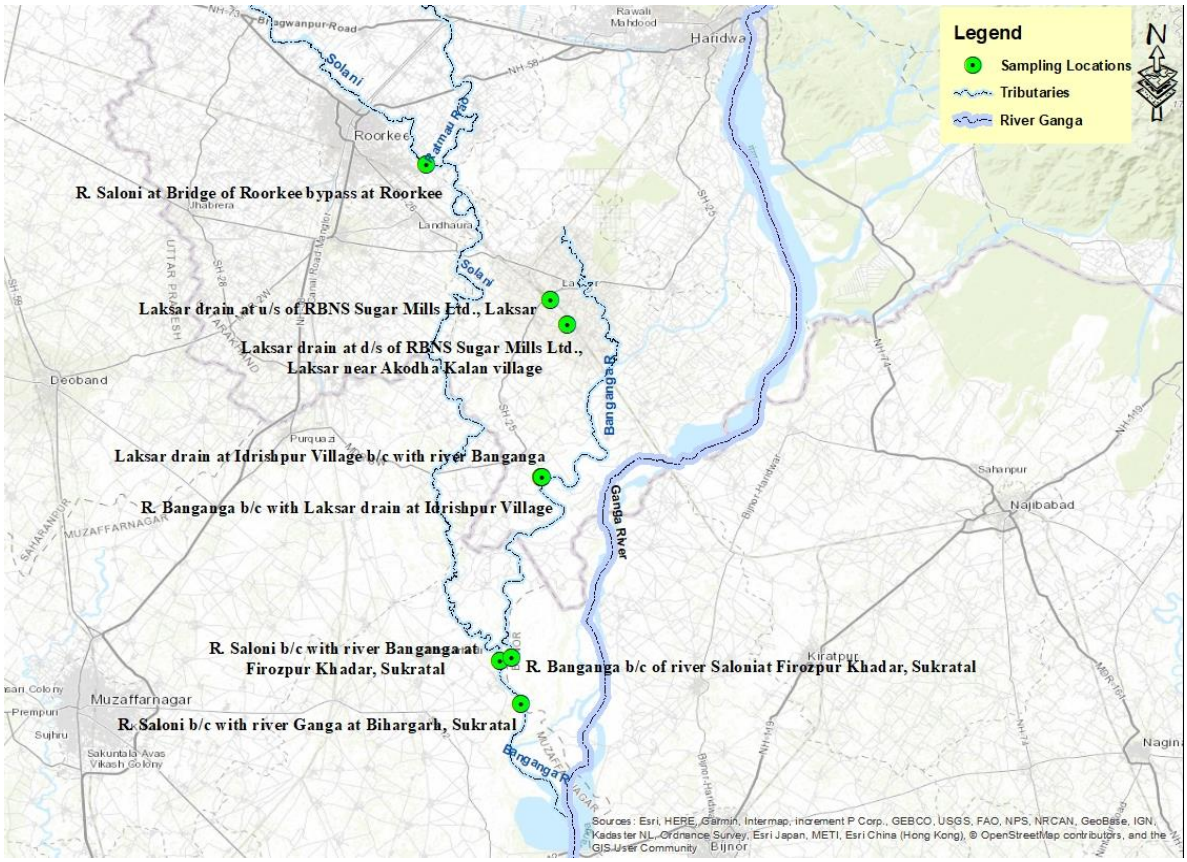


Fig. 5.17: Map of monitoring locations of samples and catchment area of River Banganga & Saloni

River Banganga

River Banganga is presumed to be originated from a diversion/stream of River Ganga near Katarpur Alipur village in Bahadrabad Tehsil in Haridwar District, Uttarakhand and travel around 70 km before confluencing with River Ganga near village Shukratal in Muzaffarnagar district of Uttar Pradesh. River Banganga gained flow after receiving untreated sewage from nearby villages. For pollution source mapping, the joint team carried out monitoring and sampling of River.

River Banganga lacks freshwater source from its origin till downstream of Sultanpur town in Uttarakhand. River Banganga receive freshwater from Pathri river and, after confluence of Pathri river, water quality of river Banganga was meeting primary water quality criteria for bathing w.r.t. pH, BOD and FC. Near Idrishpur village in Roorkee district, Uttarakhand, Laksar drain confluences with river Banganga. Water quality of river Banganga improved after confluence of Laksar drain and was meeting primary water quality criteria for bathing w.r.t. pH, DO, BOD and FC. At approximately 1.3 Kms upstream of Shukratal Ghat in Muzaffarnagar district, river Solani meets with Banganga and water quality of river Banganga was meeting primary water quality criteria for bathing w.r.t. pH, DO, BOD and FC.

River Solani

River Solani originates from the Himalayan foothills, near Dehradun and runs along an approximate length of 145 km through Biharigarh, Bhagwanpur, Roorkee, Laksar city/towns before falling into River Banganga at upstream of Shukratal in Muzaffarnagar. River Solani receive flow from rain along with discharge of untreated sewage from nearby villages and treated sewage of 33 MLD STP Roorkee. Moderate pollution in river was observed from origin to upstream of Laksar town. The STP was found complying w.r.t discharge norms prescribed under Hon'ble NGT order dated 30.04.2019 in O.A. No. 1069/2018 except total phosphorus (2.7 mg/l against norm of 1 mg/l) and Faecal coliform (14 x 10^4 MPN/100 ml against norm of <230 MPN/100 ml). The water quality of river Solani before confluence with river Banganga was meeting primary water quality criteria for bathing w.r.t. pH, DO, BOD and FC. Water quality of River Banganga after confluence of River Solani at Shukratal Ghat, Muzaffarnagar was meeting primary water quality criteria for bathing w.r.t. pH, DO, BOD and FC.

Laksar drain

The Laksar drain originates from Laksar town in Uttarakhand and carries storm water along with the untreated sewage of Laksar town. From origin to confluence with River Banganga, Laksar drain carry untreated sewage of several villages in the catchment. The drain traverses a distance of approximately 20.37 kilometers before confluence with River Banganga near Idrishpur village in Uttarakhand.

At origin wastewater characteristics of the drain indicated that it is carrying sewage only. During non-operational phase of units in catchment of Laksar drain no industrial pollution was observed in the drain, however, industrial impact was found in the drain during operational time of industries. Another drain namely Hadwa drain, which carries untreated sewage from villages in its catchment area, meets the Laksar drain near Mirzapur Sadat village. Wastewater characteristics showed improvement in water quality of Laksar drain after confluence of Hadwa drain. Various fish species were observed in Laksar drain after confluence of Hadwa drain till its confluence with river Banganga.

5.6 Pollution Source Mapping of Shila Khala Drain

The flow in Sheela Khala drain was observed after receipt of discharge from a paper mill located at Village-Noorpur, Roorkee, District-Haridwar, Uttarakhand. Upstream of this location the drain was found dry. After that, Shila Khala drain travels approximately 80 km before meeting river Kali-West near Simbhalki village, Muzaffarnagar (Uttar Pradesh). Shila Khala drain receives effluent from Jhabreda Road industrial area, Roorkee and sewage from villages in nearby and further enters into Uttar Pradesh near Ransaura village, Saharanpur. After travelling ~10 km mundet drain confluences in Shila Khala drain near Makhdoompur (Uttarakhand). Monitoring of Shila Khala drain was carried out from the point where the flow was observed near Noorpur village (Uttarakhand) to confluence with river Kali-West near Simbhalki village in Muzaffarnagar, Uttar Pradesh. The monitoring locations on Shila Khala drain, Mundet drain and river Kali-West shown in **Fig. 5.18.**

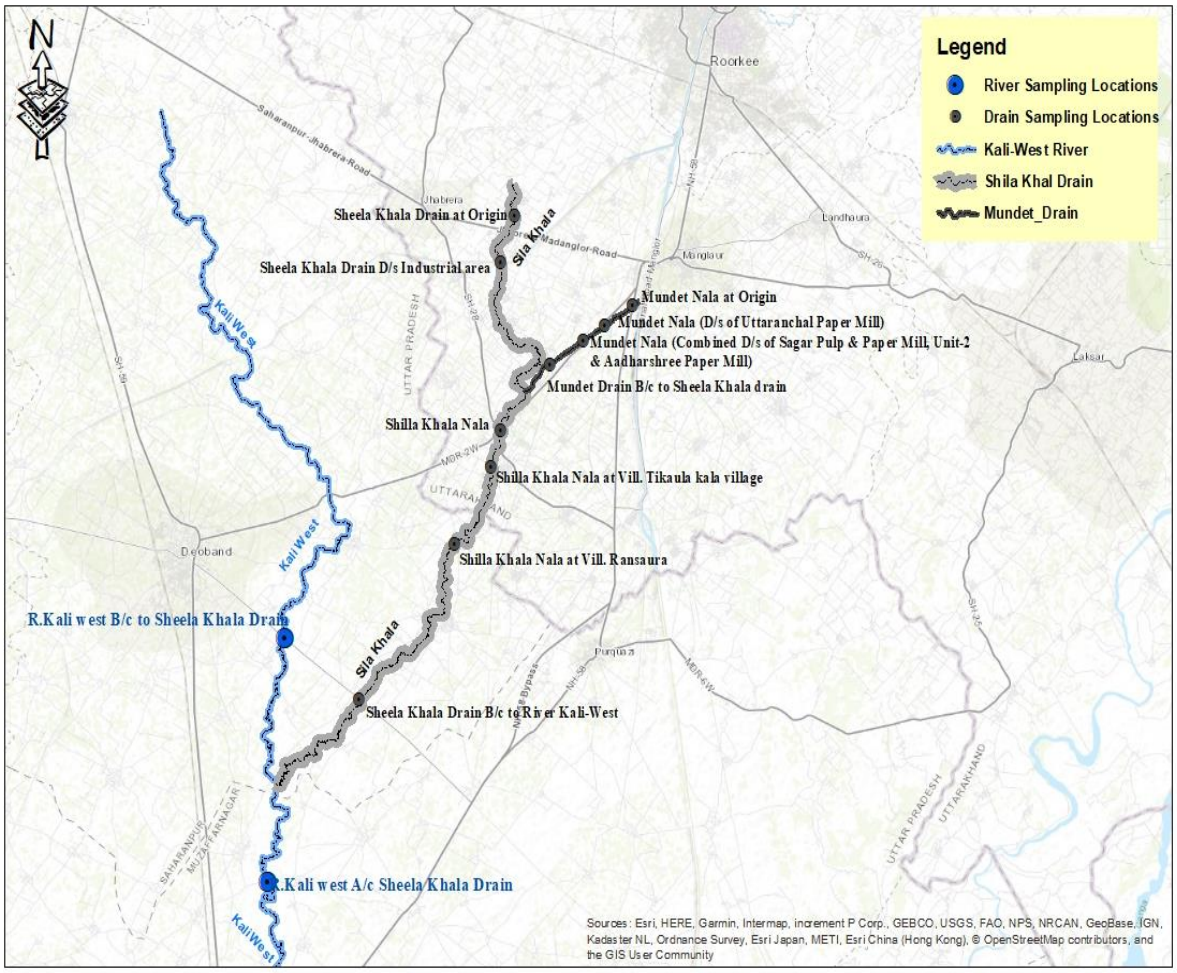


Fig. 5.18: Sampling locations on Shila Khala drain, Mundet drain and river Kali-West

Drain water quality:

- Shila Khala drain originates from somewhere else but the flow in the drain only observed after receipt of discharge from a paper mill located at Village-Noorpur, Roorkee, District-Haridwar, Uttarakhand. Upstream of the paper mill, the drain was found dry. The analysis results of the samples collected from the drain at origin indicates that the drain is carrying partially treated/untreated industrial effluent. First order drain namely Mundet drain originates near Delhi-Haridwar highway from seepage of nearby Upper Ganga canal (335 m away) confluences with Shila Khala drain at Makhdoompur village. It was observed that Mundet drain carries treated/partially treated effluent from paper mills located in upstream of Laknauta and also the sewage from nearby villages. After confluence of Mundet drain, mostly the Shila Khala drain was found covered with water hyacinths and improvement in the water quality of drain was observed however, still the characteristics indicated that drain is carrying partially treated wastewater. In the stretch from Ransaura village, Saharanpur, U.P to before confluence into Kali-west river no industrial activity was observed and mostly the drain was found covered with hygroscopic plants which made the drain function as natural wetland and further improvement in drain water quality was observed. No impact of the drain was observed in water quality of Kali-west river.

SECTION 6: WATER QUALITY

Dr. Brajesh Srivastava, Dr. Priyanka Chaudhary, Dr. Prabhat Ranjan, Ms. Garima Dublish, Dr. Jaya Sharma, Dr. Anu Goel Gupta, Dr. Jyoti Sharma, Dr. Khyati Mittal

CPCB has undertaken various initiatives to monitor the water quality status of the River Ganga and its tributaries. These initiatives include:

1. Manual water quality monitoring of River Ganga through the concerned SPCBs at 112 locations;
2. Real time water quality monitoring of river Ganga and its tributaries through sensor-based system at 40 locations; and
3. Half-yearly biomonitoring (pre- and post-monsoon) of River Ganga, River Yamuna and their tributaries.
4. Monitoring of river Ganga, its tributaries/sub-tributaries, adjoining drains and Sewage Treatment Plants (STPs) during Magh Mela (an annual event) at Prayagraj.
5. Mapping of pollution sources of tributaries/sub-tributaries of river Ganga was also done which includes identification of polluted stretch/hot spots, list of polluting sources and action plan for control of pollution and water quality restoration.

6.1 Manual water quality monitoring

Central Pollution Control Board (CPCB) carried out monitoring for assessment of water quality of River Ganga at 112 locations from 2023 onwards on main stem of river Ganga (Uttarakhand-19, Uttar Pradesh-41, Bihar-33, Jharkhand-04 and West Bengal-15) through SPCBs of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal. Manual monitoring locations on river Ganga are shown in **Fig. 6.1.**

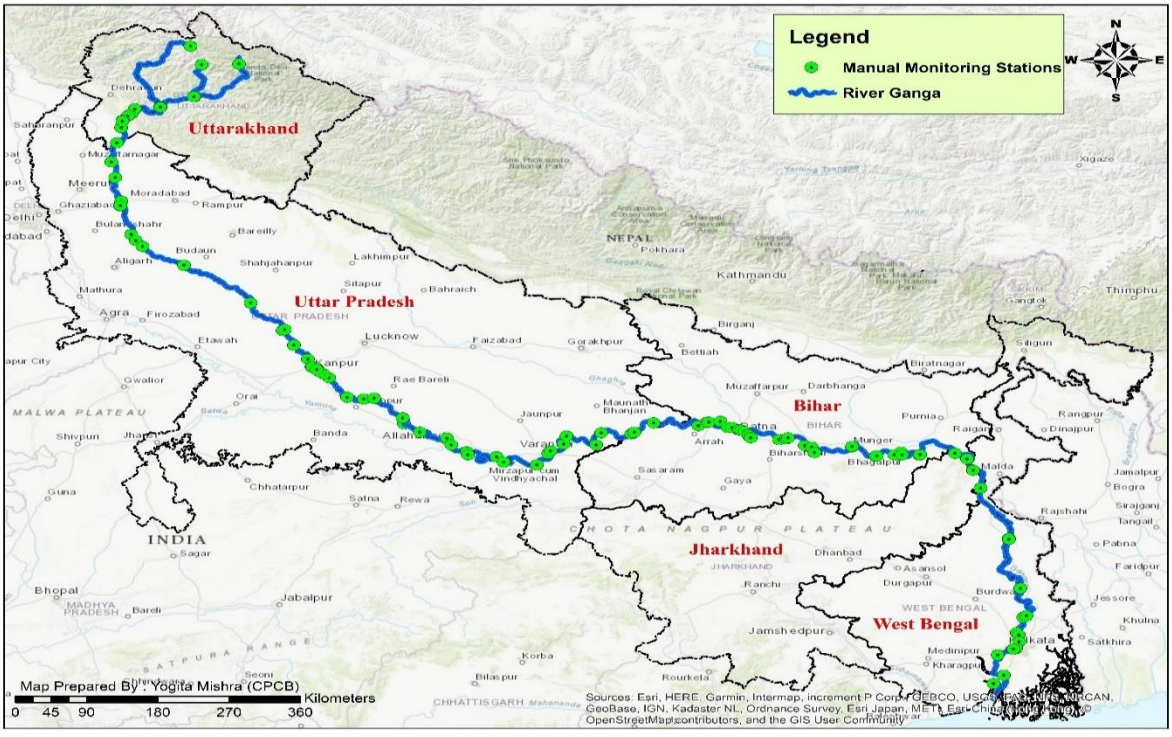


Fig. 6.1 Manual monitoring locations on river Ganga

Frequency of monitoring in Upper Ganga reaches i.e. at Gangotri, Kedarnath & Badrinath is on annual basis, from Rudraprayag to Devprayag on quarterly basis and thereafter remaining stretch i.e. from Swarg Ashram (Uttarakhand) to Ganga at Patikali (West Bengal) on fortnightly basis. Water samples are analysed by respective SPCBs. The state-wise distribution of monitoring stations is given in **Table 6.1.**

Table 6.1 Monitoring frequency and state-wise distribution of water quality monitoring stations

State	Manual monitoring network				Monitoring agency
	Monitoring stations	Monitoring frequency			
		Yearly	Quarterly	Bimonthly	
Uttarakhand	19	3	6	10	UKPCB
Uttar Pradesh	41	-	-	41	UPPCB
Bihar	33	-	-	33	BSPCB
Jharkhand	4	-	-	4	JSPCB
West Bengal	15	-	-	15	WBPCB
Total	**112**	**3**	**6**	**103**	

Water samples have been analysed for up to 65 parameters viz. field observations-07 (fortnightly), core parameters-11 (fortnightly), general parameters-19 (fortnightly), trace metals-09/toxic substance-01 (twice in a year), pesticides-15 (twice in a year), biomonitoring-03 (on need basis). The detailed list of parameters along with monitoring frequency is shown in **Table 6.2.**

Table 6.2 Details of parameters monitored on river Ganga

Parameters	Present Frequency
Field Observations (7) Weather, Approximate depth of main stream/depth of water table, Colour and intensity, Odor, Visible effluent discharge, Human activities around station, station detail.	Fortnightly
Core Parameters (11) Temperature, pH, Conductivity DO, BOD, Nitrate -N, ammonia- N, Total coliform, Fecal Coliform, Fecal Streptococci & E. coli	Fortnightly
General Parameters (19) COD, TKN, Ammoniacal -N, Total Dissolved Solids, Total Fixed Solids, Total Suspended Solids, Turbidity, Hardness, Fluoride, Boron, Chloride, Sulphate, Total Alkalinity, P-Alkalinity, Phosphate, Sodium, Potassium, Calcium, Magnesium	Fortnightly
Trace Metals (9) Arsenic, Nickel, Copper, Mercury, Chromium, Cadmium, Zinc, Lead, Iron	Twice in a year (April and October)
Pesticide (15) Alpha BHC, Beta BHC, Gama BHC (Lindane), OP DDT, PP DDT, Alpha Endosulphan, Beta Endosulphan, Dieldrin, Carboryl (Carbamate), 2.4D, Aldrin, Malathian, Methyl Parathian, Anilophos, Chloropyriphos	Twice in a year (April and October)

6.1.1 Data Generation and Salient Findings

Out of 112 sanctioned manual monitoring stations, monitoring was conducted only at 109 stations during 2023. Monitoring data is submitted through Environmental Water Quality Data Entry System (EWQDES). Thereafter, the data is compiled, verified, validated, and communicated to NMCG, presented at various ministries, provided to RTIs applicants and VIP references etc. Water quality data is also shared with National Water Informatics Centre (NWIC) since 2018 by CPCB, and is being made available in public domain on India Water Resources Information System (India-WRIS)

Based on the monitoring data received during 2023, the ranges of pH, DO, BOD, FC, and FS are shown in ***Appendix 6.1.***

Water Quality Status

River water quality is assessed for notified primary water quality criteria for bathing water w.r.t parameters pH (6.5-8.5), Dissolved Oxygen (DO≥ 5 mg/l), Biochemical Oxygen Demand (BOD≤ 3 mg/l), Fecal Coliforms (FC≤ 2500 MPN/100 ml) and Fecal Streptococci (FS≤ 500 MPN/100 ml) ***(Appendix 6.2).***

Water quality data of River Ganga for water quality parameters, specifically pH, DO, BOD, FC and FS, for the period January-December, 2023 was analysed based on the median values (central tendency of the data) to identify river stretches /locations which are not meeting primary water quality criteria for bathing waters for the mentioned set of parameters. However, in terms of pH the water quality of river Ganga observed to be meeting primary water quality criteria for bathing at all monitoring locations during all occasions. The state-wise major observations are as follows:

(a) Uttarakhand

The water quality of river Ganga was monitored for pH, DO, BOD, FC and FS at 19 locations of Uttarakhand from Jan to Dec' 2023. The results indicated that the water quality is meeting the primary water quality criteria for bathing w.r.t. pH, DO, BOD, FC and FS, at all the monitoring locations on all occasions along the entire stretch of Uttarakhand from Ganga at Gangotri to Roorkee d/s. The DO level was observed to be more than 6 mg/l on most of the occasions in the entire stretch of Uttarakhand.

Based on the median values, entire stretch of Uttarakhand is meeting the primary water quality criteria for bathing w.r.t. pH, DO, BOD, FC & FS. Variation in values/levels of DO, BOD, FC, and FS is presented in **Fig. 6.2 to 6.6**, respectively.

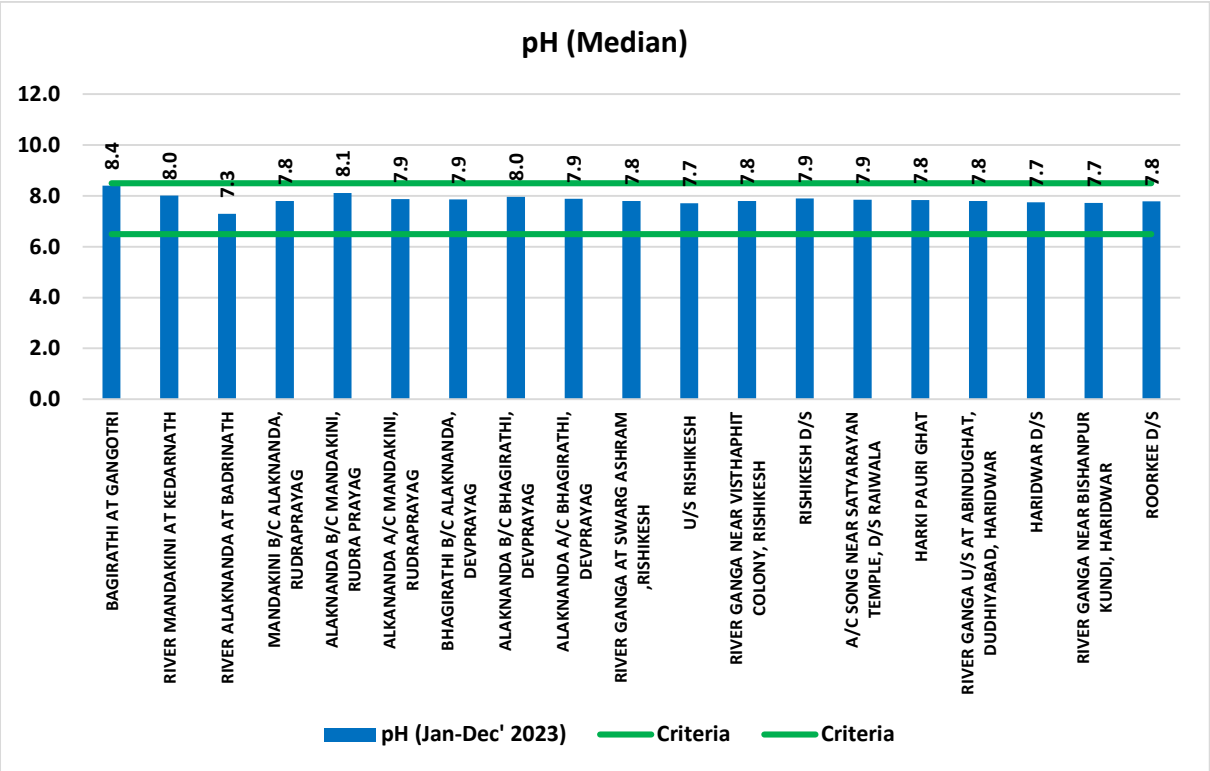


Fig. 6.2 River Ganga water quality-pH level in Uttarakhand stretch.

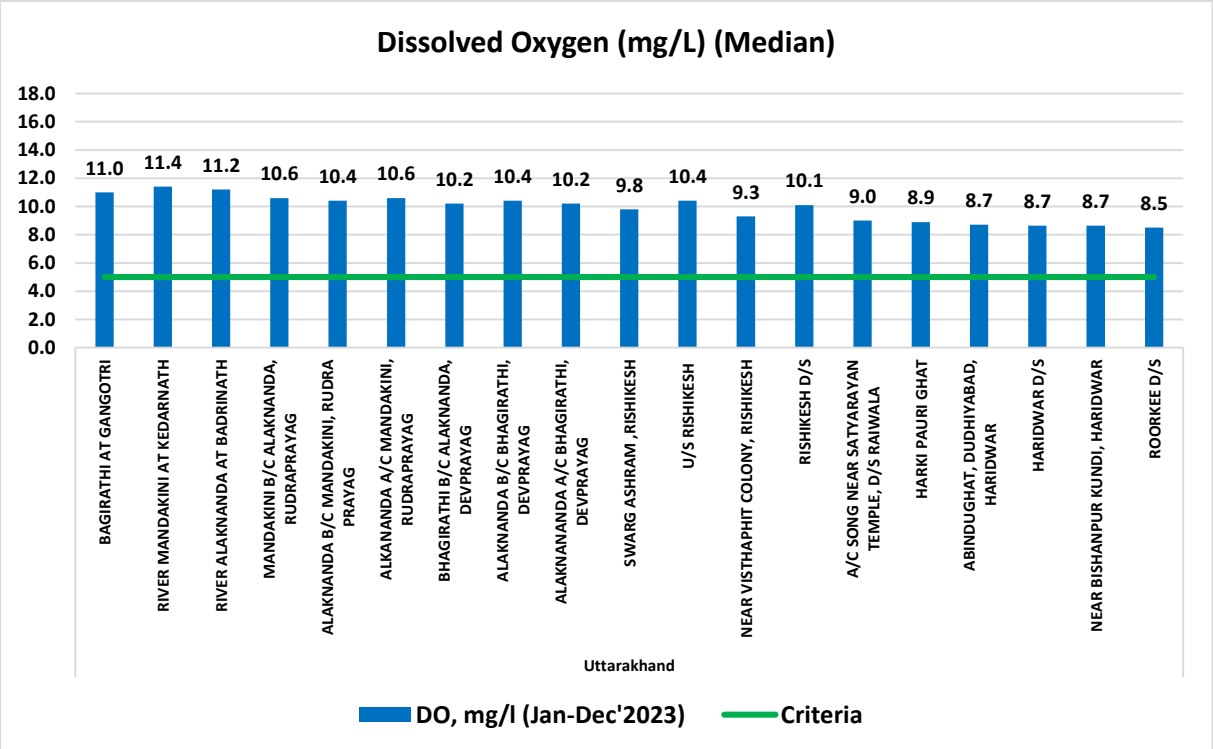


Fig. 6.3 River Ganga water quality-DO level in Uttarakhand stretch.

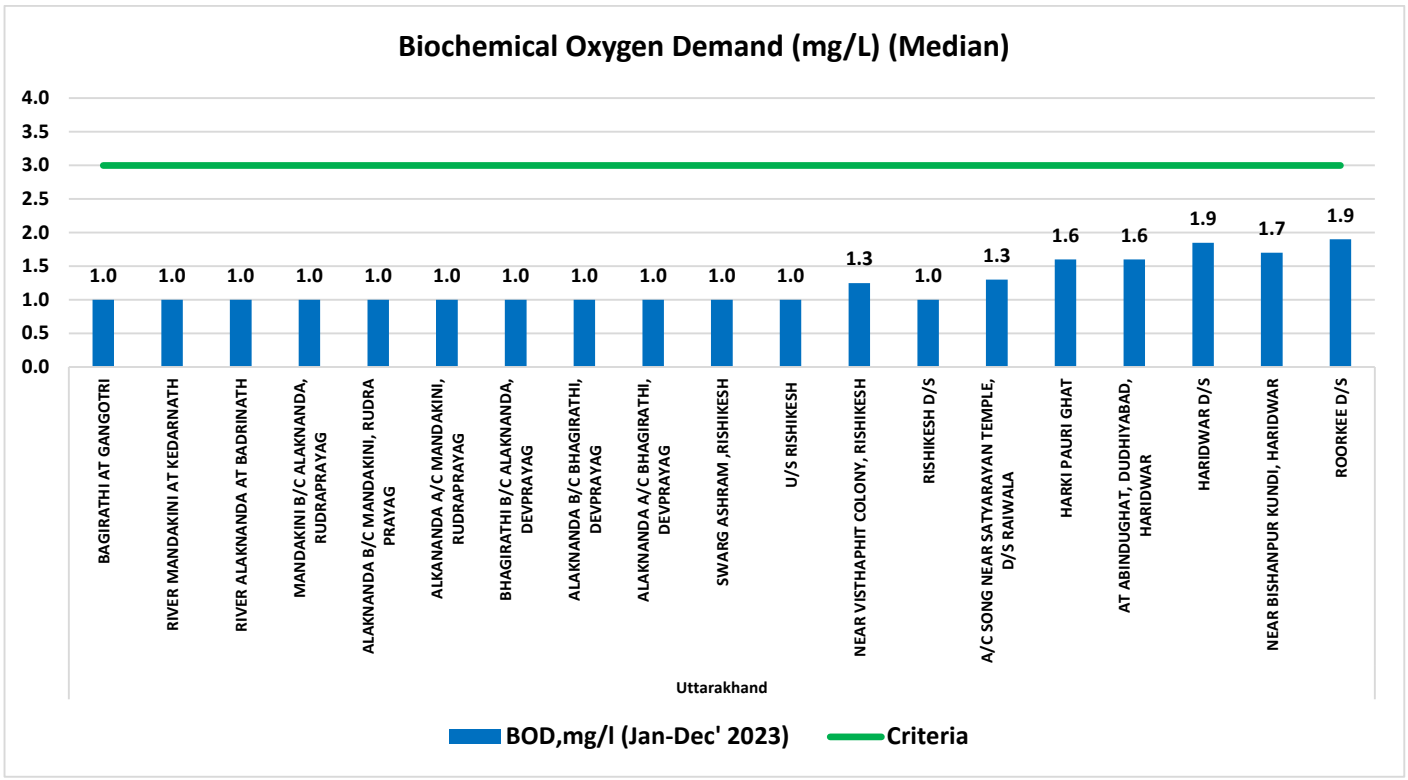


Fig. 6.4 River Ganga water quality-BOD values in Uttarakhand stretch

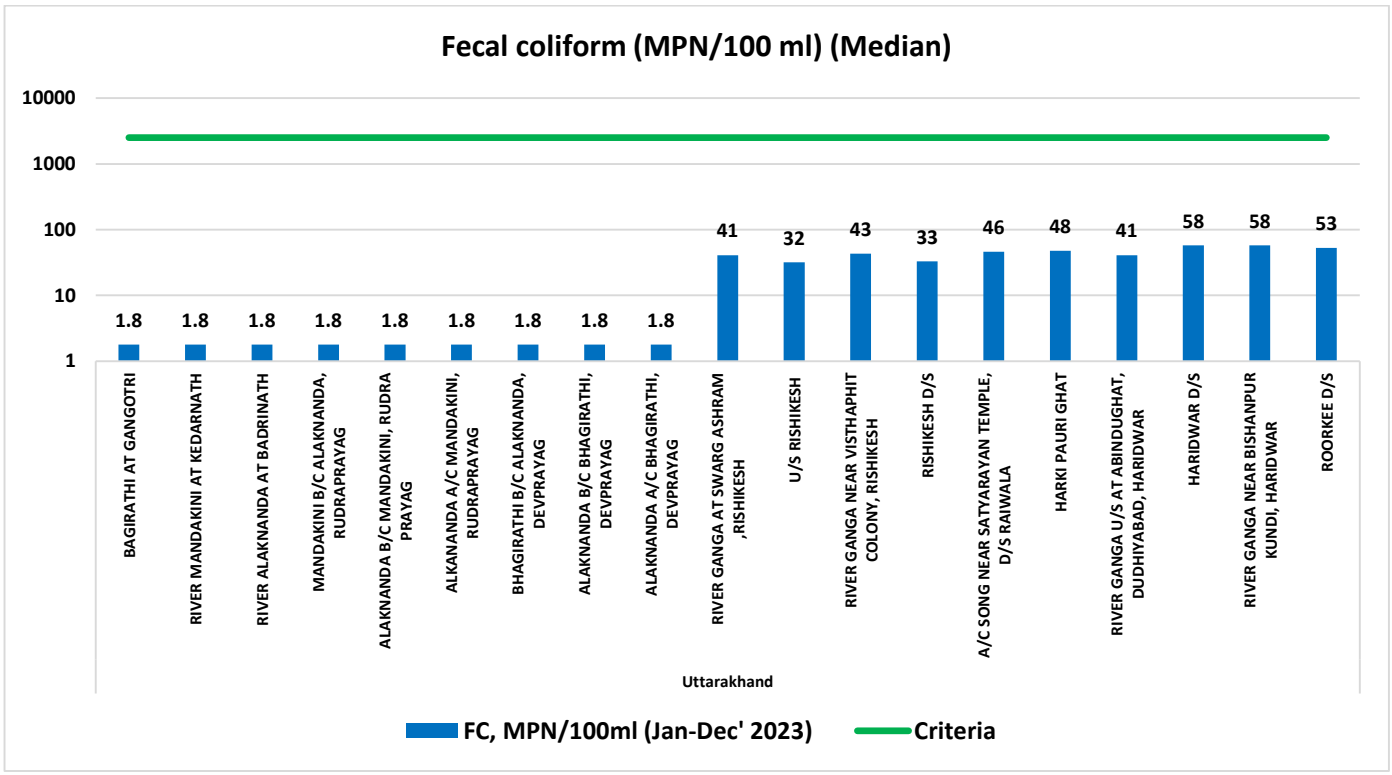


Fig. 6.5 River Ganga water quality-FC levels in Uttarakhand stretch

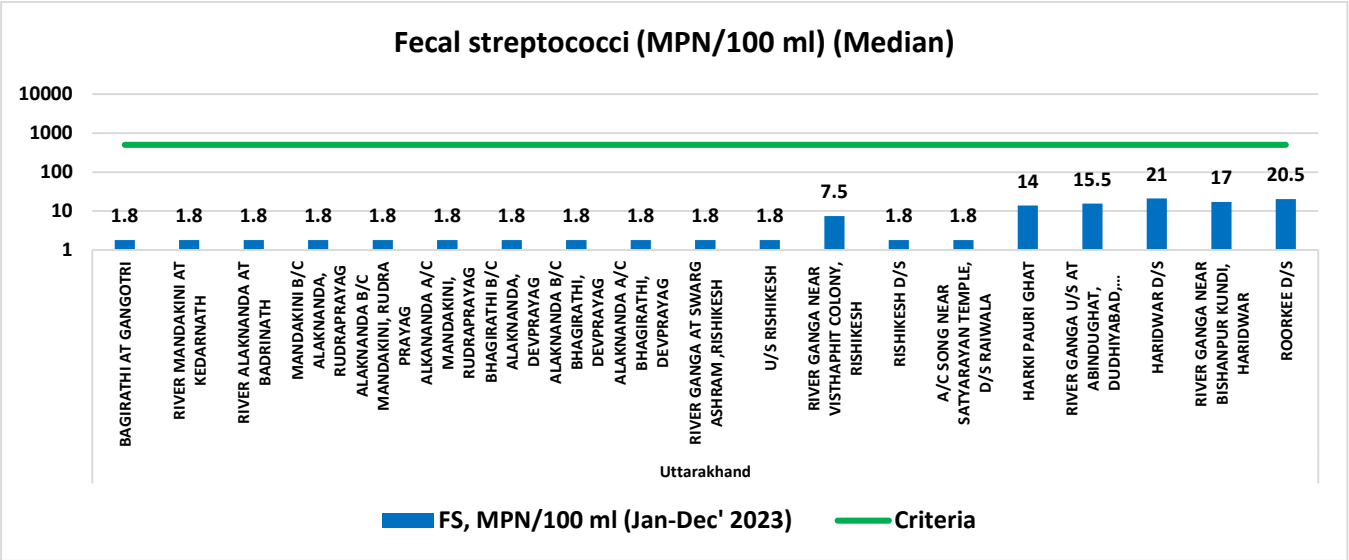


Fig. 6.6 River Ganga water quality-FS levels in Uttarakhand stretch

(b) Uttar Pradesh

In Uttar Pradesh, the water quality of River Ganga was monitored for pH, DO, BOD & FC at 38 locations and for FS at 27 locations from Jan to Dec' 2023. Ranges of their respective values/levels are shown in **Fig. 6.7 to 6.11**, respectively.

pH and Dissolved Oxygen:

Water quality of river Ganga was observed to be meeting with the primary water quality criteria for bathing w.r.t pH & DO at all the monitoring locations on most of the occasions along the entire stretch of Uttar Pradesh from Madhya Ganga Barrage, Bijnor to Tarighat, Ghazipur. DO level observed to be more than 6 mg/l on most of the occasions in the entire stretch of Uttar Pradesh.

Based on the median values, river water quality is meting the primary water quality criteria for bathing w.r.t. pH & DO in the entire stretch of Uttar Pradesh.

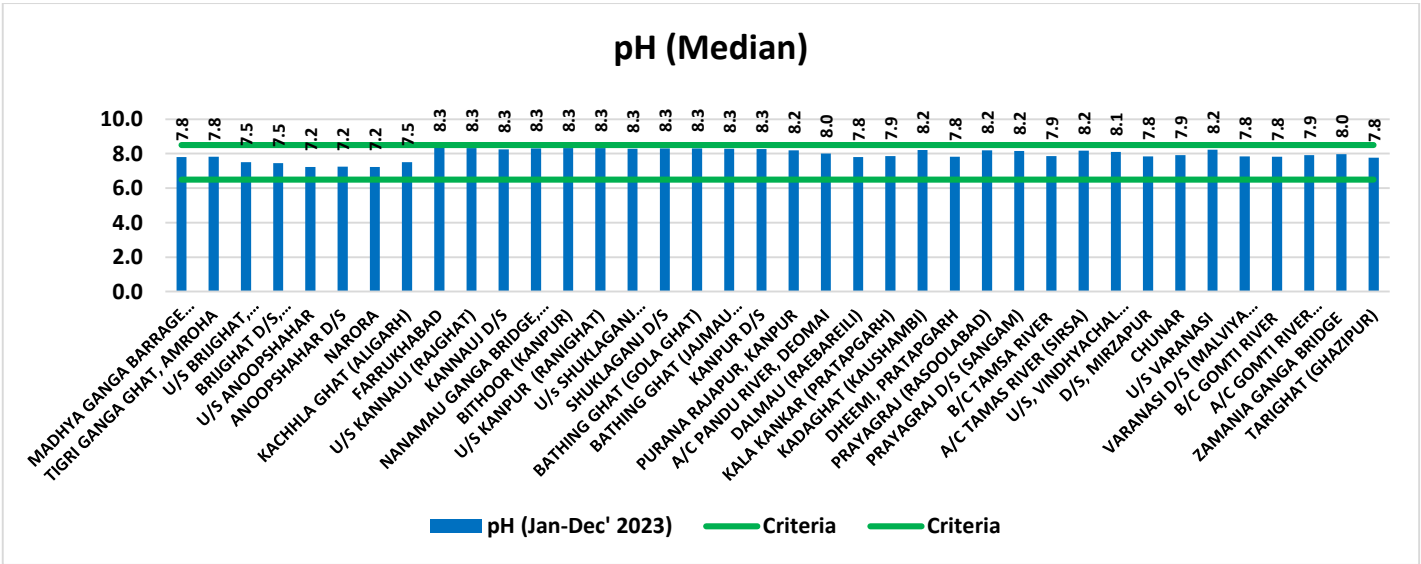


Fig. 6.7 River Ganga water quality-pH values in Uttar Pradesh stretch

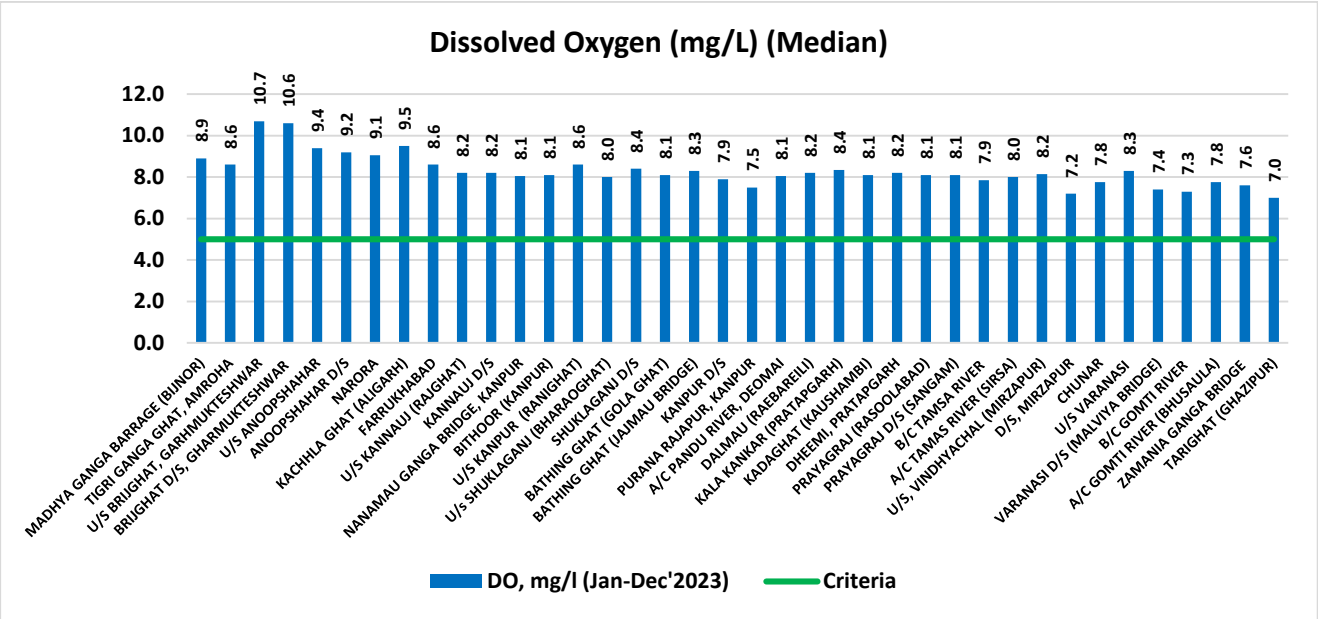


Fig. 6.8 River Ganga water quality-DO values in Uttar Pradesh stretch

Biochemical Oxygen Demand:

Based on water quality data of river Ganga w.r.t. BOD during 2023, 2 polluted stretches identified with respect to BOD values in Uttar Pradesh:

(i) Farrukhabad to Dheemi, Pratapgarh - The locations in this stretch were monitored 301 times and were found to have BOD values exceeding 3 mg/L, for 232 times in the range from 3.1- 14.8 mg/L.

(ii) D/s Mirzapur to Tarighat, Ghazipur that have been consistently found to exceed BOD criteria on multiple occasions in varying months. The locations in this stretch were monitored 155 times and were found to have BOD values exceeding 3 mg/L, for 120 times in the range from 3.1- 4.7 mg/L.

Based on the median values, river water quality was meeting the primary water quality criteria for bathing w.r.t. BOD in the stretch/ locations from (i) Madhya Ganga Barrage, Bijnor to Farrukhabad (09 locations); (ii) A/c Pandu River at Madeveshwar temple; (iii) Kalakankar to Kadaghat (Kaushambi) (02 locations); (iv) Prayagraj (Rasoolabad) to U/s Vindhyachal (05 locations); and (v) U/s Varanasi. However, four polluted stretches/ locations identified which are not meeting the primary water quality criteria for bathing in terms of BOD are (i) U/s Kannauj to Purana Rajapur, Kanpur; (ii) Dalmau, Raebareli; (iii) Ganga bridge, Dheemi (Pratapgarh); and (iv) D/s Mirzapur to Tarighat, Ghazipur.

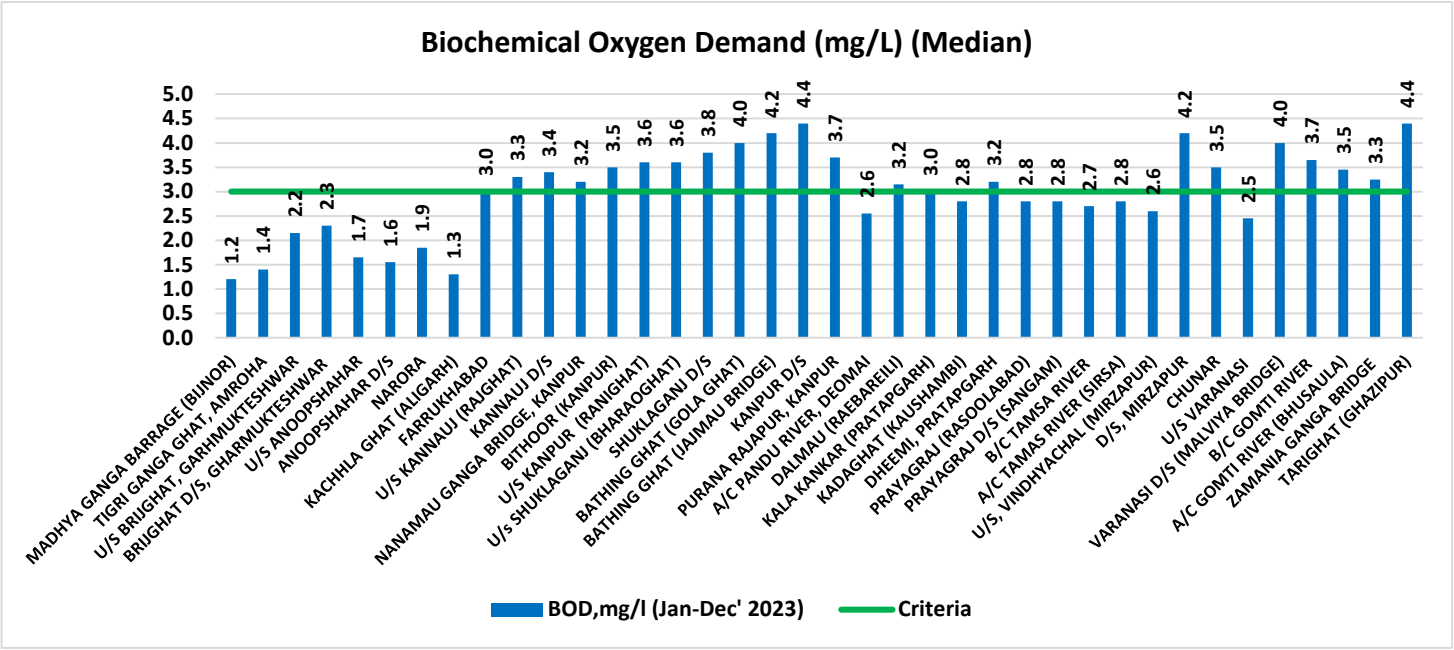


Fig. 6.9 River Ganga water quality-BOD values in Uttar Pradesh stretch

Faecal Coliforms:

Based on individual values of data sets, 02 polluted stretch has been identified with respect to FC values which are as follows:

(i) U/s Kannauj to Purana Rajapur, Kanpur - The locations in this stretch were monitored 162 times and found to have FC values exceeding 2500 MPN/100 mL, for 100 times in the range from 2600-17000 MPN/100 ml.

(ii) D/s Mirzapur to Tarighat, Ghazipur - The locations in this stretch were monitored 131 times and found to have FC values exceeding 2500 MPN/100 mL, for 131 times in the range from 4600-17000 MPN/100 ml.

Based on the median values, the sub-stretches/locations meeting the primary water quality criteria in terms of FS were (i) Madhya Ganga Barrage, Bijnor to Kannauj D/s; (ii) A/c river Pandu to U/s Vindhyachal; and (iii) U/s Varanasi. The polluted sub-stretch/ locations identified w.r.t. FC were from (i) Nanamau Bridge (U/s Bithoor) to Purana Rajapur, Kanpur (except Bithoor); and (ii) D/s Mirzapur to Tarighat Ghazipur (except U/s Varanasi).

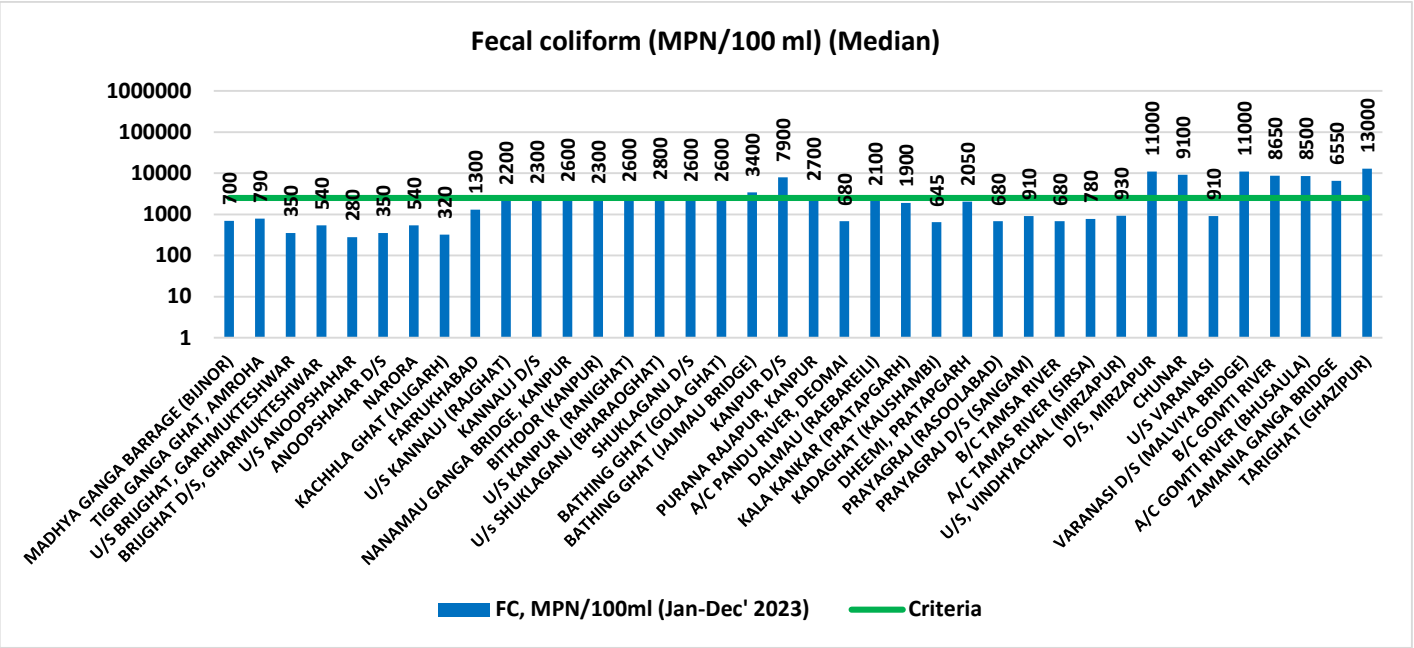


Fig. 6.10 River Ganga water quality-FC levels in Uttar Pradesh stretch

Faecal Streptococci:

Out of total 27 locations monitored for FS in Uttar Pradesh, based on the individual values of data sets, water quality is not meeting FS criteria from U/s Vindhyachal, Mirzapur to Tarighat, Ghazipur stretch of Uttar Pradesh. The locations in this stretch monitored 155 times and found to have FS values exceeding 500 MPN/100 mL, for 141 times in the range from 550-13000 MPN/100 ml.

Based on median values, river water quality was meeting FS criteria in the stretch from Madhya Ganga Barrage, Bijnore to U/s Vindhyachal and U/s Varanasi. However, water quality was not meeting FS criteria from D/s Mirzapur to Tarighat, Ghazipur (9 locations).

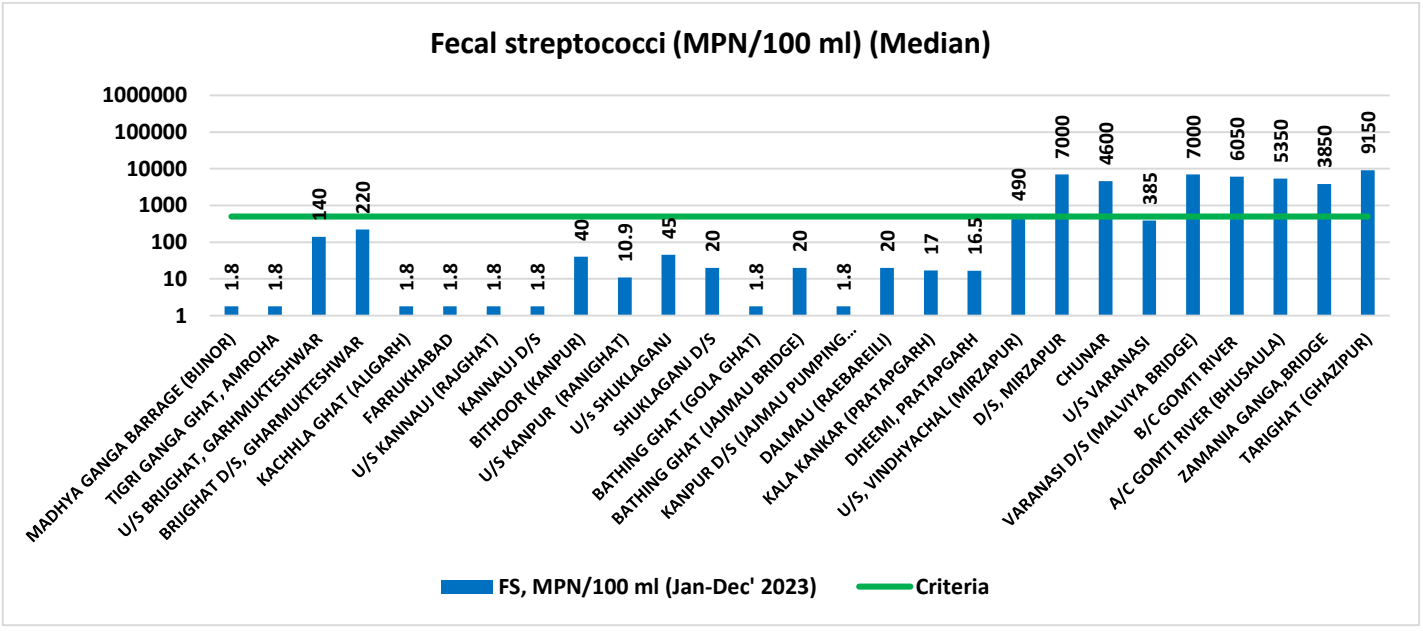


Fig. 6.11 River Ganga water quality- FS levels in Uttar Pradesh stretch

(c) Bihar

Water quality of River Ganga was monitored for pH, DO, BOD, FC & FS at 33 locations from Jan to Dec' 2023. The respective ranges of values/levels of these parameters are shown in **Fig. 6.12 to 6.16**, respectively.

pH, Dissolved Oxygen & Bio-chemical Oxygen Demand:

Entire stretch of river Ganga in Bihar was meeting the primary water quality criteria for bathing w.r.t pH, DO & BOD based on individual values of data sets as well as median values. DO level observed to be more than 6 mg/l on most of the occasions in the entire stretch of Bihar.

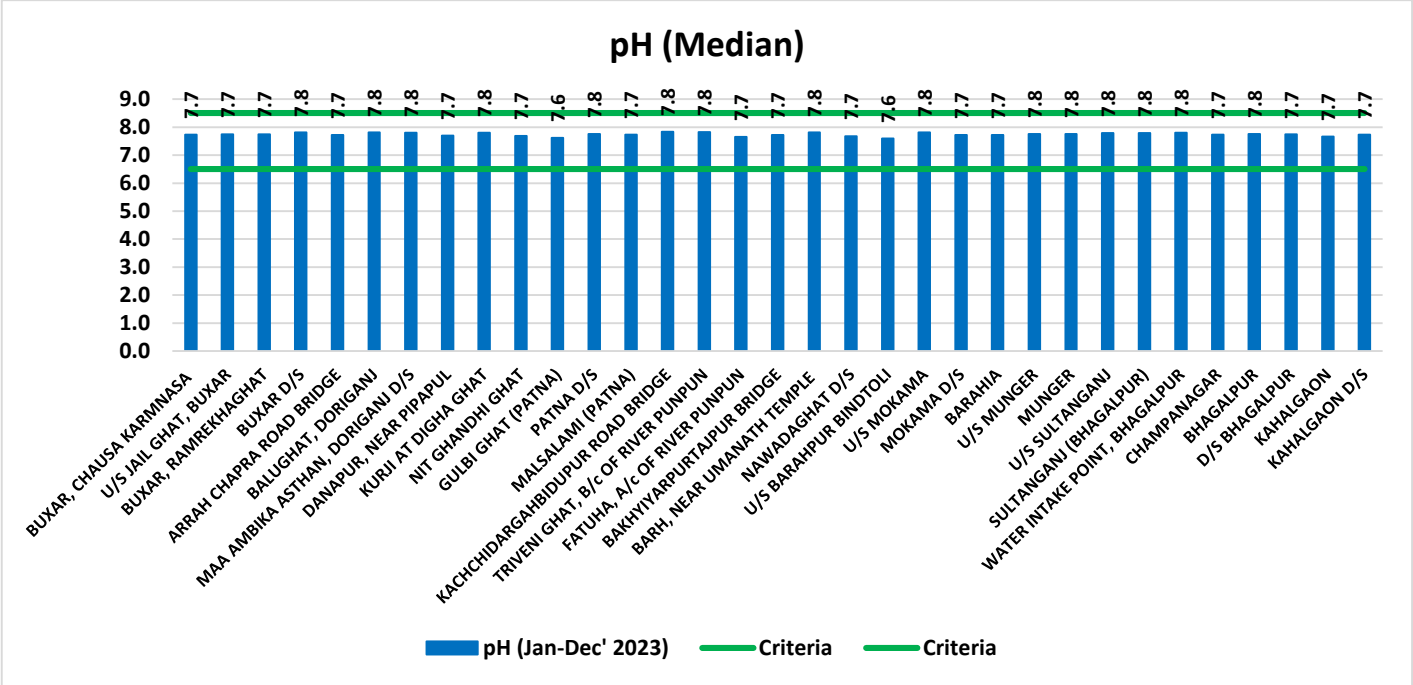


Fig. 6.12 River Ganga water quality-pH values in Bihar stretch

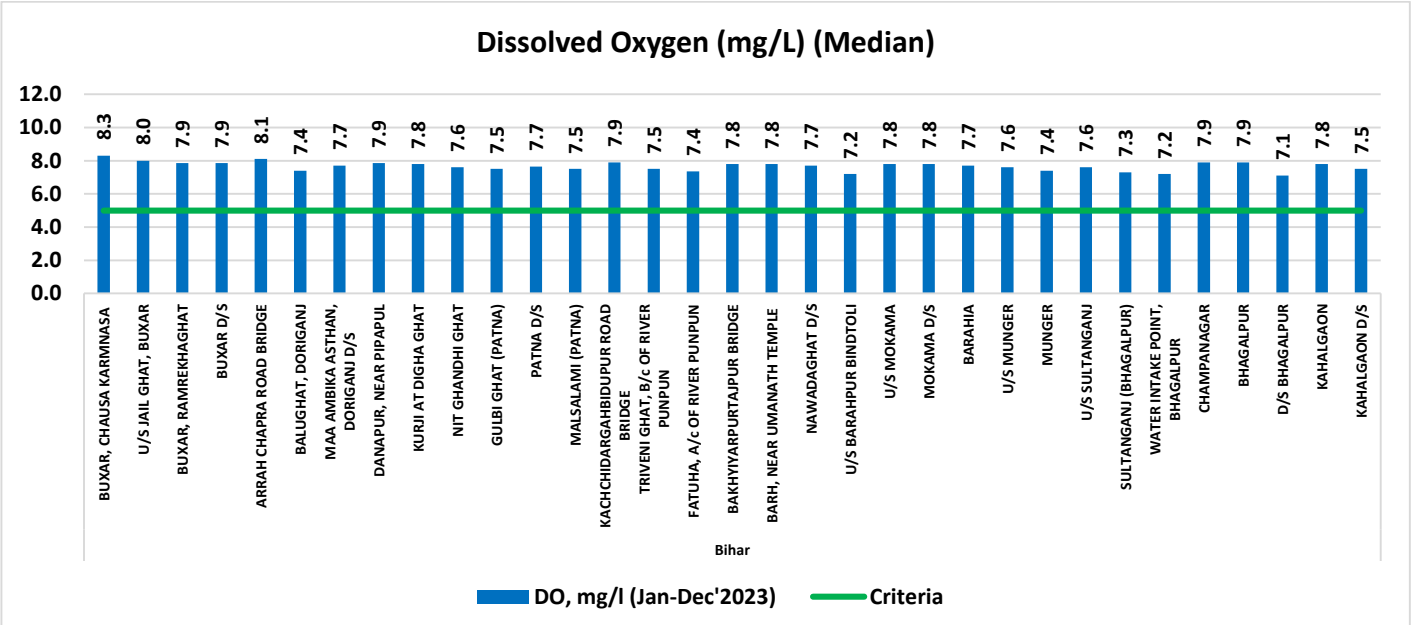


Fig. 6.13 River Ganga water quality-DO values in Bihar stretch

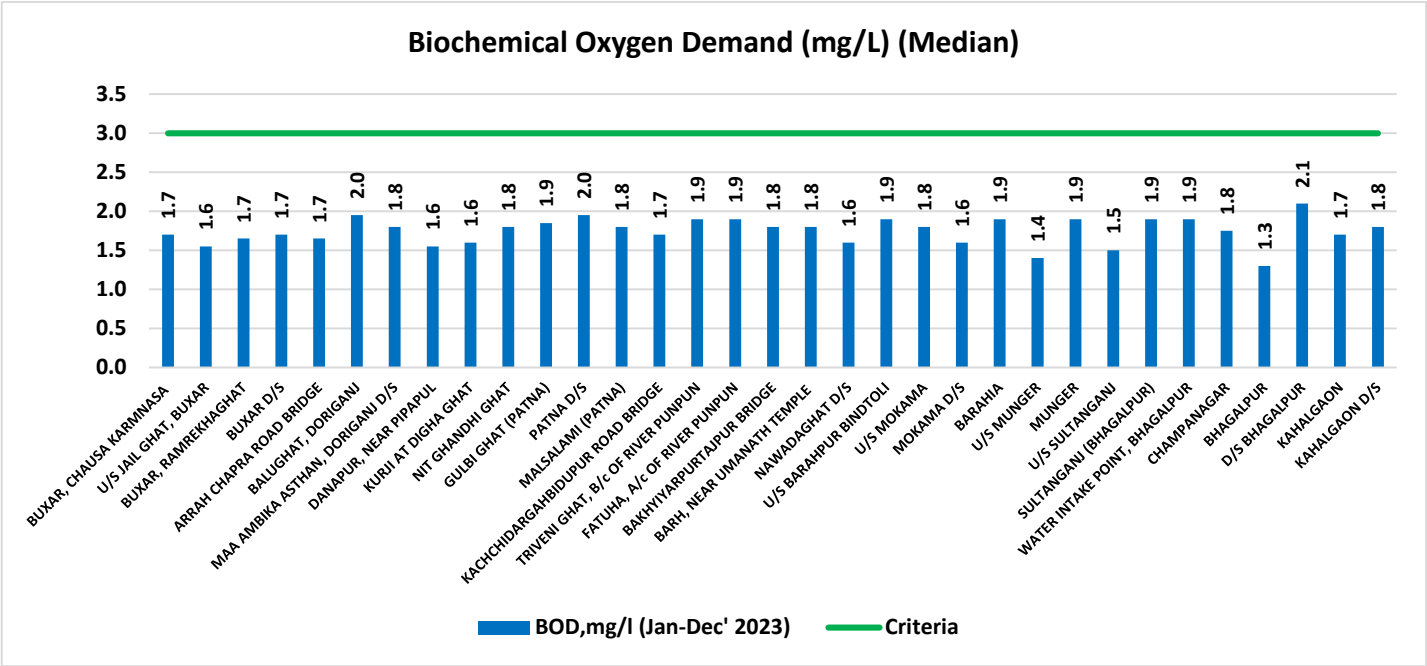


Fig. 6.14 River Ganga water quality-BOD values in Bihar stretch

Fecal coliforms:

River water quality was observed not to be meeting the FC criteria at almost all monitoring locations in the entire stretch of Bihar on most of the occasions. The locations in this stretch were monitored 751 times and found to have FC values exceeding 2500 MPN/100ml for 678 times, in the range from 3300-92000 MPN/100 ml.

Based on the median values, except for single location i.e. Arrah Chapra Road Bridge, U/s Doriganj, entire stretch of river Ganga in Bihar was not meeting the primary water quality criteria for bathing w.r.t FC.

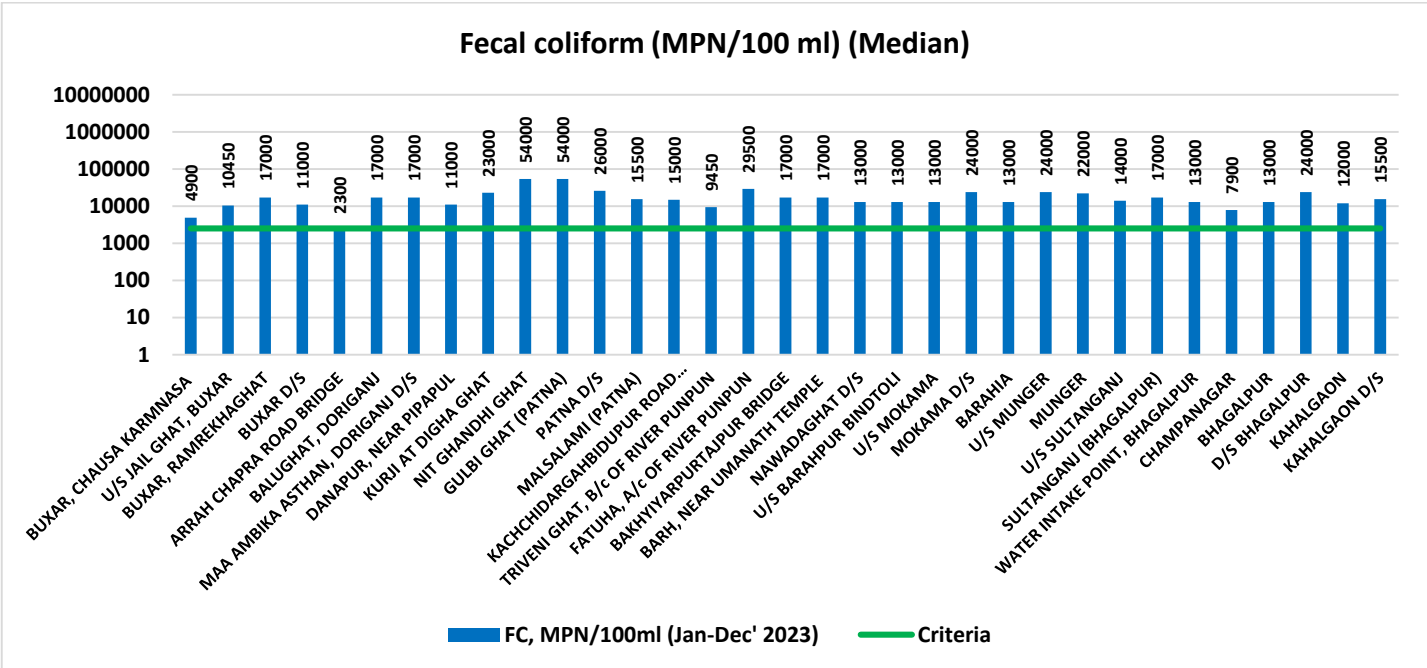


Fig. 6.15 River Ganga water quality-FC levels in Bihar stretch

Fecal streptococci:

Water quality is not meeting FS criteria, occasionally at two sub-stretches (i) Buxar Ramrekhaghat to Barh near Umanath temple (17 locations) and (ii) U/s Munger to Kahalgaon (9 locations). The locations in these stretches were monitored 576 times and found to have FS values exceeding 500 MPN/100 ml for 49 times, in the range from 540-35000 MPN/100 ml.

However, based on the median values, entire stretch of Bihar from Buxar, Chausa Karmnasa to Kahalgaon d/s, near cremation ghat was meeting the primary water quality criteria for bathing FS.

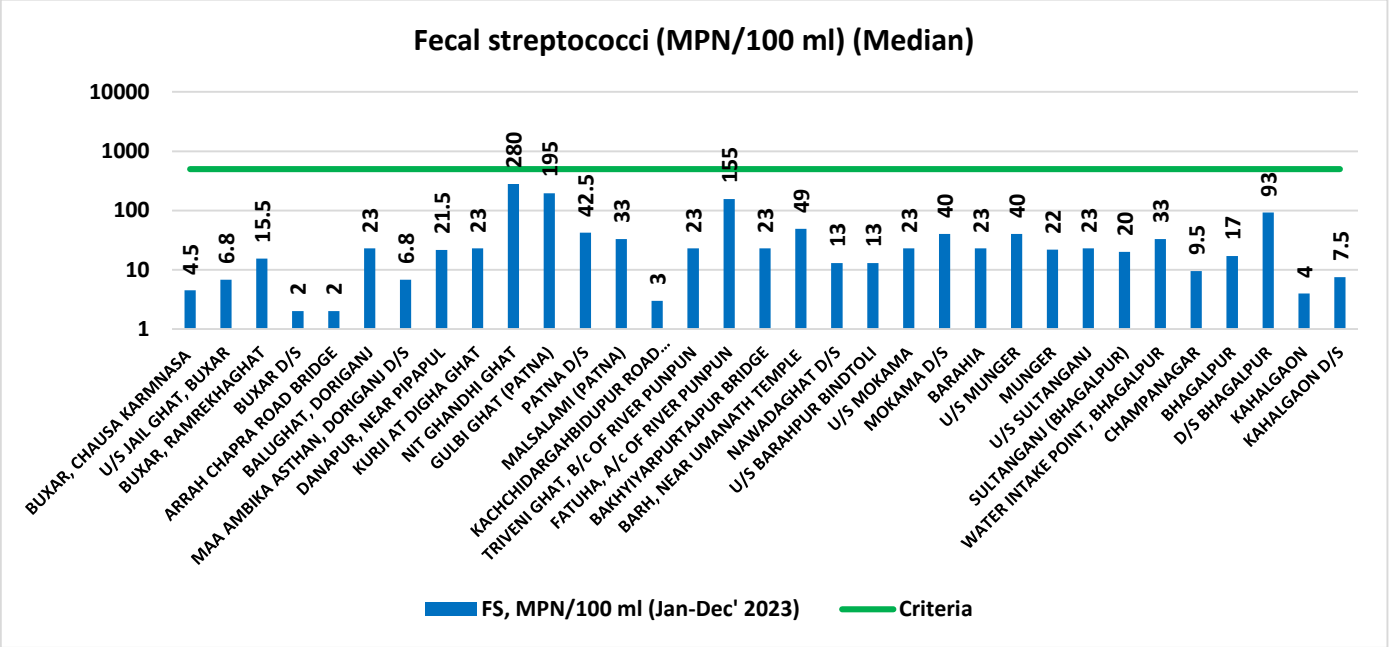


Fig. 6.16 River Ganga water quality-FS levels in Bihar stretch

(d) Jharkhand

Water quality of River Ganga was monitored for pH, DO and BOD at 4 locations from Jan to Dec' 2023. The respective ranges of values/levels of these parameters are shown in **Fig. 6.17 to 6.19**, respectively.

pH, Dissolved Oxygen and Bio-chemical Oxygen Demand:

Water quality of river Ganga was observed to be meeting with the primary water quality criteria for bathing in terms of pH, DO and BOD at all the monitoring locations on all occasions along the entire stretch of Jharkhand from U/s Near LCT Ghat to Sangi Dalan based on Individual value of data set as well as median values. DO level observed to be more than 6 mg/l on most of the occasions in the entire stretch of Jharkhand.

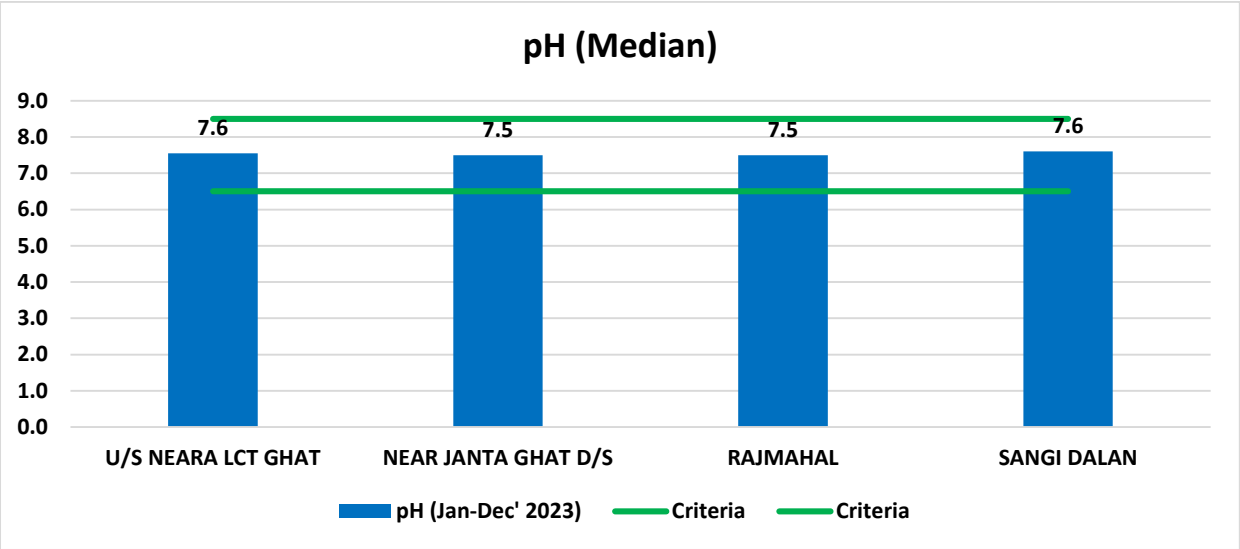


Fig. 6.17 River Ganga water quality-pH values in Jharkhand stretch

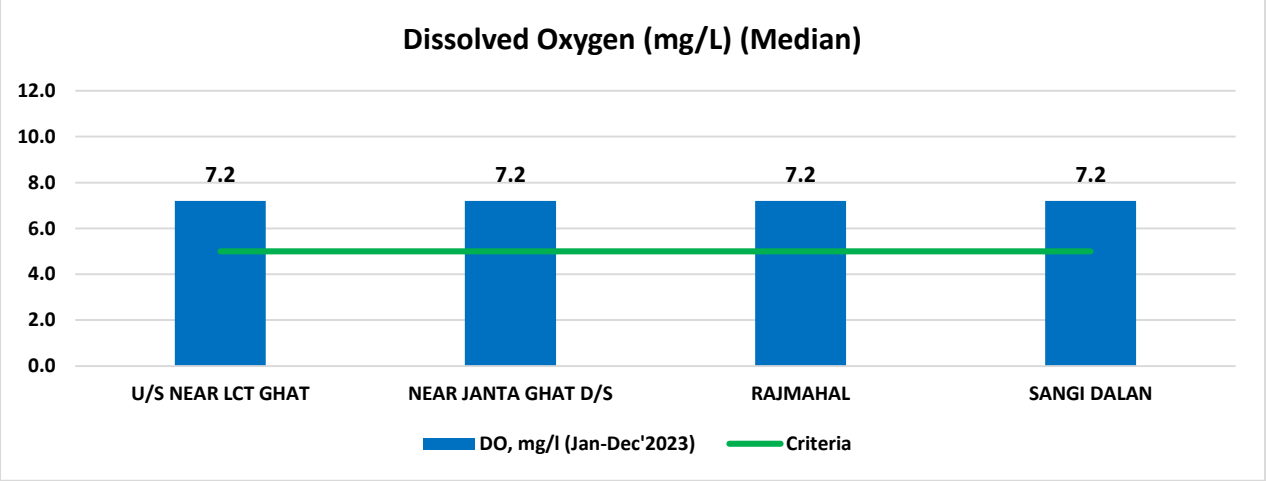


Fig. 6.18 River Ganga water quality-DO values in Jharkhand stretch

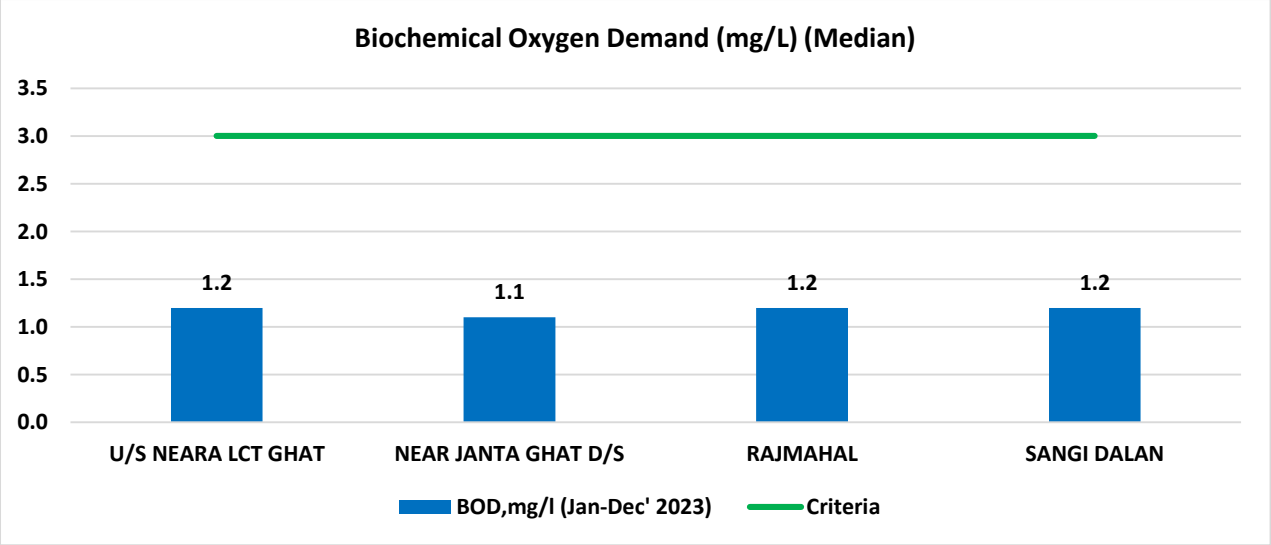


Fig. 6.19 River Ganga water quality-BOD values in Jharkhand stretch

(e) West Bengal

Water quality of River Ganga was monitored for pH, DO, BOD, FC & FS at 15 locations from January to Dec' 2023. The respective ranges of values/levels of these parameters are shown in **Fig. 6.20 to 6.24**, respectively.

pH and Dissolved Oxygen:

River water quality was observed to be meeting the primary water quality criteria for bathing w.r.t pH & DO at all the monitoring locations on most of the occasions along the entire stretch of West Bengal from Farrakha Murshidabad to Patikali, near Durga chak. DO level observed to be more than 6 mg/l, for 64.5% of the monitoring occasions in the entire stretch of West Bengal.

Based on the median values, entire stretch of river Ganga in West Bengal is meeting the primary water quality criteria for bathing w.r.t. DO.

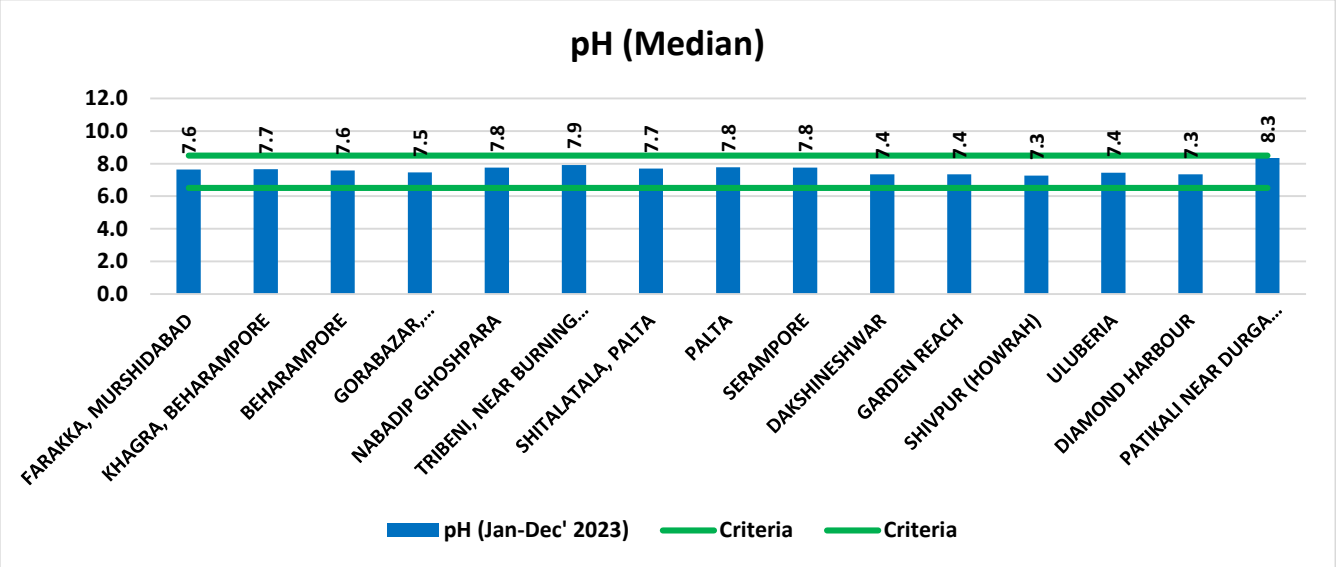


Fig. 6.20 River Ganga water quality-pH values in West Bengal stretch

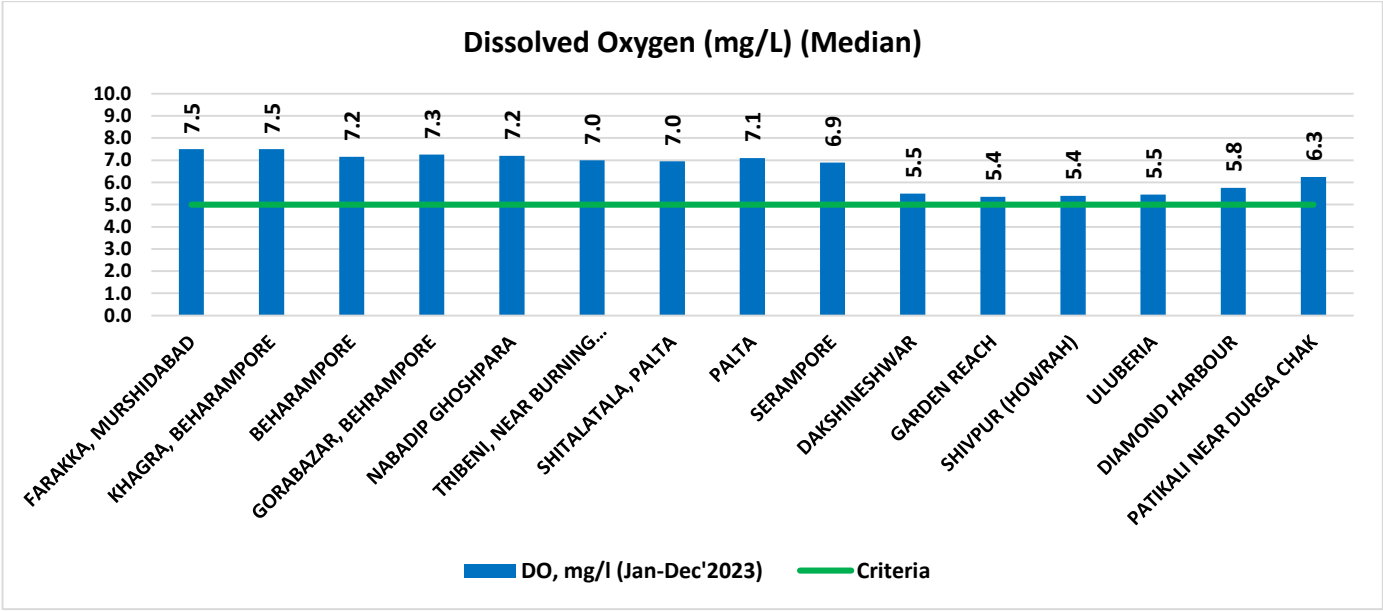


Fig. 6.21 River Ganga water quality-DO values in West Bengal stretch

Bio-chemical Oxygen Demand:

For the entire stretch from Farrakha, Murshidabad to Patikali, near Durga chak, it was observed that the values were occasionally exceeding the bathing water quality criteria w.r.t. BOD from Dakshineshwar to Diamond Harbour (05 locations) during Jan-Apr' 2023. The locations in this stretch monitored 120 times and found to have BOD values exceeding 3 mg/L, for 11 times, in the range from 3.1-3.9 mg/L.

Based on the median values, river water quality was observed to be meeting with the primary water quality criteria for bathing w.r.t. BOD at all the monitoring locations along the entire stretch of West Bengal from Farrakha Murshidabad to Patikali, near Durga chak.

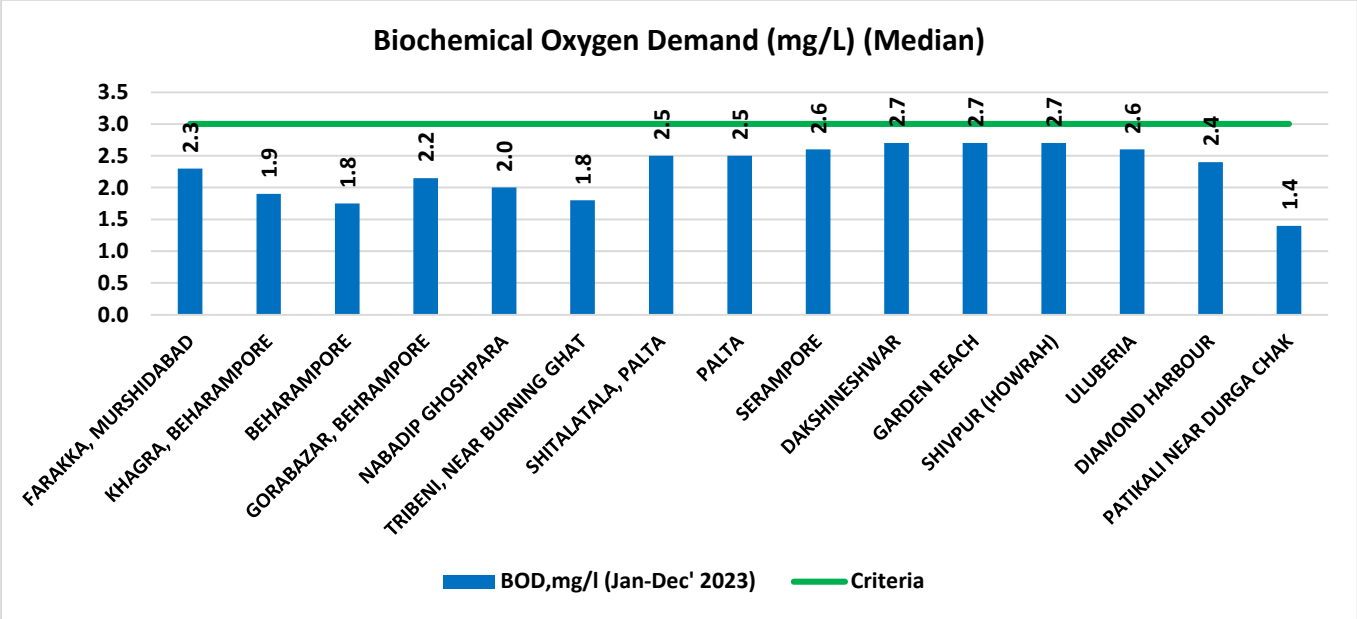


Fig. 6.22 River Ganga water quality-BOD values in West Bengal stretch

Faecal coliforms:

River water quality was observed to exceed the bathing water quality criteria w.r.t. FC at almost all monitoring locations in the entire stretch of West Bengal except two locations namely Farrakha, Murshidabad and Khagra Behrampore.

However, based on the median values, entire stretch of river Ganga in West Bengal is meeting the primary water quality criteria for bathing w.r.t FC except four locations namely (i) Farrakha (Murshidabad); (ii) Khagra (Behrampore); (iii) Nabadip Ghoshpara near Monipurghat; and (iv) Tribeni near Burning Ghat.

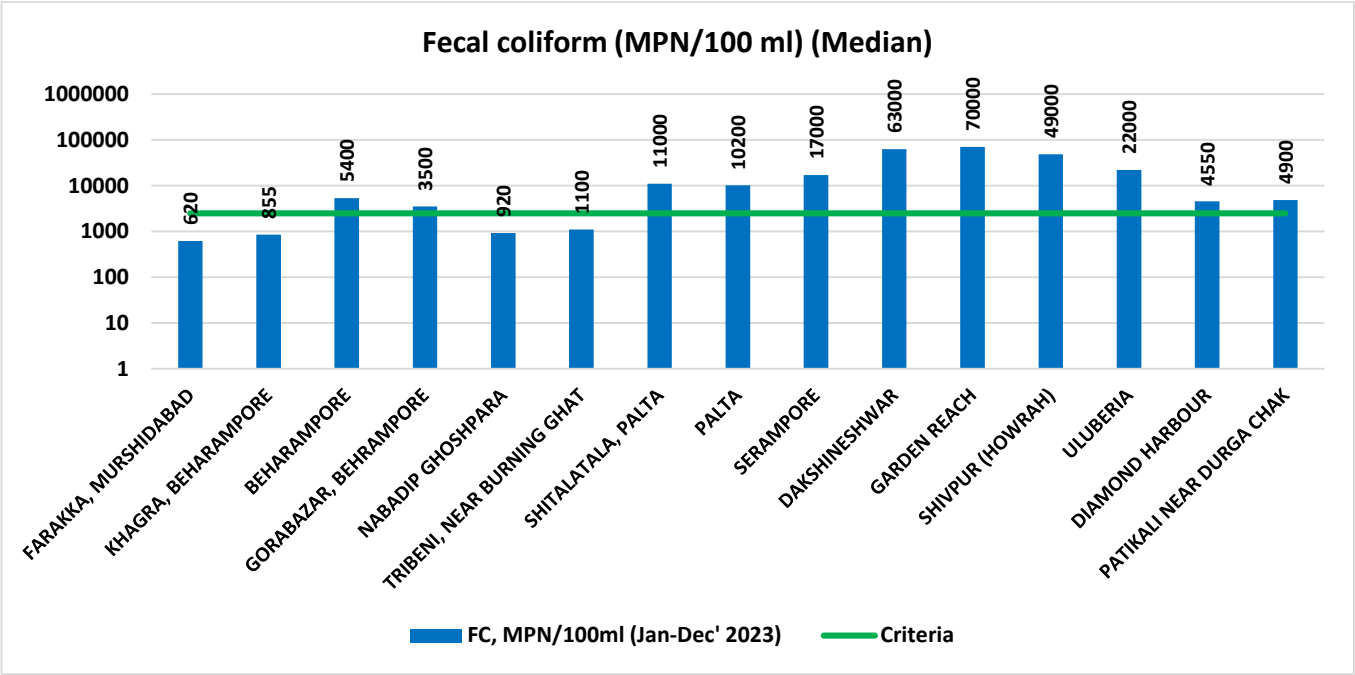


Fig. 6.23 River Ganga water quality-FC levels in West Bengal stretch

Faecal Streptococci:

Water quality was observed to exceed the bathing water quality criteria w.r.t. FS multiple times from Beharampore to Gorabazar, Behrampore and from Shitlatala Palta to Garden Reach.

Based on the median values, water quality was meeting the bathing water quality criteria w.r.t. FS in the entire stretch except from Shitlatala Palta to Sreampore (3 locations).

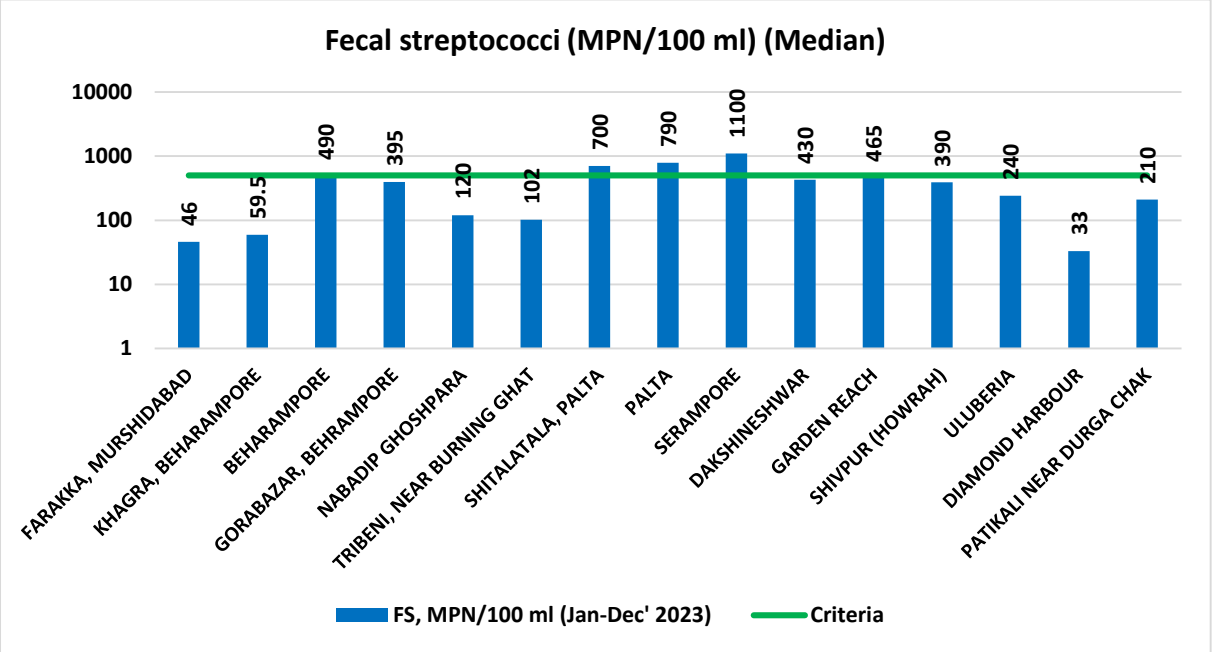


Fig. 6.24 River Ganga water quality-FS levels in West Bengal stretch

i Polluted River Stretches (PRS)

CPCB has identified polluted river stretches (PRS) in year 2018 (2016 & 2017 data) and 2022 (2019 & 2021 data) with respect to BOD parameter. The locations/stretches of river not meeting with the primary water quality criteria for outdoor bathing for BOD i.e. more than 3 mg/L are identified as polluted locations or polluted stretches. PRS are categorized under five Priority Classes (I to V) on the basis of maximum BOD level observed. The criteria for prioritisation of river stretches is given below:

- **Priority – I**: Monitoring locations exceeding BOD concentration 30.0 mg/l
- **Priority – II**: Monitoring locations having BOD between 20.0 – 30.0 mg/l
- **Priority – III**: Monitoring locations having BOD between 10.0 – 20.0 mg/l
- **Priority–IV**: Monitoring locations having BOD between 6.0 – 10.0 mg/l
- **Priority –V**: Monitoring locations having BOD between 3.0 – 6.0 mg/l

a. Status of Polluted River Stretches in river Ganga

The year wise identified polluted river stretches on river Ganga are given as follows:

2018 (2016 & 2017 data):

- Haridwar to Sultanpur (Priority IV, BOD range/Max value 6.6 mg/l) (Uttarakhand)
- Kannauj to Varranasi (Priority IV, BOD range/Max value 3.5-8.8 mg/l) (Uttar Pradesh)
- Buxar to Bhagalpur (Priority V, BOD range/Max value: 3.2-4.2 mg/l) (Bihar)
- Tribeni to Diamond Harbour (Priority III, BOD range/Max value: 5-12.2 mg/l) (West Bengal)

2022 (2019 & 2021 data):

- Farrukabad to Allahabad, Mirzapur to Ghazipur (Priority V, Max BOD: 6.0 mg/l) (Uttar Pradesh)
- Along Buxar, Patna, Fatwah and Bhagalpur (Priority IV, Max BOD: 7.9 mg/l) (Bihar)
- Behrampur to Haldia (Priority IV, Max BOD: 8.0 mg/l) (West Bengal)

Current status (Jan-Dec' 2023)

- Farrukhabad to Purana Rajapur, Kanpur (Priority III, Max BOD range: 3.3-14.8 mg/l); Dalmau to Kalakankar (Priority V, Max BOD range: 3.8-3.9 mg/l); Ganga bridge, Dheemi, Pratapgarh (Priority V, Max BOD: 3.2 mg/l) D/s Mirzapur to Chunar (Priority V, Max BOD range: 3.8-4.5 mg/l); Varanasi D/s to Tarighat (Ghazipur) (Priority V, Max BOD range: 3.6-4.7 mg/l) (Uttar Pradesh)
- Bhagalpur D/s (priority V, Max BOD: 5.5 mg/l) (Bihar)
- Dakshineshwar to Diamond Harbour (Priority V, Max BOD range: 3.1-3.9 mg/l) West Bengal)

b. Restored/improved polluted river stretches along river Ganga

The polluted stretches restored in 2023 (based on 2023 data) as compared to 2018, are (i) Haridwar to Sultanpur (~42 kms) in Uttarakhand; (ii) A/c river Pandu, Deomai, Fatehpur to Dalmau, Raebareli (~37.4 kms); Kadaghat, Kaushambi to Dheemi, Pratapgarh (~26 kms); Prayagraj, Rasoolabad to U/s Vindhyachal (~132.5 kms) & U/s Varanasi to D/s Varanasi (~11 kms) in Uttar Pradesh; (iii) Buxar to Bhagalpur (~400 kms) in Bihar; and (iv) Khagra Behrampore to Serampore (~252.3 km) & Patikali, Durgachak (~10 km) in West Bengal. Details of polluted river stretches restored/improved is given in **Table 6.3.**

Table 6.3 Polluted rive-stretches in 2018 (2016 & 2017 data), 2022 (2019 & 2021 data), and 2023 (Jan-Dec) based on maximum BOD values

State	Year	Stretch identified	No. of stations	Length (Kms)	BOD Range/ Max value	Priority	Restored/ Improved (Compared 2018 onwards)
Uttarakhand	2018	Haridwar to Sultanpur		42	6.6	IV	Restored entire stretch
	2022	-	-	-	-	-	
	2023	-	-	-	-	-	
Uttar Pradesh	2018	Kannauj (D/s) to Varanasi (D/s)		495	3.5-8.8	IV	• Restored: A/c river Pandu, Deomai, Fatehpur to Dalmau, Raebareli (~37.4 kms); Kadaghat (Kaushambi) to Dheemi, Pratapgarh (~26 kms); Prayagraj, Rasoolabad to U/s Vindhyachal (~132.5 kms) & U/s Varanasi to D/s Varanasi (~11 kms) • Improved entire stretch except Kannauj D/s (Priority IV), Bithoor, Bathing ghat Gola ghat & Kanpur D/s (Priority III)
	2022	• Farrukhabad to Allahabad (Sangam) • Mirzapur (U/s) to Ghazipur		388 214	6.0	V	
	2023	Farrukhabad to river Ganga Purana Rajapur	• 12	171.5	3.3-14.8	III	
		• Dalmau (Raebareli) to Kalakankar Pratapgarh) • Ganga bridge-Dheemi Pratapgarh* • D/s Mirzapur to Chunar, • Varanasi D/s to Tarighat (Ghazipur)	• 02 • 01 • 02 • 05	49 42 43 109	3.8-3.9 3.2 3.8-4.5 3.6-4.7	V	
Bihar	2018	Buxar to Bhagalpur		400	3.2-4.2	V	• Entire previous stretch restored (~400 kms) • New location Bhagalpur D/s
	2022	Along Buxar, Patna, Fatwah and Bhagalpur		100	7.9	IV	
	2023	D/s Bhagalpur*	• 01	29	5.5	V	
West Bengal	2018	Tribeni to Diamond Harbour		132	5.0-12.2	III	• Improved entire stretch • Restored: Khagra Behrampore to Serampore (~252.3 kms) & Patikali, Durgachak (~10 kms)
	2022	Behrampore to Haldia		377	8.0	IV	
	2023	Dakshineshwar to Diamond Harbour	• 05	88.5	3.1-3.9	V	

* Length calculated up to next monitoring location.

- Out of total length of river Ganga i.e. 2525 km, stretch of river Ganga is polluted based on Biochemical Oxygen Demand
  - 1069 km in year 2018
  - 1079 km in year 2022
  - 532 km in year 2023
- Approximate 911 km stretch of river Ganga has been restored

ii Pollution Hotspot

- The stretch of river Ganga from Farrukhabad to Purana Rajapur, Kanpur lies in **Priority-III**.
- Treated effluent from Jajmau CETP and STP complex (3 STPs and 1 CETP) discharges into irrigation channel which is used for irrigation in nearby fields. The treated effluent from CETP Rooma discharges into irrigation channel through local/ UPSIDC drain. The irrigation channel discharges carrying treated/ partially treated effluent and sewage into river Ganga through breaches at Jana village.
- 34 drains (Farrukhabad-05, Bithoor-06, Shuklaganj-04, Kanpur-17 & Unnao-02) are directly discharging into river Ganga in this stretch and carries Flow-252.38 MLD, BOD load-0.4 TPD (*based on pre-monsoon, 2023 drain monitoring data).*
- High pollution in this stretch could be due to combine effect of three major tributaries namely Ramganga, Kali-East & Garra.
    - River Kali-East traverse through Muzaffarnagar, Meerut, Hapur, Ghaziabad, Bulandshahar, Aligarh, Kasganj and finally merges with River Ganga at Kannauj in Uttar Pradesh on right bank. Total 29 drains were identified discharging wastewater (Flow-1393.32 MLD & BOD load-321.66 TPD) into river Kali- East. High value of BOD (7.72 mg/l) was observed in river Kali-East at Khudaganj, Kannauj during Magh Mela, 2023.
    - River Ramganga traverses through Bijnore, Moradabad and Bareilly and finally confluence with river Ganga at downstream of Farrukhabad. Wastewater having Flow-443.4 MLD and BOD load- 36.16 TPD was found discharging into river Ramganga through 24 drains. The river Ramganga also receives industrial and domestic discharge from Kashipur, Haldwani, Rudrapour and Rampur districts through tributaries majorly, Dhela, Kosi and Gaula.
    - River Garra carries wastewater from Shajahanpur and Hardoi and confluence with river Ganga at u/s to Rajghat in Hardoi district.
- Farrukhabad to Jajmau cluster has the poor quality in entire Ganga stretch. It has 741 GPIs (Tannery, Sugar, Textile, Distillery, Pulp & Paper and Others) which contribute about 118.11 MLD waste-water having pollution load of 10.962 TPD.

6.2 Real time water quality monitoring of river Ganga and its tributaries

CPCB, in Phase I under the National Ganga River Basin project, established a network of 36 Real Time Water Quality Monitoring (RTWQM) stations, based on data purchase model. The contract was signed for five years' duration at a cost of 37.5 Million Euro (Rs 26.4 Crore). The project commenced on 11.03.2017 and ended on 11.09.2023, which includes three interim extensions.

In Phase II, the network of RTWQM stations was further expanded by setting up additional 40 RTWQM stations on River Ganga and its tributaries, based on same model (i.e. data purchase model). The project was awarded to the eligible firm for five-years duration at a cost of Rs 27 crore + GST as applicable on 28.07.2020. The data commencement from 40 RTWQM stations started from 14.02.2022. 12 water quality parameters are monitored uniformly at all 40 stations, namely, BOD, DO, COD, TOC, Chloride, Water level, Water depth, pH, Conductivity, Nitrate,

Turbidity and Temperature. The stations are functional on 24 x 7, and provides data on hourly basis. List of 76 RTWQM stations is attached at ***Appendix 6.3 and 6.4***. Presently, only 40 RTWQM stations are operational.

Table 6.4: Distribution of stations based on 36 and 40 RTWQM project

State	Stations in 36 RTWQM project	Stations in 40 RTWQM project	Total no. of stations
Uttarakhand	01	05	**06**
Uttar Pradesh	21	15	**36**
Haryana	-	1	**01**
Bihar	04	10	**14**
Jharkhand	-	03	**03**
West Bengal	10	06	**16**
Total	36	40	**76**

Figure 6.25: Photographs of fixed, floating and cross-sections stations

6.2.1 Work accomplished during 2023

The data generated by the sensors installed at 76 locations is received at the DSP server installed at CPCB office and immediately transferred to CPCB server for data qualification and payment. The data validation for 36 RTWQM project was done by CPCB through in-house data validation mechanism. CPCB has engaged Data Qualification Services Consultant (DQSC) for validation of data in 40 RTWQM project and the DQSC has commenced its services w.e.f. 05.07.2022.

6.2.1.1 Field Visits undertaken to witness calibration check of RTWQM stations

As per contract conditions, calibration is required to be performed at every 14 days for all the RTWQM stations. For 40 RTWQM stations, the calibrations of the sensors are witnessed by representatives of DQSC at every 14 days. A field visit mobile app has been developed and provided to the field technicians from DQSC for capturing important data during site visits for witnessing calibration. As part of the data qualification process, all sensors are subject to self-audit by the DSP. DQSC's responsibility is to witness all self-audits and document the audits/calibration checks as part of the data qualification process.

The details of the required calibration and calibration performed during the said period are tabulated below:

S. No.	Period	Actual visits performed for Calibration checks
1	January - March 2023	262
2	April - June 2023	257
3	July -September2023	268
4	October - December 2023	252
	TOTAL	**1039**

Samples for the parameters such as BOD, COD and TOC - validation of which cannot be done at site using portable field, are collected, preserved and analysed in the laboratory, set up by the DSP following standard methods. Based on data qualification by DQSC, hourly, daily and monthly data qualification reports are generated automatically through the WISKI software developed by the DQSC.

6.2.1.2 Analysis of RTWQM data availability & qualification

The RTWQM data generated at all the locations are transmitted initially to the Service Provider's dedicated server placed in CPCB's data centre on real time basis. The data is then transferred to the CPCB server housed in the same data centre on real time basis for further validation by DQSC.

Completeness of data for qualification

Data supplied for any hour is considered for validation and payment provided following conditions be satisfied:

a) Qualified measurements must be received from at least 90% of the total locations and

b) The qualified measurements received from each such location shall not be less than 90% of the measurements specified for it.

In 36 RTWQM project, the details of data availability for the period 01.01.2023 to 11.09.2023 are as below:

Table 6.5: Data availability for the period 01/01/2023 to 11/09/2023

State	Stations	Data Availability (%)	Reason
Uttarakhand	1	90.9	Connectivity issue
Uttar Pradesh	21	72.9	Force Majeure & Connectivity issue
Bihar	4	79.5	Connectivity issue
West Bengal	10	65.1	Force Majeure & Connectivity issue
Total	36	**77.1 %**	

40 RTWQM project: The data availability for the period January 2023 to December 2023 for 40 RTWQM project reveals that the total data received was maximum in January, 2023 (3,06,516 hrs, i.e. 85.8 %) followed by December, 2023 (2,72,569 hrs, i.e. 76.3 %) whereas minimum data was received in March, 2023 (2,24,044 hrs., 62 %) followed by September, 2023 (2,40,141 hrs, i.e. 69 %.). The total data received from the operational stations is 74.5 % (excluding stations under Force Majeure Conditions (FMC).

Table 6.6: Month-wise availability of RTWQM data from January - December 2023

Months	Total Targeted Data (TTD)	Total received Data (TRD)	% of Received Data: TTD	Qualified Data (QD)	% of Qualified data: Received Data	Disqualified Data (DD)	% of Dis-Qualified data: Received Data
Jan 23	357120	306516	85.83	298041	97.24	8475	2.76
Feb 23	322560	246561	76.44	191183	77.54	55378	22.46
Mar 23	357120	224044	62.74	195223	87.14	28821	12.86
Apr 23	345600	243408	70.43	232105	95.36	11303	4.64
May 23	357120	254952	71.39	248399	97.43	6553	2.57
Jun 23	345600	264216	76.45	240844	91.15	23372	8.85
Jul 23	357120	279650	78.31	247142	88.38	32508	11.62
Aug 23	357120	267846	75.00	259379	96.84	8467	3.16
Sep 23	345600	240141	69.49	237489	98.90	2650	1.10
Oct 23	357120	262020	73.37	243542	92.95	18454	7.04
Nov 23	345600	270194	78.18	260830	96.53	9364	3.47
Dec 23	357120	272569	76.32	263809	96.79	8760	3.21
TOTAL	**42,04,800**	**31,32,117**	**74.50**	**29,17,986**	**93.02**	**2,14,105**	**6.98**

6.2.2 Data generation and salient findings

6.2.2.1 Assessment of RTWQM water quality data for stations based on annual average value on main stem of River Ganga

Of the total 35 RTWQM stations on main stem of River Ganga (18 stations under 36 RTWQMS and 17 stations under 40 RTWQMS), 23 stations were operational. 12 stations remained non-operational due to force majeure conditions. Monthly average data for main stem stations on River Ganga is attached as ***Appendix 6.5 & 6.6***. 36 RTWQM project ended on 11.09.2023.

i) pH

pH was found complying at all the 23 operational stations. The maximum value for pH was reported as 8.4 at U/s of Behrampore, West Bengal & Pontoon bridge, Prayagraj, while the minimum pH value was observed at Asni Ghat, Fatehpur as 7.1.

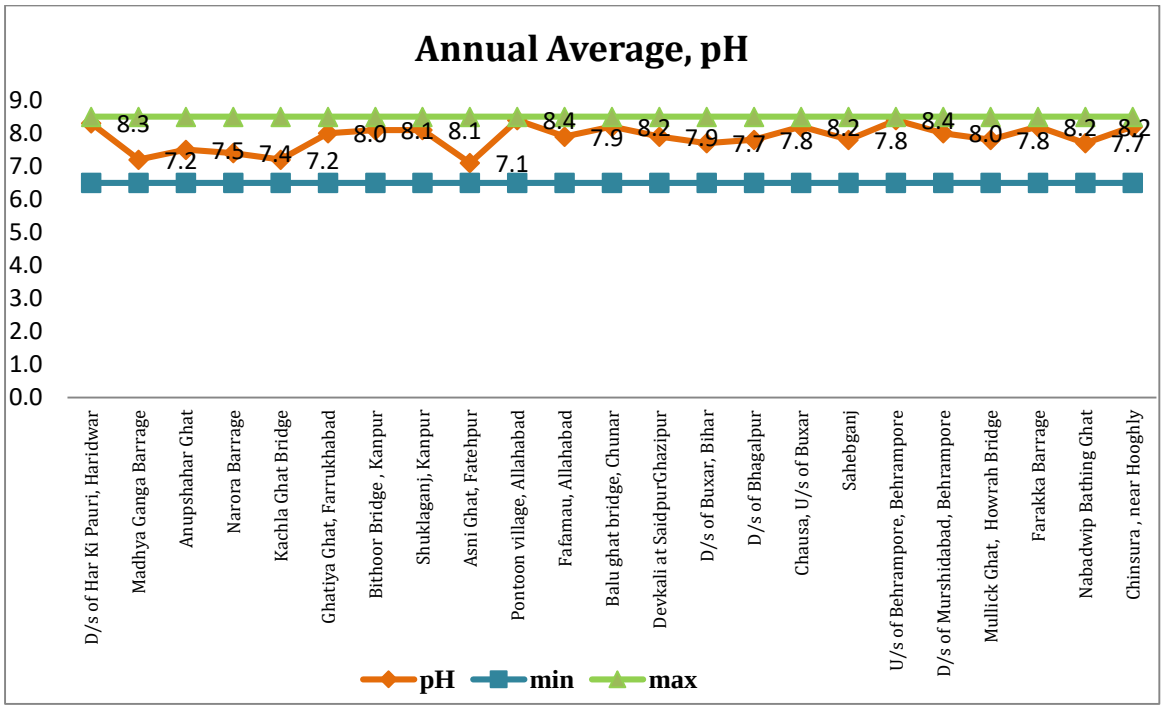


Figure 6.26: Trend Analysis of pH at main stem stations of River Ganga in 2023

ii) Dissolved Oxygen (mg/l)

With respect to the primary water quality criteria for bathing, out of 23 operational stations, Dissolved Oxygen was found complying at 22 stations in 2023 and non-complying on 01 station i.e. Mullick Ghat, Howrah Bridge. Maximum value for DO was reported as 10.0 mg/l at D/s of Har Ki Pauri, Dam Kothi Barrage, Haridwar and minimum value was reported at Mullick Ghat, Howrah Bridge as 4.2 mg/l.

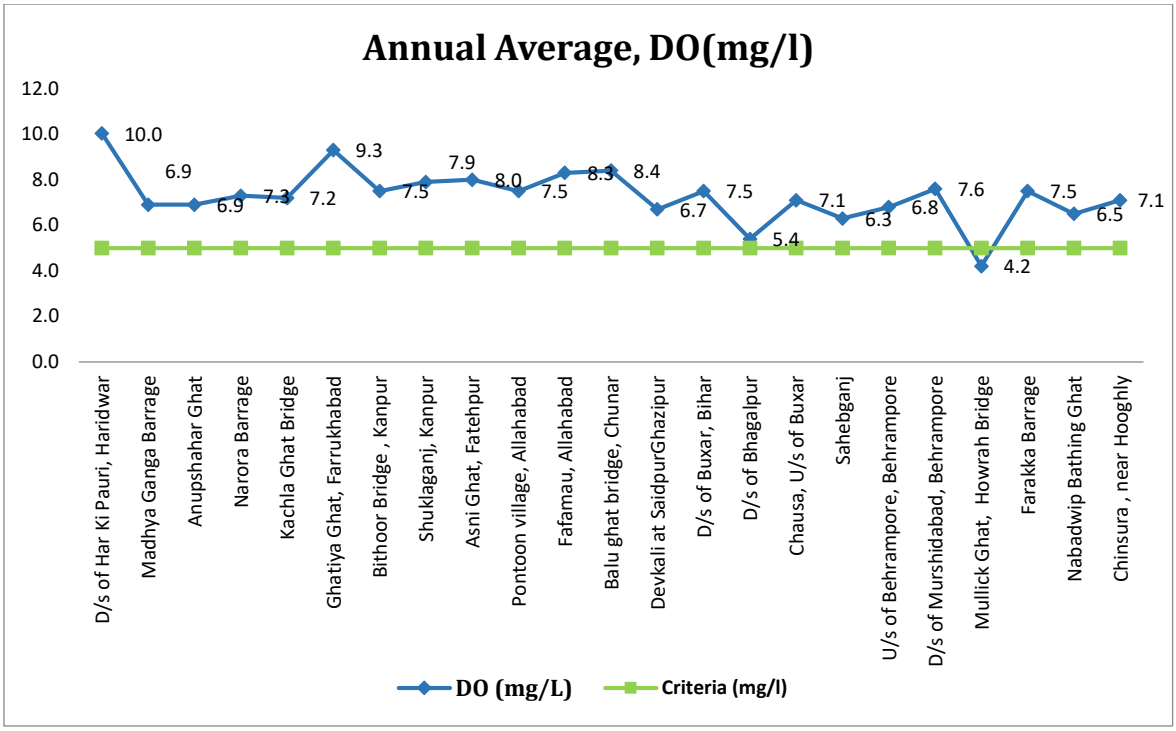


Figure 6.27: Trend Analysis of DO (mg/l) at main stem stations of River Ganga in 2023

iii) Biological Oxygen Demand (mg/l)

BOD was found complying w.r.t bathing criteria at 18 stations and non-complying at 06 stations. In the stretch of U/s of Behrampore to Mullick Ghat, Howrah Bridge, 03 stations were found non-complying. Maximum value for BOD was reported as 4.8 mg/l at U/s of Behrampore, West Bengal while the minimum value was observed at D/s of Har Ki Pauri, Haridwar as 0.8 mg/l.

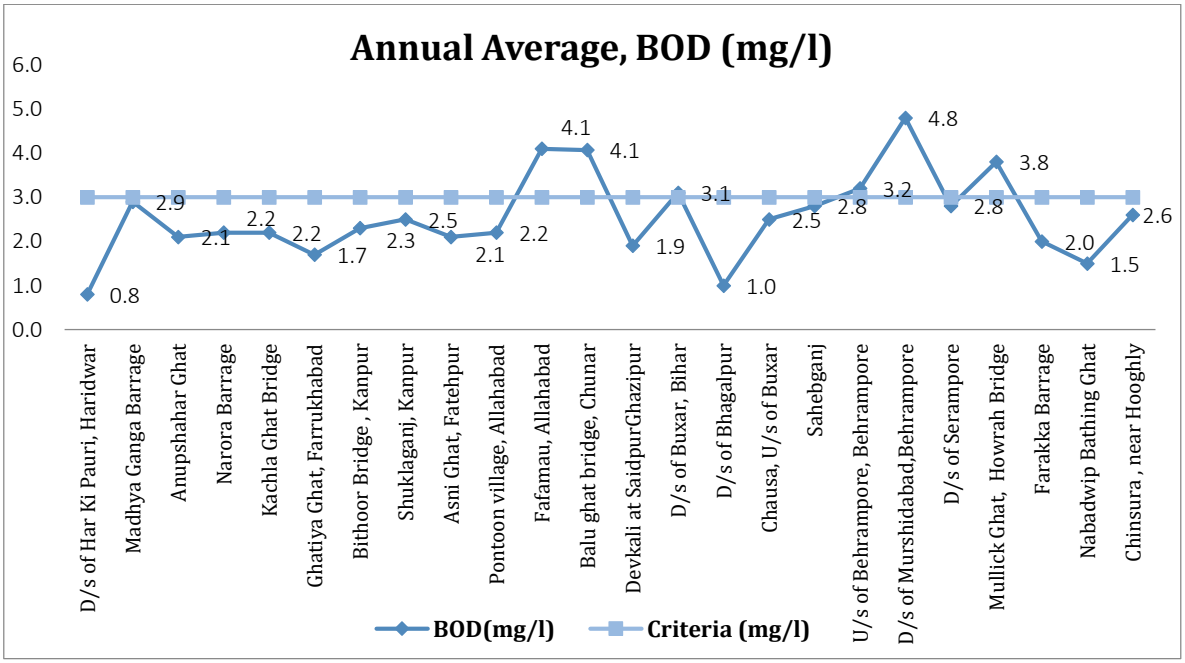


Figure 6.28: Trend Analysis of BOD (mg/l) at main stem stations of River Ganga in 2023

6.2.2.2 Assessment of RTWQM water quality data of stations based on annual average on tributaries of River Ganga

There were 32 RTWQM stations installed at tributaries of River Ganga, of which 22 stations were found operational and 10 stations were not operational due to force majeure conditions. Monthly average data for tributaries is attached as ***Appendix 6.7 & 6.8***. As mentioned earlier, 36 RTWQM project ended on 11.09.2023.

i) pH

pH was found complying at all 22 operational RTWQM stations. Maximum value for pH was reported as 8.4 at Fathua on Punpun, Patna and the minimum pH value was observed at River Ramganga, Farrukhabad as 7.2.

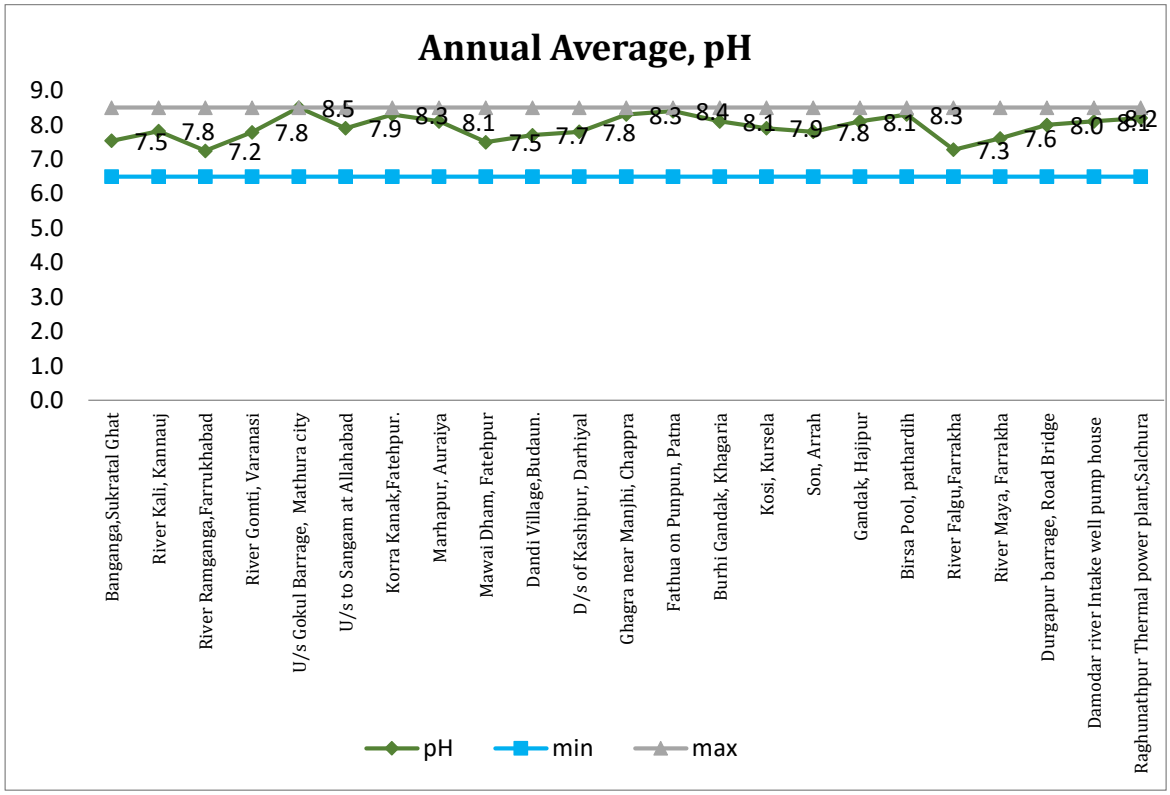


Figure 6.29: Trend Analysis of pH at stations on Tributaries of River Ganga in 2023

ii) Dissolved Oxygen (mg/l)

Dissolved Oxygen was found complying at 19 stations out of the operational 22 stations. Non-compliance was observed at 03 stations (U/s of Gokul Barrage, Mathura City, Fathua on Punpun, Patna and River Maya at Farrakha). Maximum value for DO was reported as 8.8 mg/l at River Gomti, Varanasi and minimum value was reported at Fathua on Punpun as 1.0 mg/l.

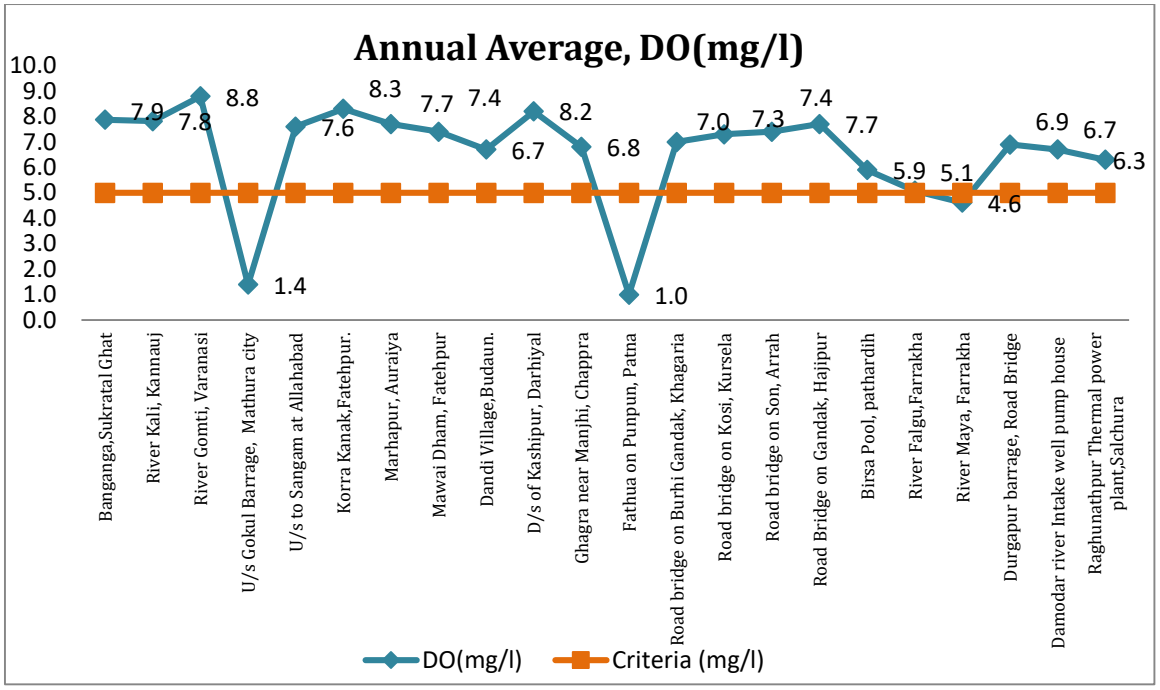


Figure 6.30: Trend Analysis of DO (mg/l) at stations on tributaries of River Ganga in 2023

iii) Biological Oxygen Demand (mg/l)

BOD was found complying w.r.t bathing criteria at 15 stations and found non-complying at 07 stations. Maximum value for BOD was reported as 12.4 mg/l at U/s of Gokul Barrage, Mathura. However, minimum BOD value was observed at Gandak, Hajipur and Damodar River Intake Well Pump house as 0.9 mg/l.

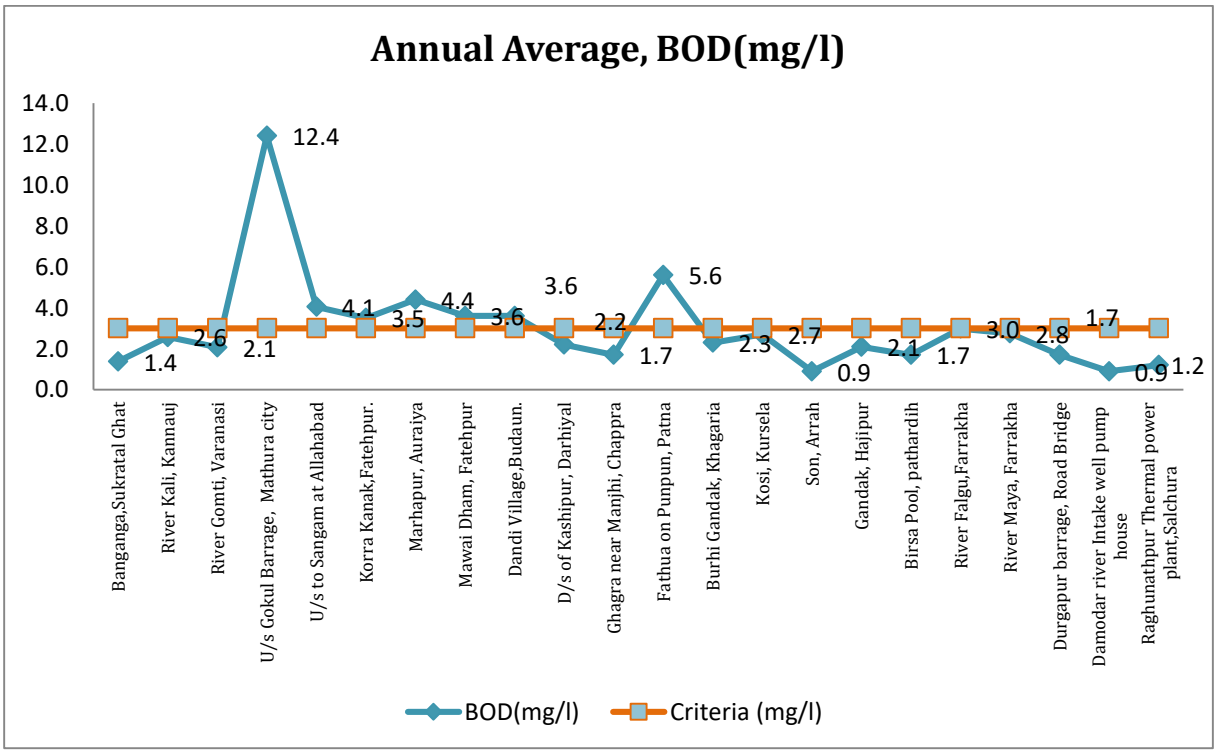


Figure 6.31: Trend Analysis of BOD (mg/l) at stations on tributaries of River Ganga in 2023

6.2.2.3 Relocation of non-functional RTWQM stations

Data supply from some of the locations have been affected due to low water, flood, theft and vandalism. DSP raised concern regarding some of the stations under not in a position to supply data for long period. DSP and DQSC jointly surveyed various sites to identify the suitable locations for shifting of these stations and suggested sites for relocation. SPCBs (Uttarakhand and U.P.) / RD-Lucknow carried out survey for suitability of locations. Based on reports obtained from SPCBs and RD-Lucknow, six locations are proposed for shifting.

6.2.2.4 Display of RTWQM data from 40 locations in public domain

The real time water quality instant data has been placed in public domain through CPCB website https://cpcb-dashboard.in/#/ .

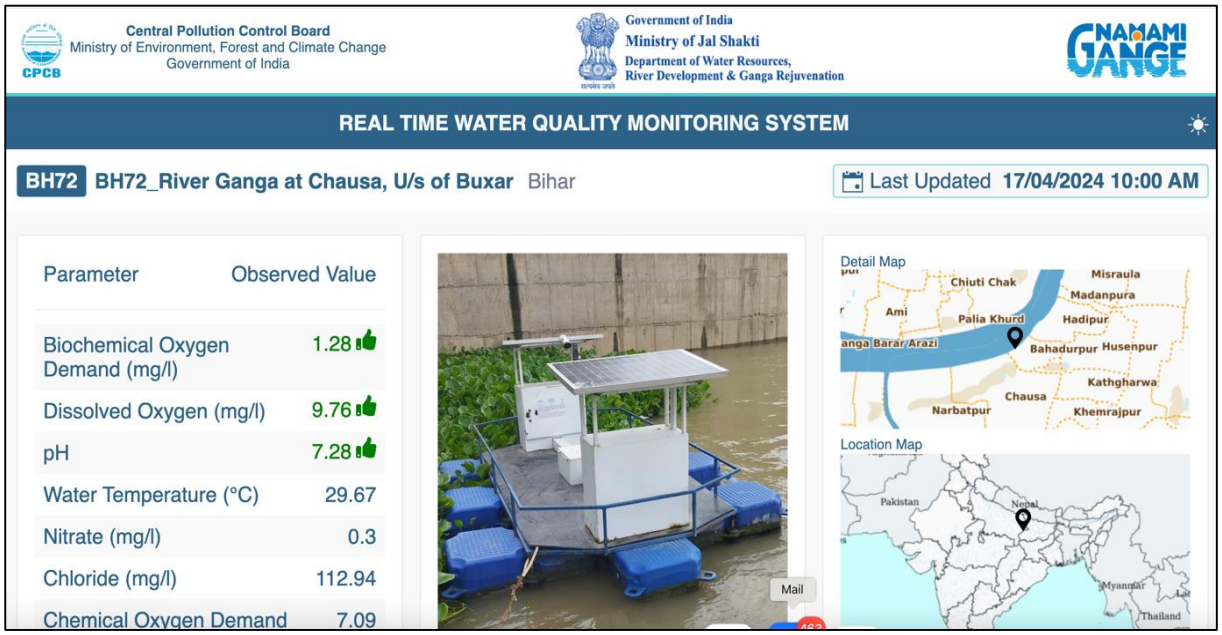


Figure 6.32: Screenshot of RTWQM data display at CPCB website

6.2.3 Way Forward

- Preparation of a comprehensive report with station-wise analysis of RTWQM data and correlation with specific parameters.
- Relocation of 06 non-functional RTWQM stations due to Force Majeure conditions to suitable locations.
- Development of portals for the State Pollution Control Board for assessment of river water quality.

6.3 Biomonitoring

6.3.1 Work accomplished during 2023

Choice of Bio-indicators

The dynamism of the river ecosystems provide habitat to a wide range of organisms from viruses and bacteria (microscopic), to invertebrates, fishes, amphibians, reptiles and mammals

(macroscopic). Each group of organisms can indicate the anthropogenic impact on the ecosystem characteristics in one way or another but a specific approach makes the bio-monitoring study more relevant. The ecologists always quest for the ideal indicator organisms, the monitoring of which can represent the impact of environmental conditions and pollutants on the entire inhabiting biota.

An ideal indicator organism should have two main attributes:

1. It should be macroscopic (clearly visible to naked eyes) and
2. It should be non-migratory (should not migrate with the impact of pollution).

The members of the phyla Platyhelminthes, Annelida, Arthropoda and Mollusca are both macroscopic and spend one part or the entire life attached to the substratum of the river, thus, qualify as the **ideal indicators** for the purpose of bio-monitoring of lotic ecosystems. These organisms are collectively referred to as the **benthic macro-invertebrates** (**Fig. 6.33**).

Macro-invertebrates- invertebrates visible to the naked eyes and retained on a US standard no. 30 sieve of mesh size 595 – 600 µm (APHA, 2017).

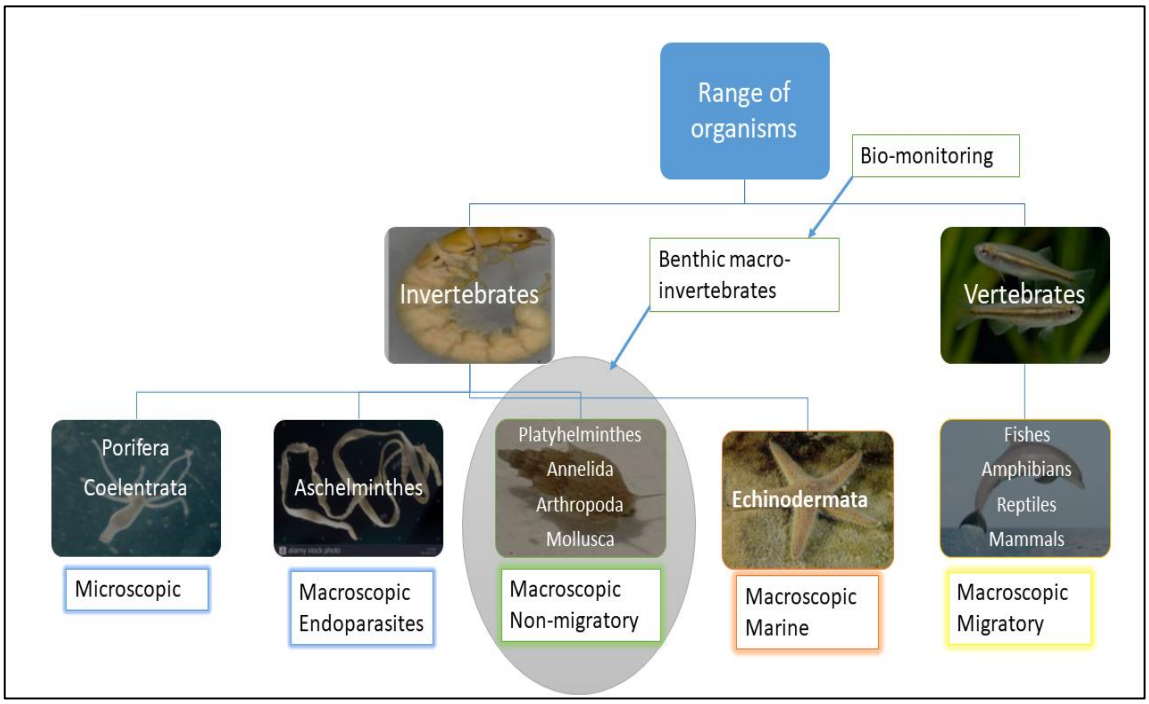


Fig. 6.33: Choice of Bio-indicators in Bio-monitoring

Central Pollution Control Board is regularly conducting bio-monitoring of 02 major rivers of the country with study area spread along 2,525 km of river Ganga and 1370 km of river Yamuna.

During the period, total 136 bio-monitoring events were conducted in 02 rounds of bio-monitoring at 42 locations of river Ganga and at 26 locations of river Yamuna, as presented in **Table 6.7** below:

Table 6.7: Study area with Bio-monitoring Events

Rivers	From Origin	To Confluence	Locations No.	Sampling Frequency	Bio-monitoring events
The Ganga	Gangotri (Uttarakhand)	Garden Reach (West Bengal)	42*	(Twice a year)	84
The Yamuna	Yamunotri (Uttarakhand)	Prayagraj (Uttar Pradesh)	26#	×2	52
				Total Events (Ganga + Yamuna)	**= 136**

Locations coordinates are listed as Appendix 6.9
#Locations coordinates are listed as Appendix 6.10

Each bio-monitoring event typically lasted for 01-02 days and involved 03 to 04 team members including Scientists, Scientific Assistants, Researchers and Attendants.

6.3.2 Data Generation and Salient Findings

To assess the biological health of water bodies, CPCB has derived a Biological Water Quality Criteria (BWQC). This is based on the range of Saprobic Score values of taxonomic groups of benthic macro-invertebrate families with respect to water quality. The water quality is classified into five different classes from Very Good to Severe and evaluated with corresponding Saprobic Score range from 1 to 10 (**Table 6.8**).

Table 6.8 Biological Water Quality Classification

Saprobic Score	Biological Water Quality Class (BWQC)
7.0 to 10.0	**Very Good**
5.0 to 6.9	**Good**
3.0 to 4.9	**Moderate**
1.1 to 2.9	**Poor**
1.0	**Severe**

The data collected during all the events are meticulously documented and analysed. Below are some key metrics:

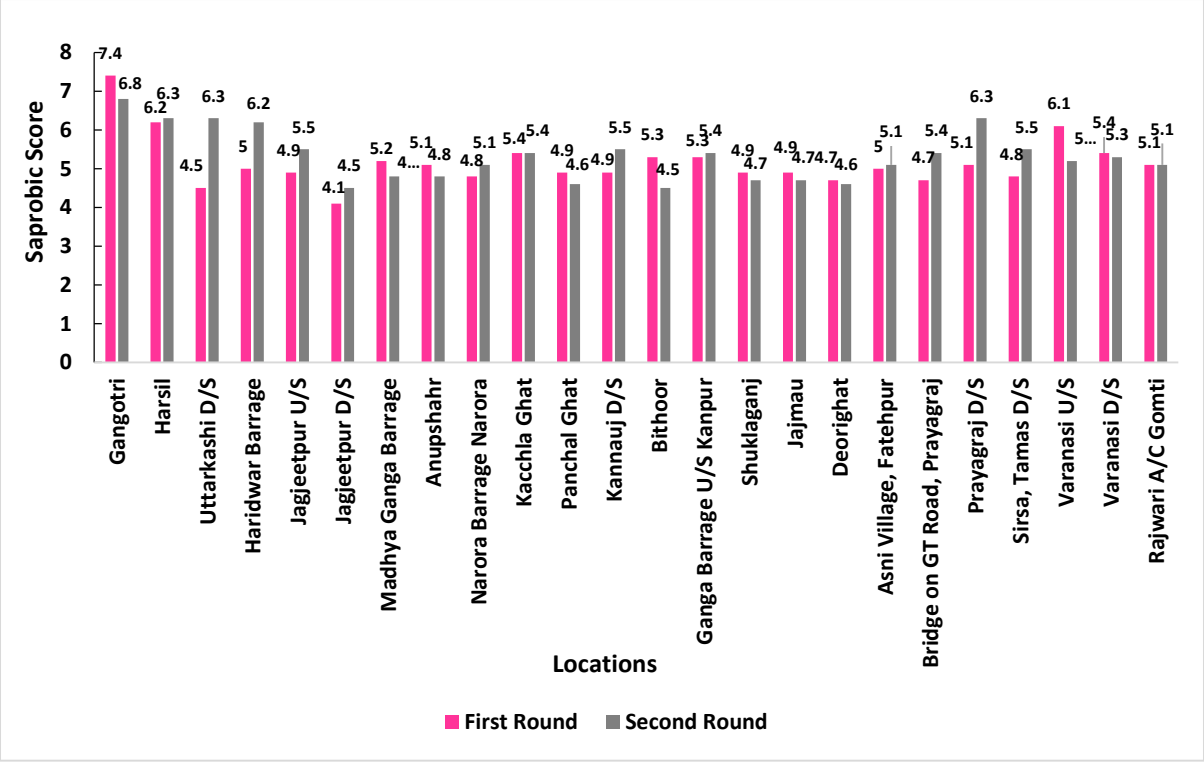


Fig. 6.34: Saprobic Score at locations of River Ganga (Gangotri to Varanasi)

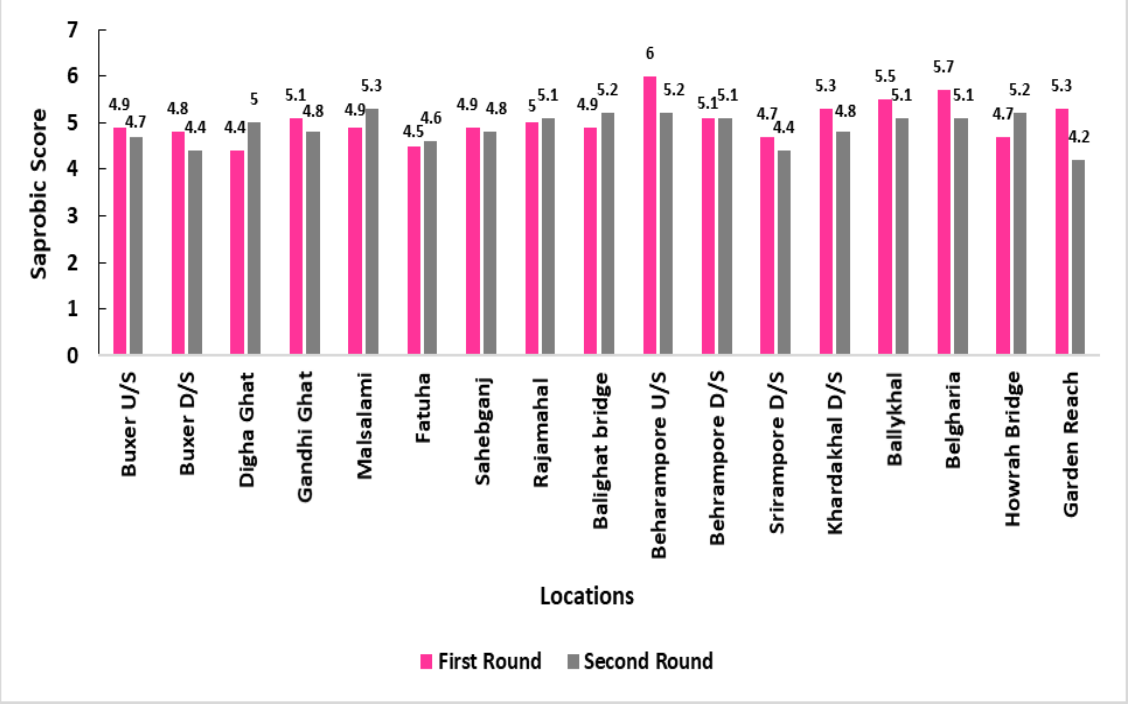
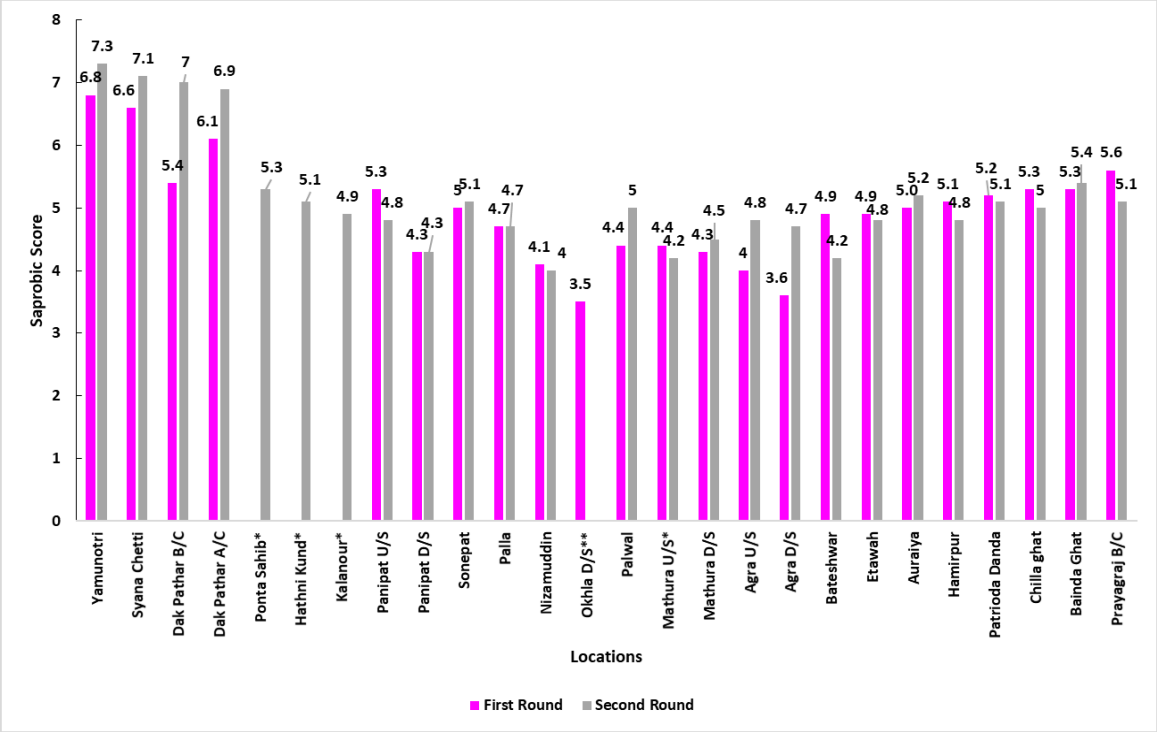


Fig. 6.35: Saprobic Score at locations of River Ganga (Bihar to West Bengal)



Bio-monitoring could not be conducted due to early onset of monsoon
****Sufficient number of Benthic macro-invertebrates were not collected***

Fig. 6.36: Saprobic Score at locations of River Yamuna

Based on monitoring data, the major observations are as follows:

6.3.2.1 River Ganga (First round)

- In Uttarakhand stretch, BWQ at Gangotri is 'Very good' and from Harsil to Haridwar Barrage, is 'Good' class after that from Jagjeetpur U/s to D/s declines to 'Moderate' class. Moderate class at Jagjeetpur U/s and D/s is correlated with abundance of intermediately tolerant families (BMWP Score 3-7) and tolerant family viz., Chironomidae (BMWP Score-2) which indicated discharge of untreated/ partially treated waste water into the stream.
- In Uttar Pradesh, stretch from Madhya Ganga barrage (Bijnore) to Kachhla ghat (Badaun), BWQ is in 'Good' class except Narora barrage which was in 'Moderate' class.
- River stretch from Panchal ghat (Farrukhabad) to Deori ghat (Kanpur) BWQ was in 'Moderate' class except 02 locations viz. Bithoor and Ganga barrage U/s Kanpur in 'Good' class.
- Stretch from Asni Village (Fatehpur) to Ghazipur (Varanasi), BWQ was in 'Good' class while 02 locations namely Bridge on GT Road, Prayagraj and Sirsa, Tamas D/s was in 'Moderate' class (**Fig. 6.34 and Fig. 6.37**).
- In Bihar stretch, all the locations from Buxer U/s to Fatuha were in 'Moderate' Class except Gandhi Ghat which was in 'Good' class.
- In Jharkhand stretch, location at Sahebganj was in 'Moderate' Class but at Rajmahal was in 'Good' class.

- In West Bengal stretch, all the locations were in ‘Good’ class except 03 locations viz., Murshidabad, Srirampore D/s and Howrah bridge (**Fig. 6.35 and Fig. 6.37**).

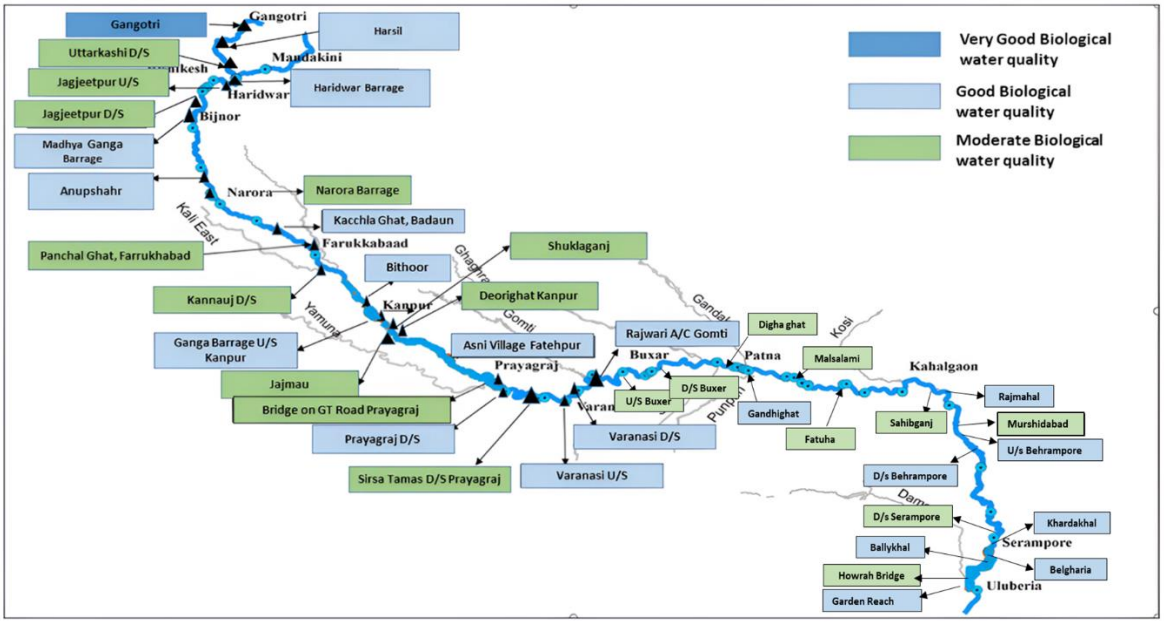


Fig. 6.37 Biological water quality map of River Ganga (First Round)

6.3.2.2 River Ganga (Second Round)

- In Uttarakhand stretch, from Gangotri to Jagjeetpur U/s, BWQ was in Good class, only 01 location i.e. Jagjeetpur D/s was in ‘Moderate’ class.
- In Uttar Pradesh, Madhya Ganga Barrage and Kachhla Ghat, the BWQ was 'Moderate' but 'Good' at Narora Barrage and Kachhla Ghat.
- From Panchal Ghat (Farrukhabad) to Deori ghat, BWQ was in ‘Moderate’ class except Kannauj D/S and Ganga barrage U/s Kanpur where BWQ was in ‘Good’ class.
- BWQ in the stretch from Asni village Fatehpur to Ghazipur (Varanasi), was in ‘Good’ class (**Fig. 6.34 and 6.38**).
- In Bihar stretch, all the locations from Buxer U/s to Fatuha were in ‘Moderate’ Class except 02 locations viz., Digha Ghat and Malsalami which were in ‘Good’ class.
- In Jharkhand stretch, location at Sahebganj was in ‘Moderate’ Class but at Rajmahal was in ‘Good’ class.
- In West Bengal stretch, all the locations were in ‘Good’ class except 03 locations viz., Srirampore D/s, Khardakhal D/s and Garden Reach which were in ‘Moderate’ class (**Fig. 6.35 and 6.38**).

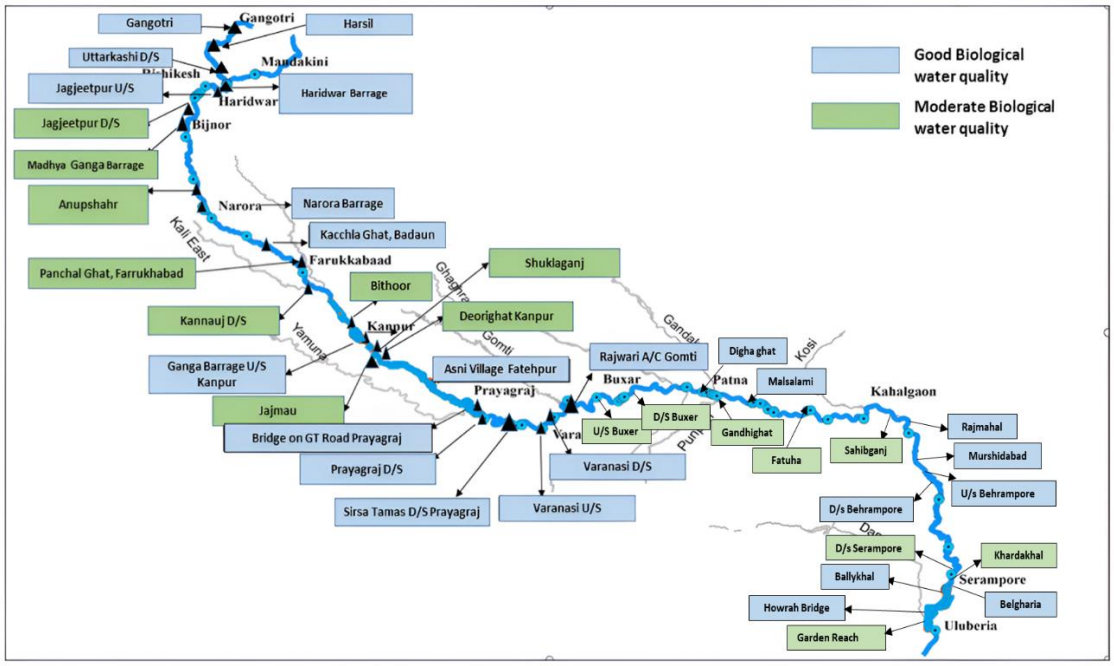


Fig. 6.38: Biological water quality map of River Ganga (Second Round)

6.3.2.3 River Yamuna (First round)

- In Uttarakhand Stretch from Yamunotri to Dak Pathar the BWQ was found to be in 'Good' class.
- In Haryana stretch, Panipat U/s & Sonepat were in 'Good' class and Panipat D/s & Palwal were in 'Moderate' class.
- In Delhi stretch, the BWQ was found in 'Moderate' class at all the three locations (Palla, Nizamuddin and Okhla D/s).
- In Uttar Pradesh stretch, from Mathura U/s till its confluence with River Ganga at Prayagraj, the BWQ of River Yamuna in the upper stretch till Etawah was in Moderate class and lower stretch (from Auraiya to Prayagraj D/s) was in 'Good' class (**Fig. 6.36 and 6.39**).

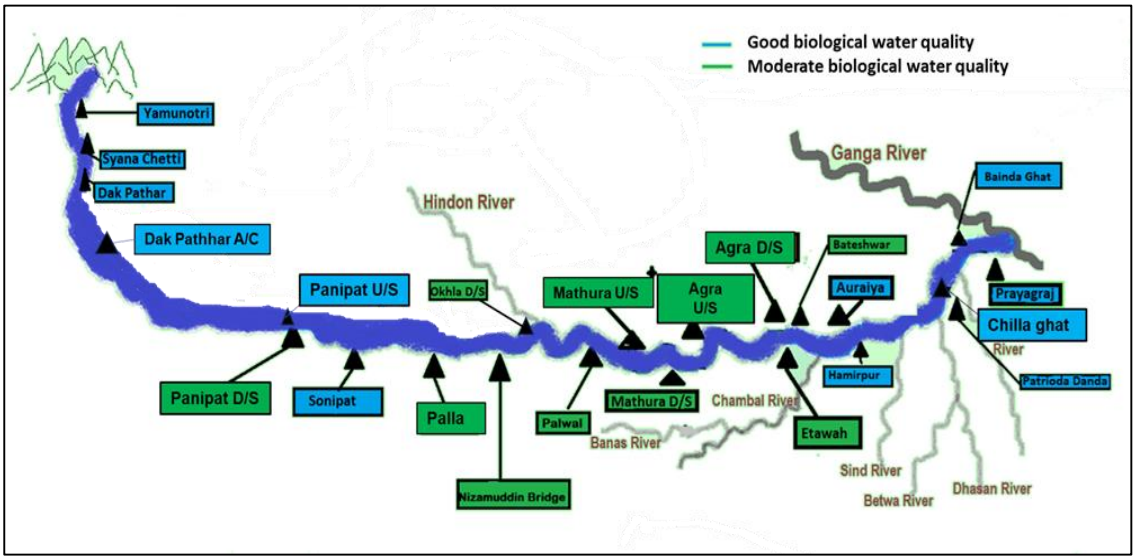


Fig. 6.39: Biological water quality map of River Yamuna (First Round)

6.3.2.4 River Yamuna (Second Round)

- In Uttarakhand, stretch from Yamunotri to Dak Pathar the BWQ was in 'Very Good' class.
- At Paonta Sahib, in Himachal Pradesh the BWQ was in 'Good' class.
- In the Haryana stretch, from Kalanour, Panipat U/s & D/s the BWQ was 'moderate' class and at Hathni kund, Sonepat and Palwal was in 'Good' class.
- In Delhi, the BWQ was in Moderate class (Palla and Nizamuddin).
- From Mathura U/s to confluence with River Ganga at Prayagraj, the BWQ from Mathura U/s to Etawah, was in Moderate class and from Auraiya to its confluence point the BWQ was in 'Good' class except at Hamirpur where it was in moderate class (**Fig. 6.36 and 6.40**).

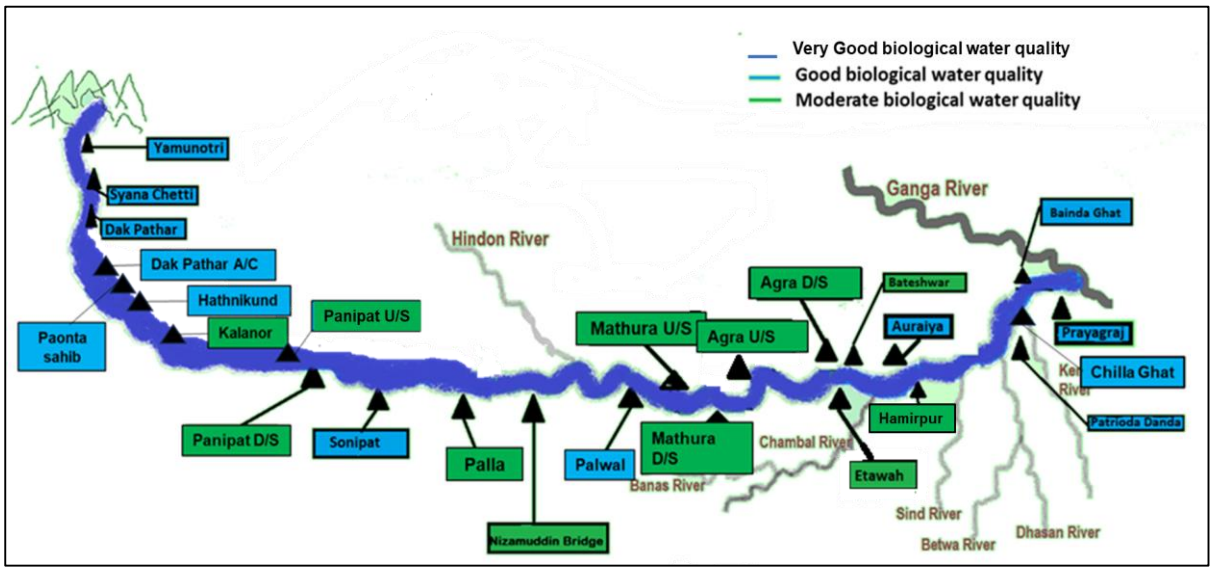


Fig. 6.40: Biological water quality map of River Yamuna (Second Round)

6.3.3 Biological water quality trend from 2017-18 to 2023-24:

A. River Ganga:

The biological water quality data trend observed during past 06 years (from 2017-18 till 2022-23) indicated that in Uttarakhand stretch, the overall water quality is in Good class at Haridwar Barrage and Upstream of Jagjeetpur, while Moderate class at Downstream of Jagjeetpur. However, the biological water quality has improved from Poor to Moderate at D/s of Jagjeetpur location. In Uttar Pradesh stretch, out of 18 locations, the water quality has been in Good class at 14 locations and in Moderate class at 04 locations, viz. Narora Barrage, Ganga Barrage, Shuklaganj, and Deorighat since past 06 years. Water quality has improved from Moderate to Good class at 08 locations *viz* Narora, Kachhla ghat (Badaun), Ganga barrage (Kanpur), Kannauj D/s, Asni village (Fatehpur), bridge on GT road (Prayagraj), Varanasi U/s and D/s. The trend in Bihar stretch shows that the biological water quality at 02 locations, Digha ghat and Malsalami remained in Good class while at Gandhi ghat and Malsalami, it remained in Moderate class. Improvement in water quality from Moderate to Good was observed at Malsalami. In West Bengal stretch, biological water quality data trend indicated that the Ganga river in West Bengal is in Good class of water quality, except for the Kharda khal location

which remains in the Moderate class. This could be due to the influence of the Khardah drain upstream of the location. Improvement in water quality from Moderate to Good class was observed at 04 locations, Murshidabad, Behrampore U/s, Belgharia and Ballykhal (**Fig. 6.41**).

Note: The biological water quality trend at 04 locations in upper mountainous stretch of Uttarakhand i.e. Gangotri, Harshil, Uttarkashi U/s & D/s, 02 locations in Bihar stretch namely Buxar U/s & D/s and 02 locations of Jharkhand stretch could not be compared with previous monitoring because bio-monitoring was initiated at these locations from the year 2022-23 and 2023-24.

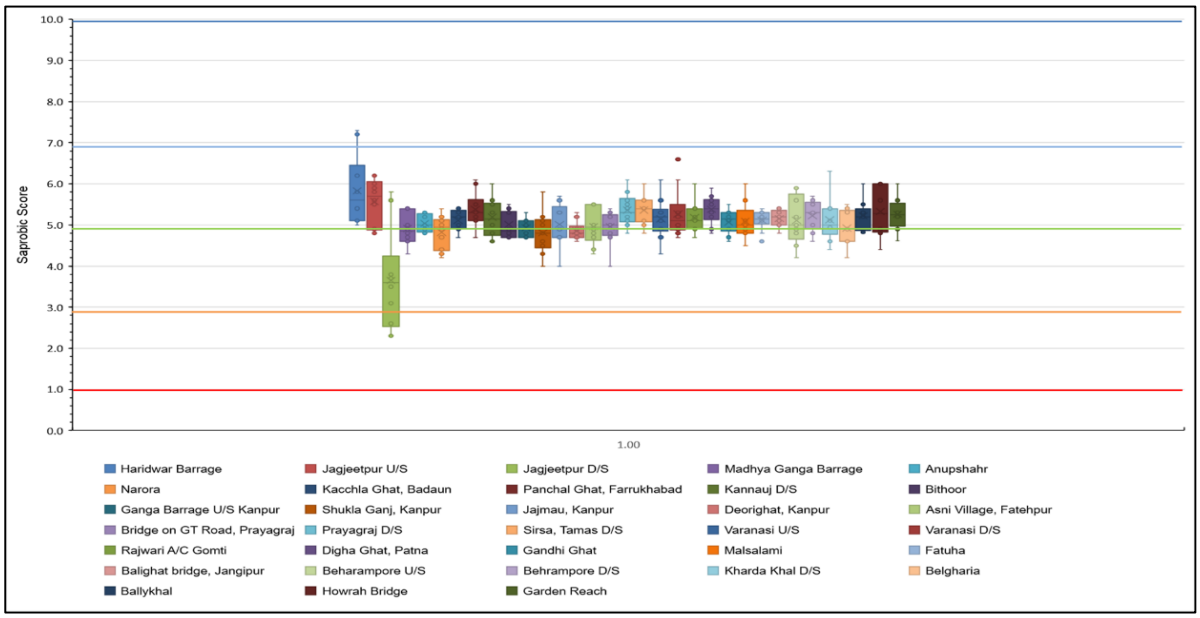


Fig. 6.41: Biological Water quality trend of River Ganga since 2017-18

B. River Yamuna:

The biological water quality data trend observed during the studied period indicates that in the Uttarakhand stretch, the overall water quality lies in the Good class, however at three locations i.e. Yamunotri, Syana Chatti and Dak Pathar B/c with River Tons the water quality has improved to Very Good. The only location of Himachal Pradesh 'Paonta Sahib' was consistently found in Good category throughout the studied period. In the Haryana stretch, the water quality of Sonepat and Hathni Kund locations was found to be in Good' category. It has been observed that water quality degraded to Moderate at Panipat U/s and improved to Good at Palwal location. In the Delhi stretch, the biological water quality has degraded to Moderate from Good class in Palla, while at Nizamuddin and Okhla D/s it was always found to be in the Moderate category. Out of the 12 locations monitored in the Uttar Pradesh stretch, Auraiya, Pateora Danda, Chilla Ghat, Bainda Ghat and Prayagraj B/c with River Ganga the water quality remains in the 'Good' class except few incidences. While in the upper stretch of river Yamuna from Mathura uptil Etawah the water quality was always in Moderate category except at Agra U/s and D/s where it dipped to Poor quality at few occasions (**Fig. 6.42**).

*Note: The monitoring at some locations was initiated since Post monsoon 2021-22 (*Yamunotri *to Dak Pathhar A/c, Panipat D/s, Bateshwar and Hamirpur to Bainda ghat) and pre-monsoon 2023-24 (Dak Pathhar B/c).*

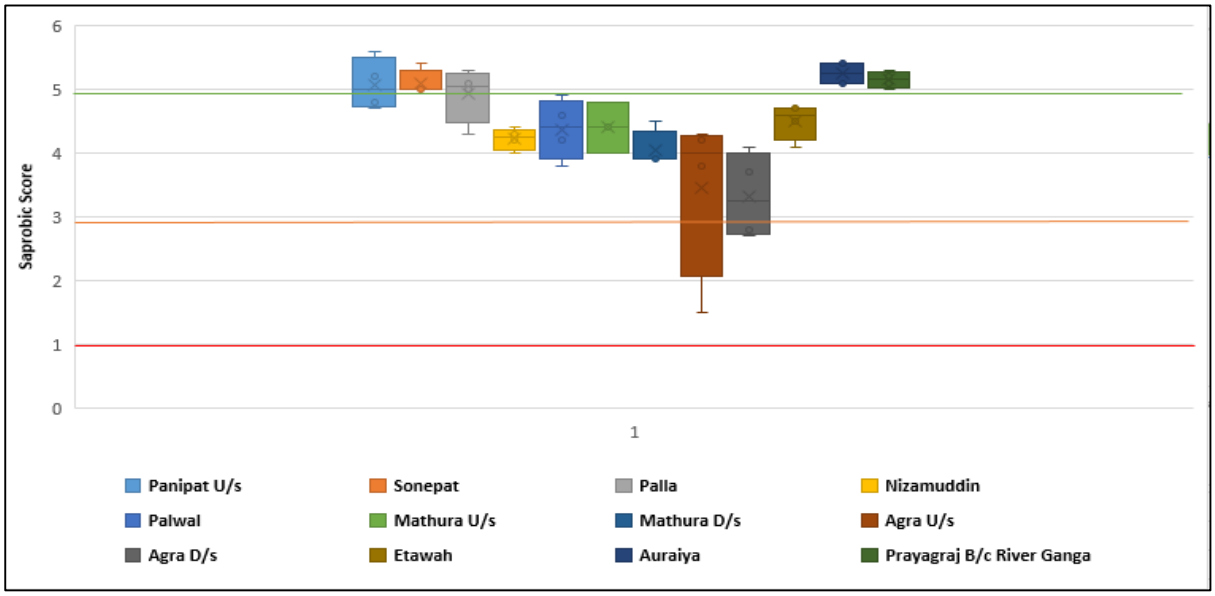


Fig. 6.42: Biological Water quality trend of River Yamuna since 2019-20

6.3.4 Way Forward

- Bio-monitoring of Fresh water bodies of the State.
- Digitalization of taxonomic keys
- Phase-wise training program for all SPCBs/PCCs/RDs.
- Baseline data generation of macro-invertebrates with reference to physico-chemical index.
- Development of Centre of Excellence for Bio-monitoring
- Species-level identification of Benthic macro-invertebrates using Classical / Molecular taxonomy approaches.

6.4 Magh Mela monitoring

Magh Mela is an annual mass bathing event(s) celebrated extensively as festival starting in the month of Magh and holds great significance for Hindu devotees who converge at the Triveni Sangam, the holy confluence points of three sacred rivers Ganga, Yamuna, and Saraswati in Prayagraj district of Uttar Pradesh. Magh Mela, 2023 was celebrated at Sangam in Prayagraj started from Paush Purnima Snaan (06.01.2023) and continued till Maha Shivratri Snaan (18.02.2023).

6.4.1 Work accomplished during 2023

To ensure water quality of river Ganga at Prayagraj, Central Pollution Control Board (CPCB) carried out monitoring of river Ganga (at 7 locations) and its tributaries/sub tributaries namely Dhela (2 locations), Kosi (2 locations), Ramganga (4 locations), Kali-East (1 location), Yamuna (1 location) and their adjoining drains (21 nos.) at various locations in Udham Singh Nagar of

Uttarakhand, Moradabad, Farrukhabad, Kannauj, Kanpur, Prayagraj of Uttar Pradesh on various occasions (**Table 6.9**). Monitoring of 8 operational STPs at Prayagraj was carried out for compliance verification during Pre- and Post-Magh Mela.

Table 6.9 Monitoring locations of river Ganga & its tributaries (Dhela, Kosi, Ramganga, Kali-East, Yamuna) & adjoining drains

S. No.	Locations	Frequency of sampling
1.	Pachhana drain near Suryapratap Pipe Industry, Kashipur (U.K.)	Fortnightly basis
2.	River Dhela at Faridnagar, Thakurdwara (U. P.)	
3.	Dhandi drain at Dhandi bridge, Moradabad-Kashipur road (U.P.)	
4.	River Dhela near Bhojpur Bridge (U. P.)	
5.	River Kosi a/c of River Bahela and b/c Rampur drain	
6.	Rampur drain b/c to River Kosi at Ajeetpur (U.P.)	
7.	River Kosi a/c of Rampur drain and b/c River Ramganga	
8.	River Ramganga b/c River Dhela at Agwanpur (U.P.)	
9.	Drain carrying treated sewage of 58 MLD Gulab Bari STP, Moradabad (U.P.)	
10.	River Ramganga a/c of River Dhela at Katghar (U.P.)	
11.	River Ramganga a/c of River Kosi at Shahbad (U.P.)	
12.	R. Ramganga at Allahganj, Farrukhabad	Once (3 days before auspicious bathing day)
13.	R. Ganga at Ghatiyaghat, Farrukhabad	
14.	R. Kali-East at Khudaganj, Kannauj	
15.	R. Ganga A/c with river Kali at Mehdighat, Kannauj	
16.	R. Ganga at Bithoor, Kanpur	Once (2 days before auspicious bathing day)
17.	R. Ganga D/s of Kanpur at Rajapur village, Kanpur	
18.	R. Ganga U/s of Prayagraj at Kuresar ghat, Prayagraj	Once (pre, during & post of each auspicious bathing day)
19.	R. Yamuna (B/c to river Ganga) near Naini bridge, Prayagraj	Once (pre, during & post of each auspicious bathing occasion and twice (auspicious bathing day)
20.	R. Ganga at Sangam, Prayagraj	
21.	R. Ganga D/s of Prayagraj at Deehaghat, Prayagraj	Once (pre, during & post of each auspicious bathing day)

6.4.2 Data Generation and Salient Findings

i. River Ganga

Water quality of river Ganga was monitored at 7 locations namely Ghatiyaghat (Farrukhabad); a/c river Kali (Kannauj), Bithoor (Kanpur); D/s Kanput at Rajapur; U/s Prayagaraj at Kuresar ghat; at Sangam and D/s Prayagraj at Deehaghat. **Fig 6.43 and 6.44** shows the monitoring locations on river Ganga at Sangam and Deeha Ghat at Prayagraj (Uttar Pradesh), respectively. Based on the monitoring data, following observations are made:

- River water quality was meeting the primary water quality criteria for bathing w.r.t. DO at all the monitored locations of river Ganga during Magh Mela, 2023.
- In terms of BOD & FC, river Ganga water quality was not meeting primary water quality criteria of bathing at all locations during various occasions. However, range of DO, BOD and FC are as follows:

- River water at Farrukhabad was DO: 9-10.5 mg/l; BOD:<1-2.15 mg/l and FC:<1.8-26000 MPN/100 ml.
- River water quality a/c Kali-East was DO: 8.9-10 mg/l; BOD: 1.34-4.55 mg/l and FC: 450-11x10^4 MPN/100 ml.
- River water quality at Bithoor was DO: 8-9.8 mg/l; BOD: 1.02-6.03 mg/l and FC: <1.8-49000 MPN/100 ml.
- River water quality at D/s Kanpur was DO: 8-10 mg/l; BOD: 1.08-6.28 mg/l and FC: 6800-54x10^5 MPN/100ml.
- River Ganga water quality at Kuresar ghat was DO: 8-11.5 mg/l; BOD: 2.09-6.2mg/l and FC: 1.8-23x10^4 MPN/100 ml.
- River water quality at Sangam was DO: 8-11.5 mg/l; BOD: 1.8-5.8 mg/l and FC: 1.8-35x10^3 MPN/100 ml.
- River water quality at D/s Prayagraj (Deehaghat) was DO: 7.7-11.5 mg/l; BOD: 1.6-5.2 mg/l and FC: 1.8-23x10^3 MPN/100 ml.

Fig. 6.43 R. Ganga at Sangam, Prayagraj

Fig. 6.44 R. Ganga at Deeha Ghat, Prayagraj

ii. River Yamuna

Water quality of river Yamuna was monitored near Naini bridge. In river water, DO, BOD and FC ranges: DO: 7-11 mg/l; BOD: 1.19-9.78 mg/l and FC: 780-920000 MPN/100 ml. **Fig 6.45** shows the monitoring locations on River Yamuna before confluence with River Ganga in Prayagraj (Uttar Pradesh).

Fig. 6.45 R. Yamuna b/c R. Ganga, Prayagraj

iii. River Kali-East

Water quality of river Kali-East was monitored at Khudaganj, Kannauj b/c to river Ganga and river water quality w.r.t. DO, BOD and FC was 7-9.8 mg/l; 1.12-7.72 mg/l and 400-9200 MPN/100 ml, respectively.

iv. River Ramganga and its tributaries

Water quality of river Ramganga was monitored at 4 locations at Agwanpur, Katghar and Shahbad (Moradabad district) and Allahaganj, Farrukhabad.

- Water quality of river Ramganga at Agwanpur, which is upstream of Moradabad, was DO: 8.5-9.55 mg/l, BOD: BDL-6 mg/l, FC: 450- $20x10^2$ MPN/100 ml & Color: BDL-16 Hazen.
- The water quality of river Ramganga at Katghar bridge (after approximately 12.5 kms downstream) was DO: 5.6-7.8 mg/l, BOD: 6-8 mg/l, FC: $13x10^3$- $40x10^4$ MPN/100 ml & Color: BDL-28 Hazen.
- In the stretch from Agwanpur to Katghar, the 58 MLD STP at Gulab Bari, Moradabad (U.P.), and tributaries like Dhela discharge into the river. The Gulab Bari STP, with an installed capacity of 58 MLD, was discharging untreated sewage into river Ramganga, having BOD levels of 90 mg/l, COD of 267 mg/l, TSS of 245 mg/l, NO_3-N of 11.49 mg/l, and NH_3-N of 27 mg/l.
- Further, River Gagan meets river Ramganga in Moradabad after approximately 14 kms.
- Water quality of river Ramganga at Shahbad, Uttar Pradesh (located approximately 72 kms downstream of Katghar) was DO: 4-6.3 mg/l, BOD: 3-5 mg/l, FC:450-$22x10^2$ MPN/100 ml & Color: BDL-18 Hazen.
- Further, water quality of river Ramganga at Allahaganj (Farrukhabad) was DO:7.8-10.5 mg/l, BOD: 1.42-8.94 mg/l & FC: 1.8-7800 MPN/100 ml.

a) River Dhela

Water quality of River Dhela at 2 locations and 2 adjoining drains namely Pachhana drain and Dhandi drain was monitored. Pachhana drain (Flow-8.73-20.23 MLD, BOD-38-305 mg/l and

COD-136-646 mg/l) meets River Dhela and after traversing a distance of approximately 2.3 kms, Dhandi drain (Flow-71.12-145.15 MLD, BOD- 20-134 mg/l and COD-69-344 mg/l) meets river Dhela.

After confluence of Pachhana drain and Dhandi drain, water quality of River Dhela at Faridnagar, Thakurdwara (U.P.) was DO: 1.4-6.93 mg/l, BOD: 7-92 mg/l, FC: 17×10^4 - 45×10^4 MPN/100 ml & Color was 7-73 Hazen. The deterioration in water quality of river Dhela is attributed to discharge of wastewater from Pachhana drain and Dhandi drain & sewage from Kashipur city.

After approximately 41 kms downstream, water quality of river Dhela near Bhojpur Bridge (U.P.) was DO: 0.2-0.8 mg/l, BOD: 43-58 mg/l, FC: 27×10^3 – 49×0^4 MPN/100 ml & Color:51-91 Hazen. **Fig. 6.46 & 6.47** shows the sampling location of Pachhana drain and River Dhela a/c of Dhandhi drain at Faridnagar, Thakurdwara (U.P.).

Fig. 6.46 Pachhana drain on Kashipur-Thakurdwara Road, Kashipur (U.K.)

Fig. 6.47 River Dhela a/c Dhandi drain at Faridnagar, Thakurdwara (U.P.)

b) River Kosi

Water quality of river Kosi was monitored at 2 locations and 1 adjoining drain namely Rampur drain was also monitored. Water samples of river Kosi were collected at Rampur-Moradabad Road, Uttar Pradesh after confluence with river Bahela and water quality of River Kosi a/c of River Bahela & b/c Rampur drain was DO: 5.08-8.08 mg/l, BOD: 4-6 mg/l, FC: 140-680 MPN/100 ml & Color: BDL-16 Hazen. Thereafter, at approximately 33 kms downstream, Rampur drain (Flow-65.13-165.89 MLD, BOD-233-366 mg/l, COD-471-981 mg/l and TSS-629 mg/l) meets river Kosi at the left bank. After confluence with Rampur drain, water quality of river Kosi was DO: 4.01-8.17 mg/l, BOD: 5-11 mg/l, FC: 130-45x10^2 MPN/100 ml & Color: BDL-18 Hazen. **Fig. 6.48** shows the sampling location of River Kosi a/c of River Bahela and b/c of Rampur drain.

Fig. 6.48 River Kosi a/c of River Bahela & b/c Rampur drain

v. Status of drains

During pre-Magh Mela period, total 18 drains were monitored at Prayagraj, out of which 6 were tapped and 12 were untapped (11 discharging into R Ganga & 1 into R. Yamuna). Out of 12 untapped drains, interim remedial measures were observed at 6 drains.

During Post Magh Mela, 8 drains were found tapped and 10 were untapped. Out of untapped drains, interim remedial measures were observed at 7 drains out of which interim measure was found non-operational at one drain. The tapping status of drains monitored during Pre-Magh Mela and Post-Magh Mela is shown in **Table 6.10.** Pollution loads in terms of BOD load discharged from drains during Pre & Post Magh Mela are shown in **Table 6.11**.

Table 6.10 Tapping status of drains monitored during Pre-Magh Mela and Post-Magh Mela, 2023

Drains monitored	Tapping status	
	Pre-Magh Mela	Post-MaghMela
Ponghat	Tapped	Tapped
Kodra	Tapped	Tapped
Nehru	Untapped	Untapped
Rasulabaad-4/Rajapur	Untapped	Untapped
Mehdauri	Untapped	Untapped
Rasulabaad-3	Untapped	Untapped
Rasulabaad-2	Tapped (Overflow)	Tapped (Overflow)
Rasulabaad-1	Tapped	Tapped
Chuhara Mandir-2	Untapped	Untapped
Chuhara Mandir-1	Tapped	Tapped
Drain near Sadanand Ashram	Untapped	Untapped
Salori	Untapped	Untapped
Arail	Untapped	Tapped
Jhunsi	Untapped	Untapped
Chattnag	Untapped	Untapped
Mavaiya	Untapped	Tapped

Drains monitored	Tapping status	
	Pre-Magh Mela	Post-MaghMela
Mannaiya	Untapped	Untapped
Sasurkhaderi	Tapped	Tapped

Table 6.11 BOD load by untapped drains during Pre-Magh Mela and Post-Magh Mela, 0223

Sl. No.	Name of Drains	Pre-Magh Mela BOD Load (TPD)	Post-Magh Mela BOD Load (TPD)
1	Chatnag	1.25	0.59
2	Arail	0.002	-
3	Manaiya	0.12	2.48
4	Mavaiya	3.82	-
5	Sadanand ashram	0.002	0.003
6	Chuhara mandir-II	0.42	0.46
7	Salori	1.64	4.75
8	Jhunsi	0.001	0.05
9	Nehru	0.03	0.06
10	Mehdauri	0.13	0.18
11	Rasulabad 2	-	0.09
12	Rasulabad 3	0.21	0.29
13	Rasulabad 4	1.41	2.6
	Total	**9.04**	**11.55**

vi. Compliance status of STPs at Prayagraj

In total, 8 STPs were monitored at Prayagraj and during Pre-Magh Mela monitoring all were found non-complying against the treated sewage discharge norms prescribed by the Hon'ble NGT vide order dated 30/04/2019 in O.A. No. 1069/2018. During Post-Magh Mela, out of 8 STPs, non-compliance w.r.t. FC was observed in 3 STPs namely Ponghat (2000 MPN/100 ml), Kodra (2000 MPN/100 ml) & Rajapur (33000 MPN/100 ml). **Table 6.12** gives the detailed status of these STPs.

Table 6.12 Status of STPs during Pre-Magh Mela and Post-Magh Mela, 2023

Name of STPs	Pre-Magh Mela				Post-Magh Mela			
	Avg. Utilized Capacity (MLD)	Operational Status	Compliance status		Avg. Utilized Capacity (in	Operational Status	Compliance status	
			NGT	MoEF&CC			NGT	MoEF&CC

Ponghat (10 MLD)	13.36	Over Capacity	Not Complying w.r.t. T. Nitrogen, BOD and COD	Complying	12.8	Over Capacity	Not Complying w.r.t. FC	Not Complying w.r.t. FC
Kodra (25 MLD)	27.69	Over Capacity	Not Complying w.r.t. BOD, COD & FC	Not Complying w.r.t. FC	28.84	Over Capacity	Not Complying w.r.t. FC	Not Complying w.r.t. FC
Salori (29 MLD)	38.01	Over Capacity	Not Complying w.r.t. TSS, T. Nitrogen, BOD & COD	Complying	44.39	Over Capacity	Complying	Complying
Salori (14 MLD)	14.53	Over Capacity	Not Complying w.r.t. T. Nitrogen	Complying	16.08	Over Capacity	Complying	Complying
Numayadahi (50 MLD)	58.21	Over Capacity	Not Complying w.r.t. T. Nitrogen & BOD	Complying	59.51	Over Capacity	Complying	Complying
Naini (80 MLD)	104.18	Over Capacity	Not Complying w.r.t. BOD & COD	Complying	124.71	Over Capacity	Complying	Complying
Naini 2 (42 MLD)	Trial run	--	Not Complying w.r.t. BOD & T. Nitrogen	Complying	35	Under capacity	Complying	Complying
Rajapur (60 MLD)	78.62	Over Capacity	Not Complying w.r.t. BOD & COD	Complying	78.47	Over capacity	Not complying w.r.t FC	Not complying w.r.t FC

6.4.3 Action taken

1. Directions issued to UKPCB & UPPCB under section 18 (1) (b) of the Water (Prevention and Control of Pollution) Act, 1974 for ensuring pollution free condition of river Ganga at Prayagraj during Magh Mela, 2023.

2. CPCB issued letters to UKPCB (02) and UPPCB (02):

- To identify pollution sources responsible for high pollution in river Dhela at Faridnagar, Thakurdwara;
- To identify pollution sources responsible for high pollution in Dhandi and Rampur drain and take immediate necessary action to effectively control polluting sources;
- To direct concerned authorities to remove the solid waste dumped in Rampur drain and dispose it safely; and
- To take necessary action against the operating agency of 58 MLD Gulab Bari STP, Moradabad (U.P.) for improper operation of the STP and ensure that STP shall not discharge any untreated sewage into river Ramganga.

6.5 Pollution source mapping of River Hindon

River Hindon is an important tributary of River Yamuna, which flows between River Ganga (right side) and River Yamuna (left side) for approx. 400 Kms. River Hindon originates in the Saharanpur district of Uttar Pradesh at a distance of about 3 to 4 Kms from the Barsani Falls inside the dense forest area of Upper Siwalik region (lower Himalayas) and traverses through Muzaffarnagar, Meerut, Baghpat, Ghaziabad and Gautam Buddh Nagar districts before joining River Yamuna at Greater Noida. It is purely a rain fed river with a catchment area of about 7,083 Sq. Kms. Dhamola, Kali-West and Krishni are three major tributaries of River Hindon.

6.5.1 Work accomplished during 2023

Monitoring of River Hindon, its tributaries and adjoining drains were carried out during Nov'22 - Mar'23 by teams of officials from CPCB, UPPCB and UKPCB. River water sampling was carried out at 66 river locations (Hindon-34, Kali West- 21, Dhamola-4, Krishni-5 and Yamuna-2) (**Fig. 6.49**). A total of 55 adjoining drains of rivers Hindon (26), Kali-West (17), Dhamola (5), Krishni (4) and Yamuna (3) were also monitored (**Fig. 6.50**). Ground water sampling was carried out at 31 locations. The objectives of the monitoring were:

a) Mapping of Rivers Hindon, Kali-West, Dhamola & Krishni and identifying major adjoining drains of the rivers;
b) Characterization of water quality of rivers at various locations;
c) Identification, quantification, and characterization of major drains discharging into rivers;
d) Performance assessment of STPs in Saharanpur, Muzaffarnagar and Ghaziabad districts;
e) Groundwater monitoring & quality assessment and
f) Survey of river Hindon and its tributaries for the preparation of River rejuvenation action plan.

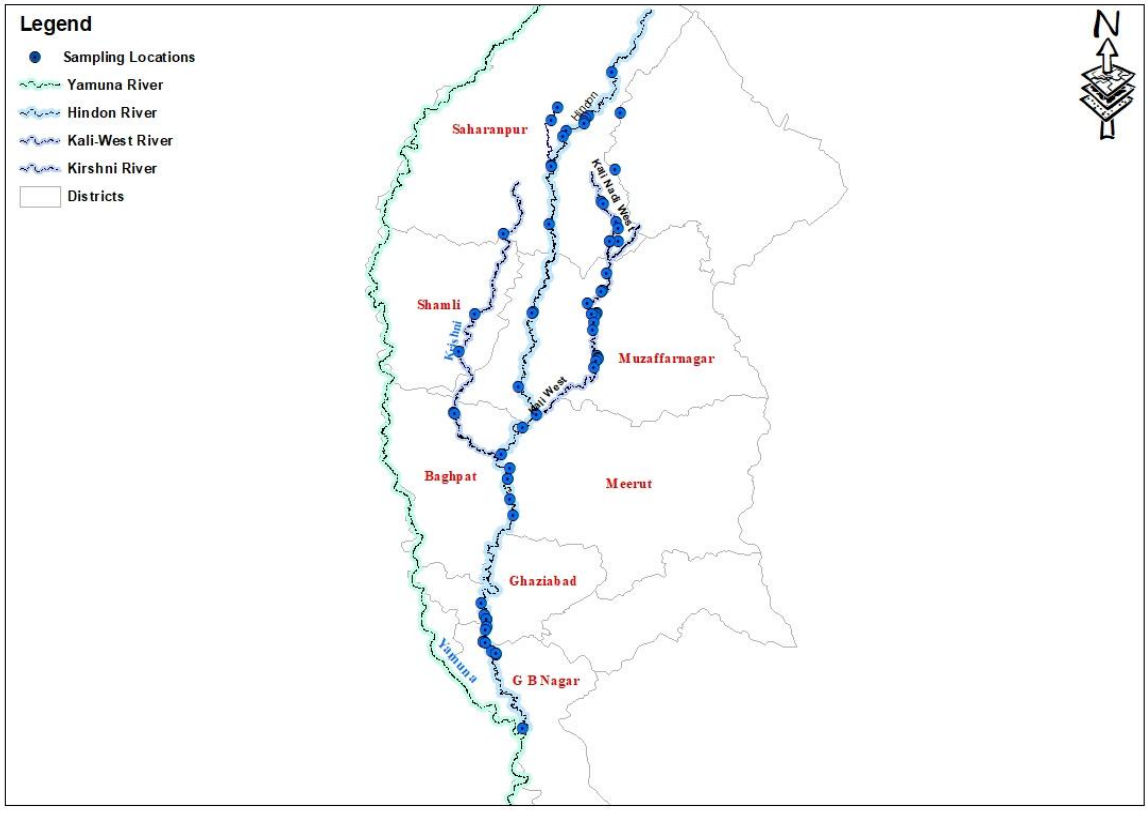


Fig. 6.49 Monitoring locations on Rivers Yamuna, Hindon, Kali-West and Krishni

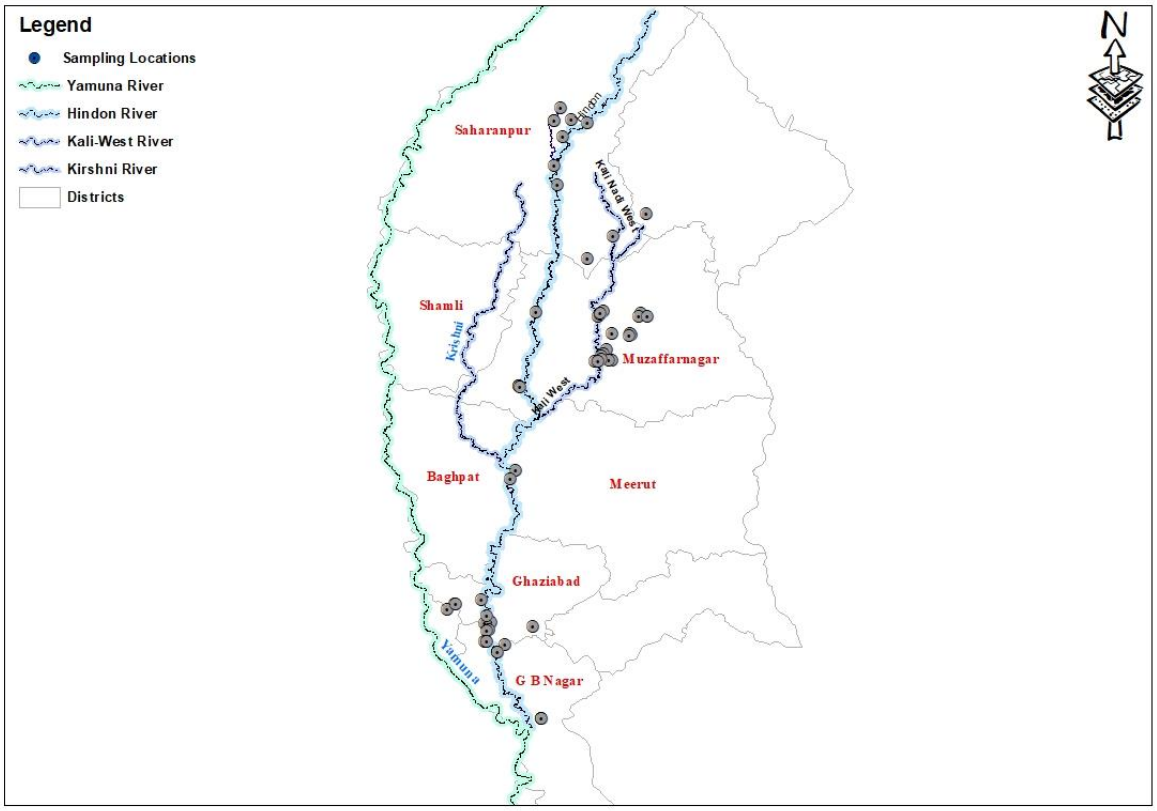


Fig. 6.50 Drains adjoining Rivers Yamuna, Hindon, Kali-West and Krishni

Flow diagram indicating water quality of river Hindon, Dhamola, Kali-West & Krishni from origin to confluence is shown **Fig. 6.51-6.54**.

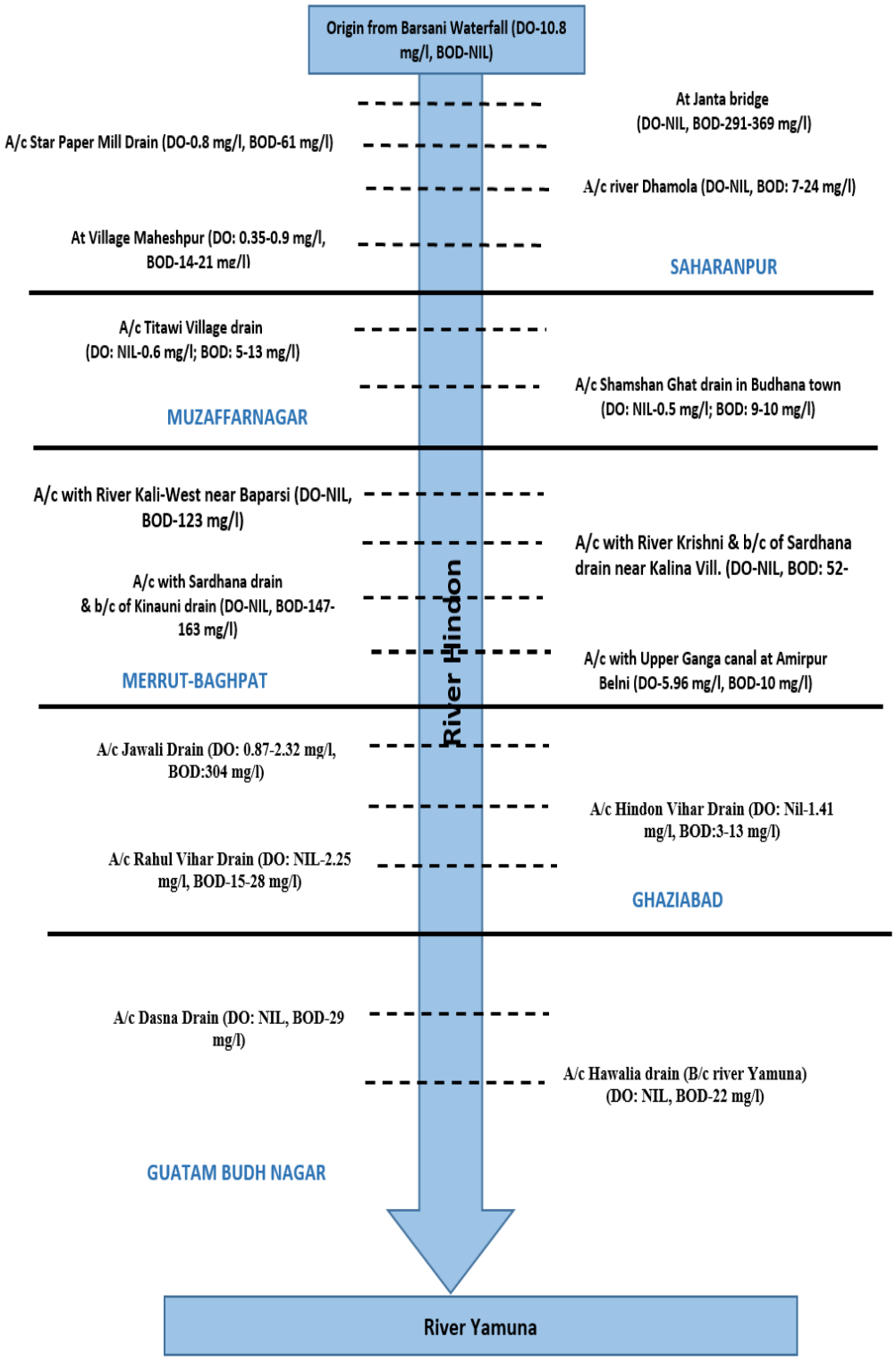


Fig. 6.51: Flow diagram of river Hindon from origin to confluence in river Yamuna

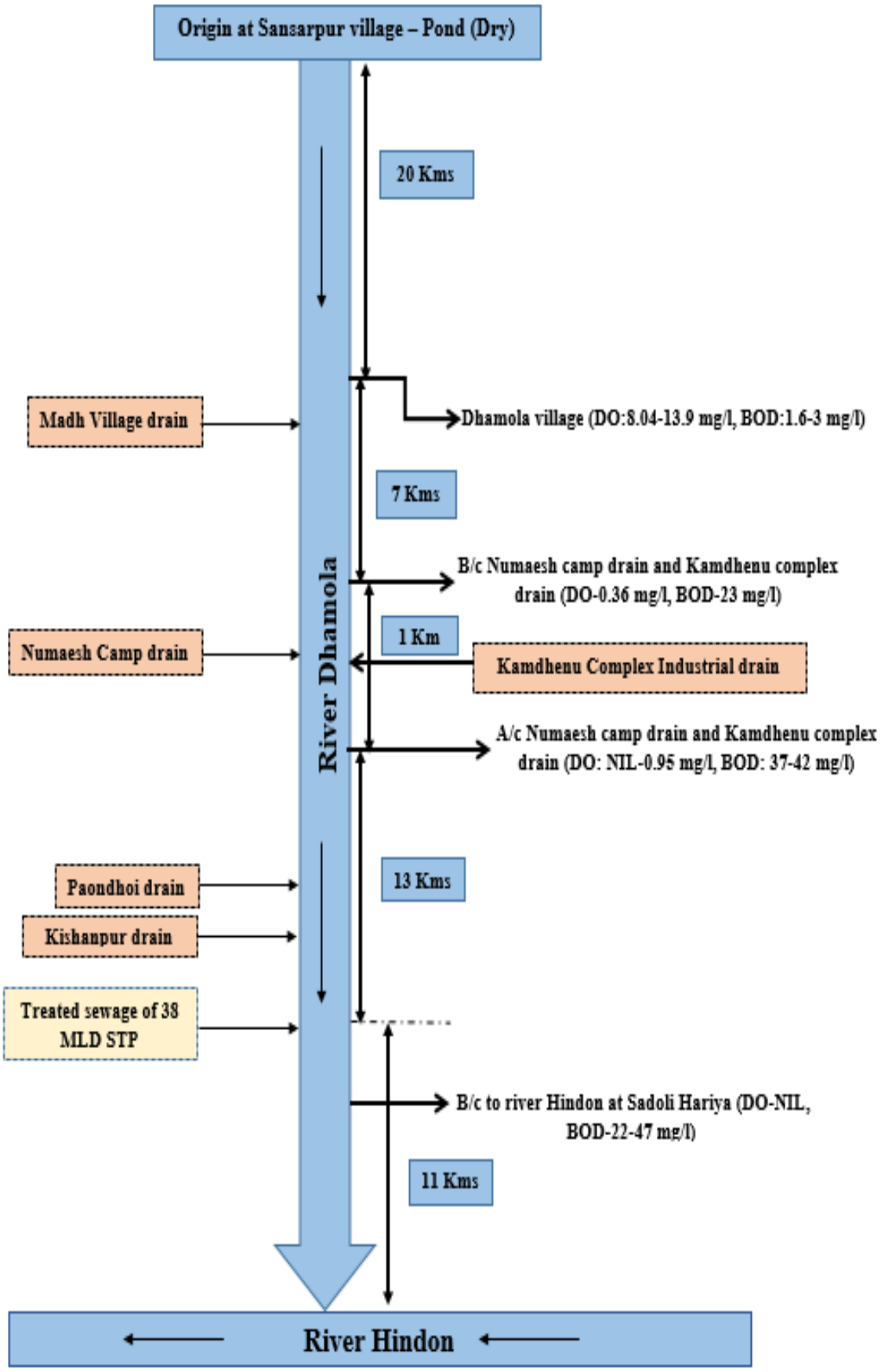


Fig. 6.52: Flow diagram of river Dhamola from origin to confluence in river Hindon

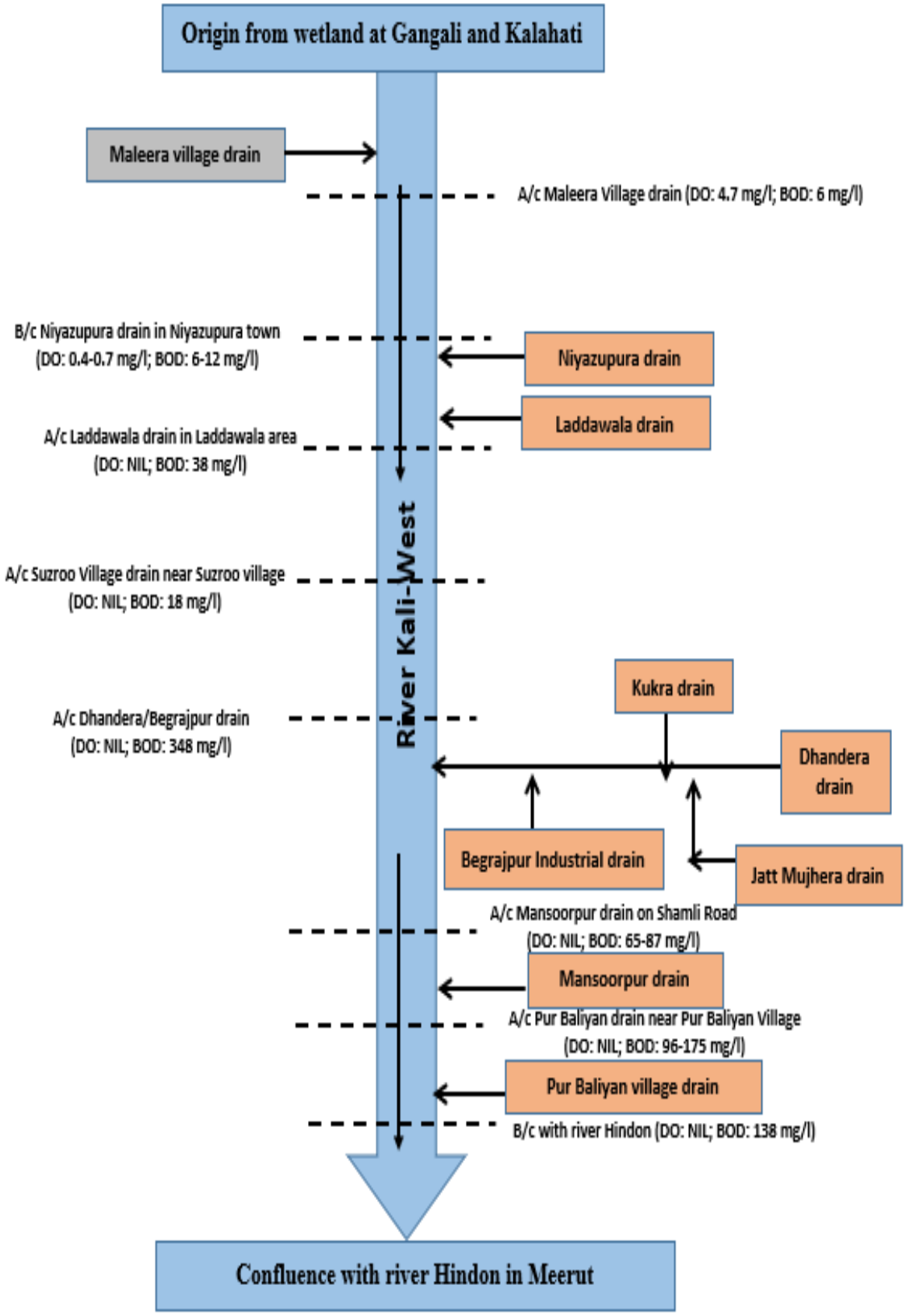


Figure 6.53: Flow diagram of river Kali-West from origin to confluence in river Hindon

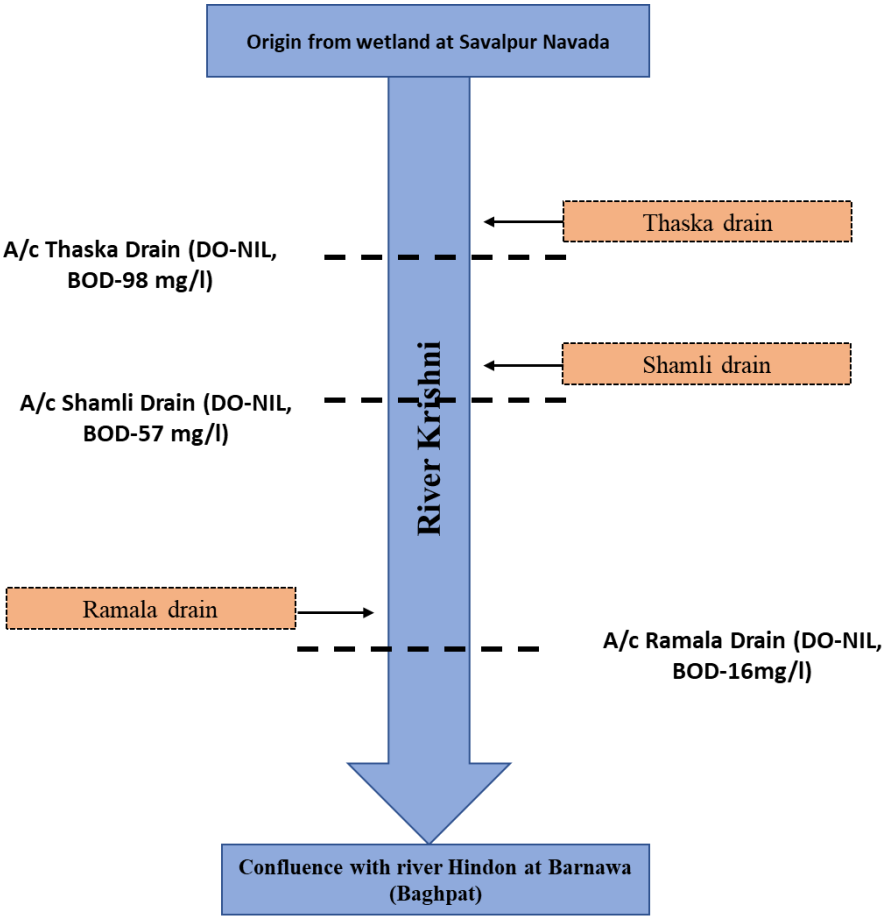


Figure 6.54: Flow diagram of river Krishni from origin to confluence in river Hindon

6.5.2 Data Generation and Salient Findings

i Water Quality of Rivers and Drains

A total of 55 adjoining drains of river Hindon (26), Kali-West (17), Dhamola (5), Krishni (4) and Yamuna (3). Based on BOD and COD values, the categorization of drains has been done:

BOD (mg/l)	No. of drains	COD (mg/l)	No. of drains
0-50	11	0-250	16
51-100	15	250-500	18
101-150	4	501-1000	11
151-250	12	>1000	8
>250	11	Dry/no significant flow	2
Dry/no significant flow	2		

River locations/stretches having BOD>10 mg/l are considered as polluted. The adjoining drains having BOD>150 mg/l, COD>450 mg/l, Color>75 Hazen, Chloride>1000 mg/l, TDS>1000 mg/l, TSS>500 mg/l, NH_3-N>50 mg/l, acidic pH (<5) which are not the typical characteristics

of domestic drains and high metal concentrations (exceeding general discharge standards prescribed in Environmental (Protection) Rules, 1986) are considered polluted.

Based on the monitoring data, total 17 river stretches/locations (Saharanpur-07, Shamli-01, Muzaffarnagar-03, Meerut-02, Ghaziabad-02 & Gautam Budh Nagar-02) were identified polluted having BOD>10 mg/l. Discontinuity of flow, dry stretch of river and encroachment of river bed was observed at many places before confluence of Star paper mill drain. The river gained flow only after receiving effluent from the Star Paper Mill drain. Hot spots of pollution in monitored rivers are listed in **Table 6.13** and also categorized in Priority level I & II.

Priority Level I: River impacted by discharge of industrial wastewater

Priority Level II: River is dry/encroached or impacted by discharge of domestic wastewater

Table 6.13 Hotspots of pollution in rivers stretches

Sl. No.	Hotspot	Priority drains and stretches (if any)	Details of pollution sources in the catchment	Level of Priority (I/II)
Saharanpur District				
RIVER HINDON				
1.	Origin to B/c of Star Paper Mill drain, Saharanpur	• No adequate flow (dry in lean season)	-	II
2.	Janta Road Bridge, Saharanpur-Dehradun Road (Saharanpur)	• Stagnant highly polluted wastewater at Janta Road Bridge	• Stagnant polluted wastewater at Janta Road Bridge. • Slaughter House -01 and Board Mills-04 in nearby catchment	I
3.	A/c Star Paper Mill drain to Village Maheshpur (Saharanpur)	• Star Paper Mill Drain (Mixed drain) • River Dhamola • Bajaj Sugar Mill Drain (Mixed drain)	• Star Paper Mill Drain: GPI-01 (Star Paper Mill) • Dhamola river: GPI-21 & non-GPI-01 • Bajaj Sugar Mill Drain: GPI -01	I
RIVER DHAMOLA				
4.	A/c of Numaesh camp drain and KD complex industrial drain (Saharanpur) to A/c of Kishanpur drain (B/c to river Hindon at Sadoli Hariya)	• KD Complex Industrial drain • Paondhoi drain • Kishanpur drain	• KD Complex Industrial Drain: GPIs -04 (Textile) • Paondhoi drain & Kishanpur drain: Sewage from Saharanpur city	I
RIVER KRISHNI				
5.	A/c of Thaska drain	• Thaska drain (Mixed drain), Saharanpur	• Thaska drain: GPI-03 • Sikka drain: GPI-01 • Shamli drain: GPI-03	I

Sl. No.	Hotspot	Priority drains and stretches (if any)	Details of pollution sources in the catchment	Level of Priority (I/II)
		• Sikka drain (Mixed drain), Shamli • Shamli drain (Mixed drain), Shamli		
RIVER KALI-WEST				
6.	Origin to Dharmpur village	River encroached by farmers for farming and cultivation purposes.	-	II
7.	A/c of Sheela drain	Sheela Drain (carries wastewater of industrial area of Roorkee)	Sheela Drain: 16 Nos. industries of Industrial Areas of Roorkee	I
Shamli District				
RIVER KRISHNI				
8.	B/c of Sikka drain to A/c of Shamli drain	• Shamli drain (Mixed drain), Shamli	• Shamli drain: GPI-03	II
Muzaffarnagar District				
RIVER HINDON				
9.	B/c of Titawi village drain to A/c of Shamshan Ghat drain (Budhana)	• Titawi village drain • Dhobi Ghat drain • Sabzi Mandi drain • Shamshan Ghat drain	• Titawi village drain: GPI-01 • Dhobi Ghat drain and Sabzi Mandi drain: No industrial unit information available	I
RIVER KALI-WEST				
10.	A/c of Niyazupura drain to A/c of Suzroo village drain	• Niyazupura drain • Laddawala drain • Shamli Road drain • Khadarwala drain • Krishnapuri drain • Suzroo village drain	• Niyazupura drain, Laddawala drain, Shamli Road drain, Khadarwala drain, Krishnapuri drain, Suzroo village drain: No industrial unit information available, MSW dumping along drains	II
11.	A/c of Dhandera drain to A/c of Pur Baliyan drain	• Dhandera drain ✓ Jatt Mujhera drain (subsidiary drain of Dhandera) ✓ Kukra drain (subsidiary drain of Dhandera) ✓ Begrajpur Industrial drain (subsidiary drain of Dhandera)	• Dhandera/Begrajpur drain: 45 units ✓ Dhandera drain: 32 units (29 GPIs & 03 non-GPIs) comprising of Pulp & Paper, Slaughter House, Tannery, Pharmaceuticals & Food Processing industries ✓ Jatt Mujhera drain: 05 GPIs (Pulp & Paper and Distillery)	I

Sl. No.	Hotspot	Priority drains and stretches (if any)	Details of pollution sources in the catchment	Level of Priority (I/II)
		• Mansoorpur drain • Pur Baliyan drain	✓ Kukra Drain: 02 GPI ✓ Begrajpur Industrial drain: 06 non-GPIs (Pharmaceuticals & Dyeing) • Mansoorpur drain: 02 GPIs • Pur Baliyan drain: No industrial unit identified, Deposition of MSW and Cattle dung along drain	
Meerut District				
RIVER HINDON				
12.	A/c of river Kali-West to confluence of river Krishni (Meerut–Baghpat border)	• River Kali West • River Krishni	Discharge of untreated/partially treated industrial wastewater and sewage from Muzaffarnagar district.	I
13.	A/c of Sardhana drain (Meerut) to B/c of Upper Ganga Canal near Pura village (Baghpat)	• Sardhana drain • Kinauni drain	• Sardhana drain: GPI-03 and Non-GPI-01, disposal of cattle dung along drain • Kinauni drain: GPI-02	I
Ghaziabad District				
RIVER HINDON				
14.	B/c of Jawli drain to A/c of Hindon Vihar drain	• Jawli Drain • Raj Nagar Extension Drain (domestic drain) • Karedha Drain (mixed drain) • Hindon Vihar drain ✓ Hindon Vihar Left Drain (domestic drain) ✓ Hindon Vihar Right Drain (domestic drain)	• Jawli Drain: CETP (Tronica City) -43 GPIs: Yarn/Textile Dying/bleaching/processing unit, 1 Non-GPI: Yarn/Textile processing • Raj Nagar Extension Drain- No industrial unit identified • Karedha Drain- GPIs: 09 & non-GPI: 01, Additional paper printing, automobile service, furniture molding and fabrication, glass printing, MS wire drawing, electrical cable manufacturing and processing units reported • Hindon Vihar Left and Right- No industrial unit identified, high deposition of cattle dung	I

Sl. No.	Hotspot	Priority drains and stretches (if any)	Details of pollution sources in the catchment	Level of Priority (I/II)
			along drain and dairy cattle farming observed along drain.	
15.	B/c of Rahul Vihar drain to A/c of Rahul Vihar drain	• Rahul Vihar drain (domestic drain)	• Rahul Vihar drain- No industrial unit identified, MSW dumping along drain	II
Gautam Buddha Nagar District				
16.	A/c of Rahul Vihar Drain to B/c of Dasna drain	• Inventory of drains was not provided by UPPCB • Bahlolpur drain monitored regarding public complaint • Monitoring team reported many such drains discharging from both banks	• Illegal industrial units operation reported in complaint. UPPCB informed that electricity supply of 16 industrial units in Bahlolpur drain has been disconnected.	I
17.	A/c Dasna Drain	• Dasna drain ✓ Bhoorgarhi – Kalugarhi Drain (subsidiary drain of Dasna) ✓ B.S. Road Drain (subsidiary drain of Dasna)	• Dasna Drain: 11 GPI ✓ Dasna drain :04 ✓ Bhoorgarhi – Kalugarhi Drain :07 GPIs: Pulp & Paper (01), Tannery (02), Metal Surface Treatment (01), Slaughter House (03) ✓ B.S. Road Drain: No industrial unit identified	II

Actions required to improve water quality of River Hindon and its tributaries namely Rivers Dhamola, Krishni and Kali-West are illustrated in ***Appendix 6.11-6.16*.**

Total 36 drains identified as hotspot drains which needs urgent action required (Saharanpur-08, Shamli-01, Muzagffarnagar-15, Meerut-02, Ghaziabad & Gautam Budh Nagar-10) (**Table 6.14**).

Table 6.14 Hotspots Drains

Sl. No.	Hotspot drains	River	BOD (mg/l)	COD (mg/l)
Saharanpur district				
1.	Star Paper Mill drain	Hindon	61-198	181-338
2.	Bajaj Sugar Mill Drain	Hindon	20-74	82-211

Sl. No.	Hotspot drains	River	BOD (mg/l)	COD (mg/l)
3.	Nagdehi drain	Hindon	34-237	103-349
4.	KD Complex Industrial drain	Dhamola	28-204	142-545
5.	Pandhoi drain	Dhamola	64	170
6.	Kishanpur drain	Dhamola	206	347
7.	Sheela drain	Kali-West	365	702
8.	Thaska Drain	Krishni	98	354
Shamli district				
9.	Shamli drain	Krishni	48	254
Muzaffarnagar District				
10.	Titawi village drain	Hindon	190-197	373-399
11.	Dhobi Ghat drain	Hindon	180-574	455-1435
12.	Sabzi Mandi drain	Hindon	115-267	273-800
13.	Niyazupura drain	Kali-West	119-230	398-522
14.	Laddawala drain	Kali-West	163-259	504-1150
15.	Shamli Road drain	Kali-West	117-202	291-694
16.	Khadarwala drain	Kali-West	164	598
17.	Krishnapuri drain	Kali-West	122	444
18.	Suzroo village drain	Kali-West	63-111	224-571
19.	Dhandera drain	Kali-West	20-1114	90-2413
20.	Jatt Mujhera drain	Kali-West	103-2230	280-4264
21.	Kukra Drain	Kali-West	62	219
22.	Begrajpur Industrial drain	Kali-West	187-936	474-3444
23.	Mansoorpur drain	Kali-West	60-579	222-1426
24.	Pur Baliyan drain	Kali-West	174-252	425-520
Meerut District				
25.	Sardhana drain	Hindon	263-460	770-1555
26.	Kinauni drain	Hindon	-	-
Ghaziabad District				
27.	Jawli Drain	Hindon	33-55	107-221
28.	Karedha Drain	Hindon	139-167	529-639
29.	Hindon Vihar Drain (Right & Left)	Hindon	169-639	574-2018
30.	Kaila Bhatta Drain • 12 GPIs: Pharmaceutical (02), Metal Surface Treatment (08), Textile (01), Tannery (01) • 3 Non-GPI: Pharmaceutical (01), Engineering (01) and Others paper board (01)	Hindon	71	278
31.	Arthala Drain • 1 GPI: Distillery & 1 Non-GPI	Hindon	52	208
32.	Pratap Vihar Drain	No industrial unit identified	102	422
33.	Rahul Vihar Drain	No industrial unit identified	176-206	736-743

Sl. No.	Hotspot drains	River	BOD (mg/l)	COD (mg/l)
34.	Dasna Drain (confluence with river in Gautam Buddha Nagar) ✓ Bhoorgarhi – Kalugarhi Drain ✓ B.S. Road Drain	Hindon	73	356
Shahdara Drain (River Yamuna)-Ghaziabad Stretch				
35.	Sahibabad Drain • 73 GPIs: Dairy (02), Engineering (01), Metal Surface Treatment (19), Pharma (01), Pulp & Paper (01), Slaughter house and Meat (06), Yarn/Textile processing (41), Textile Dyeing (02); • 2 Non-GPI: Metal Surface Treatment (01), Yarn/Textile processing (01) GPIs: Pulp & Paper (01), Tannery (02), Metal Surface Treatment (01), Slaughter House (03)	Yamuna	155	489
36.	Indirapuri Drain ✓ Banthala drain • No industrial unit identified in Indirapuri drain • Illegal industrial units operating in the catchment of Banthala drain: Soap manufacturing unit (01) (Non-operational); Metal processing (04) treatment by using acids; Garment washing unit without ETP (01).	Yamuna	90	242

ii ***Groundwater Quality***

To assess groundwater quality, total 31 samples of groundwater were collected from borewell/ hand pumps and tube wells from six districts – Saharanpur (8 Samples), Muzaffarnagar (8 Samples), Meerut (3 Samples), Baghpat (2 Samples), Ghaziabad (7 Samples), and Noida/ Greater Noida (3 Samples) within 500 meters' radius of river Hindon and its tributaries. The pH of the groundwater in the study area varied from 7.0 to 8.0 thus all groundwater samples falls under neutral pH range of water (6.5 - 8.5). The total dissolved solids content of groundwater varied from BDL to 1470 mg/l. Colour ranged from BDL to 78 Hazen. COD varied from BDL to 35 mg/l. The Chloride and Fluoride varies from 8 to 648 mg/l and BDL to 1.7 mg/l respectively. The result indicates that the groundwater quality in the study area is moderately hard to very hard.

Groundwater quality index suggest that around 55% of sample collected is of excellent water quality, 19.3% of good water quality, 19.3% of poor water quality, 3.2% of very poor water quality and rest 3.2% of water unsuitable for drinking (**Table 6.15**).

Table 6.15 Overall Water Quality Index of Groundwater

WQI value	Water quality	No. of samples	Percentage of samples
<50	Excellent	17	55
50-100	Good water	6	19.3
100-200	Poor water	6	19.3
200-300	Very poor water	1	3.2
>300	Water unsuitable for drinking	1	3.2

iii Sewage management

For the treatment of sewage generated in river Hindon basin, 15 STPs with total installed capacity of 759.5 MLD have been installed. Utilized capacity of the commissioned STPs is approximately 495.4 MLD. Inspection of 10 STPs carried out during Nov' 2022. Based on analysis results, STPs receives sewage with BOD ranging from 15 mg/l to 157 mg/l, COD ranging from 95 mg/l to 467 mg/l as compared to typical municipal wastewater (BOD: 200-250 mg/l, COD: 350-500 mg/l), The STPs are mostly found non-complying with respect to the discharge norms. Weak strength sewage was received at inlet (BOD-15 mg/l) of 56 MLD STP Bapudham, Ghaziabad. The compliance status of the STPs is shown in **Table 6.16.**

Table 6.16 Compliance status of STPs in river Hindon basin

S. No.	Name of STPs	Treatment Technology	Designed Capacity (MLD)	Utilized capacity (MLD)	Compliance Status as per NGT standards
1.	STP, Mahilpur, Saharanpur	UASB	38	38	Non-complying w.r.t. COD, TSS, FC
2.	STP, Nagar Palika, Muzaffarnagar	Oxidation Pond	32.5	17	Non-complying w.r.t. BOD, COD, TSS & FC
3.	Indirapuram STP 74 MLD, Ghaziabad	SBR	74	74	Non-complying w.r.t. BOD, COD, TSS, TN, FC
4.	Indirapuram STP 56 MLD, Ghaziabad	SBR	56	50	Non-complying w.r.t. BOD, COD, FC
5.	Indirapuram STP 56 MLD, Ghaziabad	UASB	56	56	Non-complying w.r.t. BOD, COD, TSS, TN, FC
6.	Dudahaida-3 STP 70 MLD, Vijay Nagar, Ghaziabad	UASB	70	70	Non-complying w.r.t. COD, BOD, TSS, total nitrogen, FC
7.	Dudahaida STP 56 MLD, Vijay Nagar, Ghaziabad	SBR	56	56	Non-complying w.r.t. COD & FC
8.	Morty STP Rajnagar Extension 56 MLD, Ghaziabad	SBR	56	22.5	Non-complying w.r.t. FC
9.	Govindpuram STP 56 MLD, Ghaziabad	SBR	56	12.38	Complying

S. No.	Name of STPs	Treatment Technology	Designed Capacity (MLD)	Utilized capacity (MLD)	Compliance Status as per NGT standards
10.	Bapudham-Madhuban STP 56 MLD, Ghaziabad	SBR	56	1.5	Complying

iv Industrial Pollution

During inspections carried out in 2021-22, total 373 Grossly Polluting Industries (GPIs) were found operating in river Hindon stem states (Uttarakhand-10; Uttar Pradesh-363). Sector and State wise number of GPIs of River Hindon is shown in **Table 6.17.** Other than GPI many Board manufacturing units, small scale industrial units and waste recycling units are also operating in catchment of river Hindon.

Table 6.17 Sector and State wise number of GPIs

Sector	Uttar Pradesh	Uttarakhand	Grand Total
Distillery	8	1	9
Food & Beverages	7	1	8
Others	4	0	4
Pharmaceutical	1	0	1
Pulp & Paper	45	6	51
Slaughter House	8	0	8
Sugar	13	2	15
Tannery	6	0	6
Textile	271	0	271
Grand Total	**363**	**10**	**373**

Wastewater discharge and pollution load in terms of BOD in River Hindon by 373 GPIs was found about 44365 KLD and about 1873 kg/day respectively. Highest wastewater discharge and pollution load in terms of BOD was contributed by pulp & paper sector i.e., 50 % wastewater and 25 % of BOD load is from pulp & paper sector GPIs. Second highest effluent discharge and pollution load in terms of BOD in River Hindon was contributed by Sugar sector i.e., 24 % wastewater discharge and 16.84 % of BOD load is from Sugar sector GPIs. Sector wise effluent discharge and BOD load in River Hindon is shown in **Table 6.18**.

Table 6.18 Sector wise effluent discharge and BOD load in River Hindon by GPIs

Sector	No of units	Effluent Discharge (KLD)	BOD load (kg/day)
Distillery	9	0	0
Food & Beverages	8	1676.74	360.7
Others	4	1453.55	51.47
Pharmaceutical	1	170.97	3.59
Pulp & Paper	51	22310.01	473.17
Slaughter House	8	1041.46	28.02
Sugar	15	10648.47	315.5
Tannery	6	87	1.81

Sector	No of units	Effluent Discharge (KLD)	BOD load (kg/day)
Total	373	44365.93	1873.45
		44.4 MLD	**1.87 TPD**

Salient features of the action plan proposed for restoration water quality of river Hindon and its tributaries

i. Industrial Pollution Control

Following action plan needs to be implemented for restoration of polluted river stretches and overall improvement in the river ecosystem

- Inventory of unregistered industrial/processing units (water-polluting small and medium-scale industries, including board mills, textile wet processing, recycling units for metal, battery, e-waste, and other hazardous waste). Closure/sealing of such units till they obtain CTO & have adequate functional ETP and should be brought under the ambit of GPIs and subjected to annual inspections under the Namami Gange Programme and quarterly by SPCB. [Action: SPCB, ULBs & Industrial Units]
- Setting up of new CETPs in industrial clusters: [Action: NMCG, UPPCB & Industrial Development Corporation]:

Table 6.19 Details of industrial clusters, type of clusters and number of units

S. No.	District	Industrial Cluster	Type	No. of Units
1.	Saharanpur	River Dhamola & KD Complex drain	Mixed	~15 (Textile) and others
2.	Ghaziabad	Roop Nagar & Arya Nagar (Loni)	Textile	~ 80
3.	Ghaziabad	Sahibabad Site-4	Mixed	~ 60
4.	Ghaziabad	Karedha Industrial Area	Mixed	~ 10 and many recycling/processing units
5.	G. B. Nagar	Surajpur Industrial Area	Mixed	~14 (Textile) and others

- Small scale industries (BOD>100 mg/l and COD>250 mg/l) shall not be permitted to operate using batch effluent treatment process until a continuous secondary biological wastewater treatment system is installed or they should be shifted on ZLD/dry process or should connect to CETP. [Action: UPPCB & Industrial units]
- Immediate action to address pollution hotspots in drains/rivers stretches [Action: SPCB, District Administration & Industries]
- SPCB shall prepare an action plan in consultation with industries until water quality is improved (BOD<10 mg/l in river and BOD<150 mg/l & COD<450 mg/l in drains).
- Collective accountability of industrial units in hotspot river stretch/drain should be fixed by UPPCB in case river/drain water characteristics indicate industrial pollution. Compliance should also be checked in terms of drains water quality.

Sugar:

- Total Sugar Mills: 15 (6- standalone, 3- sugar with cogen, 5- Sugar refinery)
- Target to individual sugar mill to train sugarcane-growing farmers under their command area with an emphasis to adopt drip irrigation instead of flood irrigation method by setting annual target of covering 20% land for groundwater conservation. Irrigation of all the command area by using drip irrigation method within five years. Limiting specific fresh water consumption in sugar mills:
  - Standalone & Sugar with co-gen: <55 Lit/tonne of cane crushed
  - Refinery & Refinery with co-gen: <80 Lit/tonne of cane crushed

  and specific effluent discharge not to exceed:
  - Standalone & Sugar with co-gen: <135 Lit/tonne of cane crushed
  - Refinery & Refinery with co-gen: <150 Lit/tonne of cane crushed
- Implementation of Charter for water recycling and pollution prevention in sugar units

[Action: Sugar Units & SPCB; Timeline for proposed action plan: 3 months]

Distillery:

- Total Distilleries: 10 (2 reported non-operational)
  - ZLD route: Incineration-7, Biocompositing-1, CPU installed: 8, MEE installed: 8
- In distilleries limiting specific fresh water consumption- B & C Heavy: 8 to10 KL/KL of product, for cane syrup & sugarcane juice: 6 to 8 KL/KL of product and specific spent wash generation rate not to exceed- 6 to 8 KL/KL of product, for cane syrup & sugarcane juice: 4 to 6 KL/KL of product.
- Identification of the recipient drain near the unit and monitoring on monthly basis by concerned SPCB
- Implementation of Charter for water recycling and pollution prevention in distillery units

[Action: Distillery Units & SPCB; Timeline for proposed action plan: 3 months]

Pulp & Paper:

- Total Pulp & Paper units: 51 (Operational- 47, non-operational- 4)
  - Wood based: 01, Agro based: 03, Waste paper based: 42, Market based pulp: 01
- Paper board making industries to be covered under the list of GPIs. No chemical pulping or wet strength pulping to be allowed without chemical recovery plants (CRPs).
- Pulp & Paper and Paper board making units should implement the Charter for water recycling and pollution prevention.

[Action: Pulp & Paper Units & SPCB; Timeline for proposed action plan: 3 months]

Textile:

- Inventory of textile units performing wet processing.
- Textile units performing wet processing (desizing, scouring, mercerization and bleaching), dyeing & printing and finishing (including washing) should have complete ETP comprising of secondary biological treatment units of adequate capacity operating on continuous basis (round the clock) or they should become member of CETP. In case, unit is a member of CETP, they should have Primary Effluent Treatment Plant (PETP) of adequate capacity to meet the inlet norms of concerned CETP. If unit is standalone and operate in batches and effluent generation is not enough to run the ETP on continuous basis, the unit may be shifted to the dry processes (knitting, weaving, spinning, finishing, stitching, etc.) and machinery used in wet processing shall be dismantled.
- Textile units should implement the Charter for water recycling and pollution prevention in all aspects.

[Action: Textile Units & SPCB; Timeline for proposed action plan: 6 months]

ii. Dairy/Cattle Farming Activities:

- Restriction of dairy/cattle farming operation along the bank of rivers/water bodies/drains. Dairy farms should have adequate infrastructure by their own to ensure proper handling, treatment and disposal of solid wastes and wastewater or become the member of a common facility. Concerned ULBs shall develop management plan for transportation and disposal of cattle dung/waste and shall impose user charges accordingly on each dairy farm.
- Dairy farms or Gaushalas shall follow the "Guidelines for Environmental Management of Dairy Farms and Gaushalas" issued by CPCB.

[Action: Dairy farming Operator, ULBs & SPCB; Timeline for proposed action plan: 6-12 months]

iii. River Restoration:

- Demarcation of flood plain of river and desilting of river bed [Action: District Administration, Forest Department and Irrigation Department]
- Maintain minimum flow in river Hindon (~ 100-200 cusecs) and its tributaries (~ 50-100 cusecs) such as Kali-West & Krishni including upper stretches of the rivers. [Action: UP Irrigation Dept. & CWC]
- To maintain minimum flow, provision of freshwater intrusion from Ganga/Yamuna canal into Hindon River and its tributaries (Kali-West & Krishni) can be made. The suggested locations from where freshwater may be discharged into river are [Action: Irrigation Dept. & CWC] listed in **Table 6.20**.

Table 6.20 Suggested locations for fresh water discharge into Hindon and its tributaries

S. No.	District	Location
1.	Saharanpur	Ganga Canal into: • River Kali-West near Rastam village • River Hindon near Maheshpur village • River Krishni near Bhanera Khemchand village
2.	Saharanpur	Ganga Canal into Sheela drain of River Kali-West near Rasoolpur Fakerhery village Uttarakhand
3.	Muzaffarnagar	Upper Ganga Canal into river Kali-West near Khatauli town
4.	Shamli	Eastern Yamuna Canal into river Krishni near Salfa village
5.	Baghpat	Upper Ganga Canal into river Hindon near Pura village via Jani Escape

- Rejuvenation and restoration of river stretches by constructing a series of Constructed Wetlands along the river bed and adjoining drains. Inventory of existing wetlands and ponds along the rivers and at their origin and preparation of action plan for restoration and revival. Desilting/dredging of wetlands/ponds/drains [Action: SPCB, Jal Nigam, Irrigation Dept., Forest Dept. & Technical Experts]. Suggested locations for constructed wetlands and biodiversity parks are given in **Table 6.21.**

Table 6.22 Suggested locations for Constructed Wetlands/Biodiversity Park

S. no.	River	Suggested location for Constructed Wetlands (CWs)/ *Biodiversity Park*
1.	**Hindon**	**<u>Saharanpur and Shamli districts:</u>** • Series of CWs in Star Paper Mill drain before confluence with river Hindon. • Series of CWs in river Hindon before confluence & after confluence of river Dhamola. • Biodiversity Park in Saharanpur. **<u>Muzaffarnagar district:</u>** • CW in Badhai Khurd drain before confluence with river Kali-West. • Series of CWs in Dhandera drain before confluence with river Kali-West. • CW in river Hindon A/c with three drains of Budhana namely Dhobi Ghat drain, Sabzi Mandi drain and Shamshan Ghat drain. **<u>Meerut and Baghpat districts:</u>** • CW in Sardhana drain before confluence with river Hindon. • CW in river Hindon before intrusion of freshwater from the Upper Ganga Canal. **<u>Ghaziabad district:</u>** • CWs on Jawali drain, Karedha drain, Kaila Bhatta drain, Indirapuram drain, Pratap Vihar drain and Rahul Vihar drain before confluence with river Hindon.

S. no.	River	Suggested location for Constructed Wetlands (CWs)/ *Biodiversity Park*
		• Series of CWs in river Hindon (a) after confluence with Hindon Vihar drain; and (b) after confluence with Rahul Vihar drain. **Gautam Buddha Nagar district:** • CWs on Dasna drain before confluence with river Hindon.
2.	**Dhamola**	**Saharanpur and Shamli districts:** • CW in river Dhamola before confluence with river Hindon.
3.	**Kali-West**	**Saharanpur and Shamli districts:** • CW in Sheela drain before confluence with river Kali-West. **Meerut district:** • CW in river Kali-West before confluence with river Hindon near Baparsi village, Meerut.
4.	**Krishni**	**Saharanpur and Shamli districts:** • CW in Thaska drain before confluence with river Krishni or in river Krishni after confluence with Thaska drain. • CW in Shamli drain before confluence with river Krishni or in river Krishni after confluence with Shamli drain.

The concerned District Administration may undertake a survey along with concerned state agencies and take necessary action for encroached wetlands/ponds/river stretches and develop an action plan. [Action: UPPCB, District Administration and UP Irrigation Dept.]

Illegal abstraction of groundwater at domestic level for commercial purpose has been observed. Metering of household borewell in Class I cities and Class II towns & limitation on use. [Action: U.P. Ground Water Dept.]

iv. Sewage Management:

- STPs employing advanced treatment facilities such as SBR, Extended ASP, MBBR should achieve a BOD removal efficiency of over 90%. Disbursement of payment to the operating agency shall be lined with performance in terms of BOD removal efficiency as well as compliance with NGT norms.
- STPs shall be operated with utilized capacity > 70%. The disinfection units installed at STPs should be operated properly and meet the discharge standards for fecal coliform levels.
- SMCG/NMCG with UPJN shall develop a sewage management plan for each city/town/district addressing both present and projected requirements for the next 20 years. It should be periodically reviewed, updated, and adapted to address changing circumstances, technological advancements, and evolving environmental standards.
- In case of small town, village or isolated drain, low cost decentralized treatment option such as waste stabilization pond (WSP) or constructed wetland may be considered to treat domestic wastewater. [Action: UPPCB, Jal Nigam, SMCG, & NMCG]

v. Solid Waste Management:

Prohibition on dumping of municipal/industrial solid wastes and sludge on either the active flood plain of river or into the river/drain itself. All the dumped waste along the river/drain should be removed immediately and disposed off safely. [Action: Municipal corporation/Nagar Nigam/Nagar Palika]

6.5.3 Action taken

- DO letters to SPCBs of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and Wet Bengal:
  - To address the issue of high pollution in river Hindon, tributaries & drains
  - For information of GPIs and other water polluting industries in conforming and non-conforming areas.
- DO letter issued to Additional Chief Secretary, Environment, Forest & Climate Change Department, Govt. of Uttar Pradesh and Principal Secretary, Forest, Environment & Climate Change Department, Government of Uttarakhand regarding action plan for river Hindon.
- Letter to UKPCB regarding information of water polluting industries in the state of Uttarakhand & discharging into River Hindon & Kali-West through drains.

Sugar

Sugarcane unloading areas in sugar mills

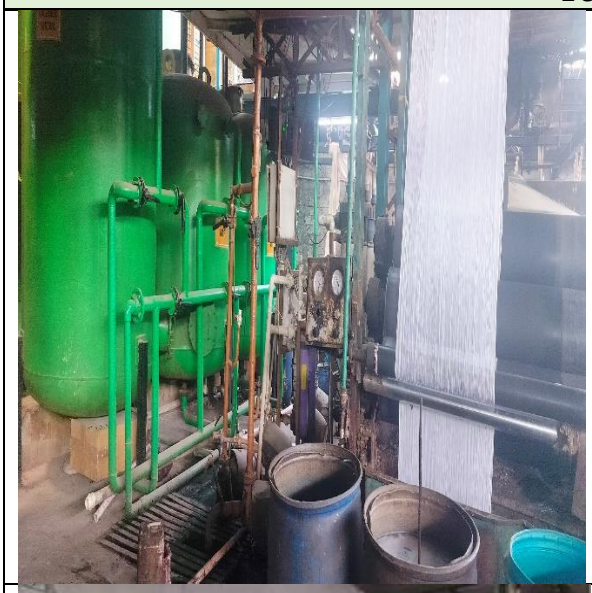
Aeration tank of ETP

Boiler chimney

DM plant installed in sugar mill

Spray pond overflow treatment system

Distillery	
	
RO based CPU	**Multi Effect Evaporator**
	
Bio-composting area	

Textile	
	
	

Pulp & Paper


PREPARATION TANK
FLOCCULANT


SECONDARY CLARIFIER
E.T.P.-1
DIA-19.32M, S.WD-3.43MTR
CAPACITY-1005 M3

(a) Biological system and (b) tertiary filtration unit installed at CETP Pilakhuwa

(c) Aeration tank and (d) secondary clarifier installed at CETP Pantnagar

(e) Hazarodous waste storage area at CETP Pantnagar and (f) use of treated effluent of CETP Pantnagar for irrigation of agricultural land

(g) MBBR tank and (h) double cylindrical aeration cum secondary clarifier installed at CETP Haridwar

CETP Banthar

CETP Unnao

20 MLD CETP at Jajmau

900 KLD CCRP at Jajmau

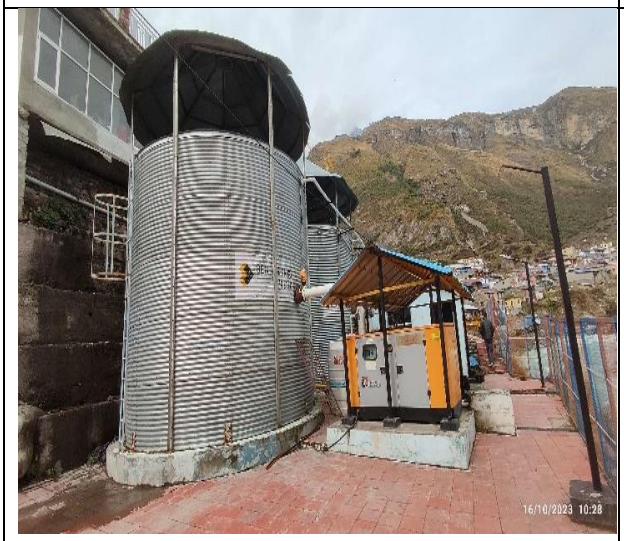
Appendix-3.2

Implementation of medium & long term measures as per the charter for tannery

Technical Intervention	Intervention	Categories to which applicable
Mandatory	Mechanical Sludge Dewatering	A1, A2, A3
Short-term Measures (within 04 months)	Mechanical desalting of raw hides	A1, A3
	Installation of Bar Screens	A1, A2, A3
	Installation of Water meters on drums	A1, A2, A3
	Installation of Smart water Saving Systems	A1, A2, A3
	Installation of solenoid valves on fleshing machines	A1, A3
	Drum Screeners	A1, A2, A3
Medium-term Measures (05-09 months)	Processing of green hides	A1, A3
	Processing of Brine cured hides	A1, A3
	Pickle-free tanning or waterless chrome tanning	A1, A3
	Enzyme based unhairing	A1, A3
	Upgradation of PETP	A1, A2, A3
	Mechanism to Separate Lime Sludge	A1, A3
Long-term Measures (10-15 months)	Chilled Hides	A1, A3
	Establishment of common tallow extraction facility	A1, A3
	Conversion of fleshing waste in to Biogas	A1, A3

A1- Raw Hide to Wet Blue (or similar), A2- Wet Blue to Finished Leather (or similar), A3- Raw Hide to Finished Leather

Appendix 4.1: Photographs of Sewage Treatment Plants

	
Marwari STP, 2.7 MLD Joshimath	**Narora 4 MLD STP**
	
Badrinath 0.26 MLD STP	**Badrinath 0.26 MLD - Disinfection system**
	
1.75 MLD Anupshahar OP	**6 MLD Garhmukteshwar STP**

Appendix 5.1

Solid waste found dumped along the drain:

Uttar Pradesh- 89 drains

Meerut (Kali East)- Abu Nalla-2, Slaughter House/Odean Nallah,

Hapur (Kali East)-Hapur city drain

Bulandshahr (Kali East)- Maman Road Drain, Adil Drain, Chandbhari Drain, Faisalabad Drain, Kasai Bada Drain, Devipura Drain and Behind Chamunda Temple Drain

Kannauj (Kali East)-Tammi Nalla

Moradabad (Ramganga)- Jigar colony, MIT Drain, Kudaghar Drain, Nawabpura Drain-2, Chakkar ki milak, Jhabbu ka Nala

Farrukhabad (Ganga)- Bhairoghat Drain, Bargadiya Drain, Hathikhana Drain

Kanpur (Ganga)- Ganga Vishnu Drain (Shuklaganj), Indra Nagar Drain (Shuklaganj), Rani Ghat Drain, Parmat Drain, Golaghat Drain, Satti Chaura Drain, Airforce Drain, Budhiyaghat Drain, Wajidpur drain,

Kanpur (River Pandu)-Halwakhanda Drain, Ganda Drain, COD Drain, Sagarpuri Drain;

Raebareli (Ganga)- Barudda Ghat /Basuda Ghat Drain (Dalmau), Pathawari Ghat Drain (Dalmau);

Pratapgarh (Ganga)- Pakka ghat drain (Manikpur), Raja Hela drain (Manikpur), Prathmik Vidyalaya drain (Manikpur), Mallahan tola drain (Manikpur);

Prayagraj (Ganga)- Sadar Bazar drain, Shivkuti Drain-4, Shivkuti Drain-06, Shankarghat Colony Drains, Shivkuti - 07 Drains, Rasulabad -1 Drain, Chhuhara Mandir -1,

Prayagraj (Yamuna)- Karela Bagh Drain, Main Ghaghar Nala, Ghaghar Nala-1-A1, Ghaghar Nala-1-B, Dariyabad Jogighat Drain (Meerapur), Dariyabad Pipal Ghat Drain, Chachar Nala;

Mirzapur (Ganga)- Public Club drain, Sundarghat drain, Hanuman Ghat Drain, Bisunderpur Drain, Barahimiliya drain, Balughat Kaccha Drain, Balughat Pakka Drain, Diwan Ghat New Drain,

Chunar (Ganga) Bhairamganj West Drain, Bhairamganj East Drain

Chunar (Jargo)-Saiddupur Drain, Tekur Nagar Drain-2

Varanasi (Ganga)- Bhainsasur Drain, Nagwa Drain/ Assi Nala,

Varanasi (Varuna)-Nai Basti Drain, Central Jail Drain, Orderly Bazar Drain, Chamrautha Drain, Purana pul Drain;

Ghazipur (Ganga)- Afim Factory Colony Drain, Collector Ghat Drain, DM Bungalow Drain, Sai Mandir Drain, Chetnat Ghat Drain, Anzahi Ghat Drain, Roohi Mandi Drain, Shamshan Ghat Drain, Harizan Basti Drain, Kot Ghat Drain, Budhenath Mahadev Ghat Drain (Saidpur), Pakka Ghat Drain (Saidpur), Sangat Ghat Drain (Saidpur), Mahaveer Ghat Drain (Saidpur), Ramghat/Ward No. 15 Malhiya Basti Drain (Saidpur), Jauharganj Drain (Saidpur), Kuluha Drain (Saidpur), Gorwa Drain (Zamania), Kankarwa Drain (Zamania), Karpurimai Drain (Zamania);

Ballia-(Ganga)-Katahal Drain;

Bihar- 73 drains

Buxar (Ganga)- Nath Baba, Tadka, Bangla Ghat, Sati Ghat, Sidnath, Sarinpur Drain;

Patna (Ganga)- Danapur Cantt, Rajapur, Bans Ghat, Collectorate, Barharwa, Rani Ghat, Balu Ghat, Masjid Ghat, Loharwa Ghat, Gosai, Bhadra Ghat, Mahavir Ghat, Nauzar Ghat, Kalighat, Mastana Ghat, Devanti Ghat, Kataiya Ghat, Makshudpur Drain (East), Makshudpur Drain (West);

Patna (Sone)- Ram Ghat, Ram Nagina Singh College drain, Sri Rampur Tola Drain;

Patna (Punpun)- Badshahi Drain, Bakipur Gorakh Drain**;**

Barh (Ganga)- Pipal Ghat;

Mokama (Ganga)- Tapaswi Ghat, Chaudhary Ghat**;**

Bhagalpur (Ganga)- Champanala 2, Champanala 2, Sahebgunj Miabari, Hathiya Nala, Saklichand, Adampur, Koyalghat, Khirni ghat, Kuppa ghat, Pipli dham, Neelkothi, Brari ghat, Kowa, kagzi, pampu Nala, LCT Ghat;

Aurangabad (Punpun)- Sangam Studio;

Rohtas (Sone)- Canal Road Drain, Main Bazar, Nasriganj Drain;

Arwal (Sone)- Nasrigunj urdu vidyalya, Burwa Mahadev, Brahmsthani, Muradpur Hujra Chowki, Malhi Patti, Karbala Maidan, Sahi Mohalla, Janakpur Ghat;

Arwal Inderpuri Barrage on Sone (Right canal) Baidrabad English Drain, Dr. Hirala Galli Drain**;**

Mirganj (Daha)- Railway station, Gopalganj;

Bagha (Gandak)- Dindayal nagar**;**

Nalanda (panchane)- Baswan bigha;

Samastipur (Budi-Ghandhak)- Magardahi Ghat

Muzaffarpur (Budi-Ghandhak)- Sikandarpur, Soda Godown Sluice Gate Chowk

Lakhisarai (Kiul)- Badhi Dargah, MahaveerAsthan, Suraj Narayan Ghat, Kali Pahari & Lal Pahari;

West Bengal- 73 drains

Mushidabad (Ganga)-Nasipur Ghosh Para WardNo-14,

North 24 Paraganas (Ganga)-Gariffa south, Gariffa North, Kalinganagar, Phuleswar Drain, Chakmadhu Nalpur, Khardha, Titagarh @ BishalaxmiGhat, Talpukur, Kumarkhali, Madaihat, Rangamti More, Tamlipara Ferry Ghat, Ram Ghat, Daduram Ghat, Barrackpore (adjacent to Ramakrishna Mission), Dhobi Ghat, Barrackpore, Barrackpore Drain (near SP Bungalow), Balughat Manirampore, Authpur Sastrinagar, Debitala Pancha Khal. Ichapur Khal, Bhatpara Open Pucca, Bhatpara, Kamrhati Jutemill, PB Ghat, Dakhineswar-Alambazar, Baranagar/Kuthighat.

Purba Bardhaman (Ganga)- Sukanta Pally High Drain, Kasiganj Drain, Sakhai para ghat,

Howrah (Ganga)-Telkal ghat, Ram Krishna Ghat, 130 Foreshore road, 101 Foreshore road, Shibpur Burning Ghat, Botanical Garden – II, Botanical Garden – I, Saraswati Khal, Nazerganj, Chakashi Khal, Kumarkhali, Madaihat, Rangamti More

Kolkata (Ganga)- Tolly Nullah, Dhankheti Khal, Rishra Burning Ghat, Bagh Khal, Cossipore, Chitpur Ghat, Drain near Howrah Bridge.

Hooghly (Ganga)-Rishra, Bally Khal, Dewangazi, Jagannath Ghat, Dakshineswar ferry ghat, Akash Ganga Ghat, Gondalpara, Telinipara, DVC Canal, Champdani Ferry Ghat, Baidyabati, Chatra khal, Serampore / Bhagirathi, Hastings Ghat, Chinsurah - Majir Rasta, Imambara Khal, Chandni Ghat, Rosbara Khal, Dhopa Ghat, BTPS outfall

East Midnapore (Ganga)- Begunberia Bridge, Green Belt Canal.

Appendix-6.1: Monitoring data of river Ganga for pH, DO, BOD, FC and FS

Station Code	State name	Station name	Monitoring frequency	pH	DO	BOD	FC	FS
1491	Uttarakhand	BAGIRATHI AT GANGOTRI	Yearly	8.4	11	1	1.8	1.8
5451		RIVER MANDAKINI AT KEDARNATH	Yearly	8	11.4	1	1.8	1.8
5452		RIVER ALAKNANDA AT BADRINATH	Yearly	7.3	11.2-11.2	1	1.8	1.8
1485		MANDAKINI B/C ALAKNDA, RUDRAPRAYAG	Quarterly	7.6-7.8	9.8-10.8	1	1.8-2	1.8
1484		ALAKNDA B/C MANDAKINI, RUDRA PRAYAG	Quarterly	7.6-8.3	10-10.6	1	1.8	1.8
1486		ALKANDA A/C MANDAKINI, RUDRAPRAYAG	Quarterly	7.4-8.2	10.2-10.8	1	1.8-2	1.8
1488		BHAGIRATHI B/C ALAKNDA, DEVPRAYAG	Quarterly	7.8-8.1	9.8-10.8	1	1.8	1.8
1487		ALAKNDA B/C BHAGIRATHI, DEVPRAYAG	Quarterly	7.8-8.3	10-10.6	1	1.8-2.0	1.8
1489		ALAKNDA A/C BHAGIRATHI, DEVPRAYAG	Quarterly	7.5-8.2	10-10.8	1	1.8-2.0	1.8
5776		RIVER GANGA AT SWARG ASHRAM, RISHIKESH	Fortnightly	7.2-8.4	9-10.6	1	31-48	1.8
1060		U/S RISHIKESH	Fortnightly	7.1-8.3	9.6-11	1	21-43	1.8
5777		RIVER GANGA NEAR VISTHAPHIT COLONY, RISHIKESH	Fortnightly	7.0-8.2	8.2-10.2	1-1.7	27-84	1.8-26
10147		RISHIKESH D/S	Fortnightly	7.1-8.5	9.2-10.8	1-1.2	1.8-43	1.8-1.8
2725		A/C SONG NEAR SATYARAYAN TEMPLE, D/S RAIWALA	Fortnightly	7.1-8.5	8.2-10	1.1-1.7	33-63	1.8-6.1
10148		HARKI PAURI GHAT	Fortnightly	7.3-8.3	8-10.3	1-2	21-79	9.2-43
3997		RIVER GANGA U/S AT ABINDUGHAT, DUDHIYABAD, HARIDWAR	Fortnightly	7.3-8.3	7.6-9.8	1.2-2.6	31-94	6-46
1061		HARIDWAR D/S	Fortnightly	7.2-8.5	7.1-9.9	1-2.6	32-84	9.3-63
5778		RIVER GANGA NEAR BISHANPUR KUNDI, HARIDWAR	Fortnightly	7.2-8.4	7.6-9.8	1-2.4	24-94	11-43
2727		ROORKEE D/S	Fortnightly	7.4-8.3	7.4-9.7	1.2-2.4	21-94	10-79
10150	Uttar Pradesh	MADHYA GANGA BARRAGE (BIJNOR)	Fortnightly	7.6-8.0	8.6-9.1	1-1.6	460-790	1.8-1.8
5707		RIVER GANGA AT NANDAUR- HASTINPUR BRIDGE NEAR HASTINPUR	Fortnightly	-	-	-	-	-
5708		RIVER GANGA TIGRI GANGA GHAT, VILLAGE-TIGARI, AMROHA	Fortnightly	7.7-7.9	8.4-8.9	1.2-1.6	460-790	1.8-1.8
10149		U/S BRIJGHAT, GARHMUKTESHWAR	Fortnightly	7.3-8.3	8.5-12	1-2.6	170-920	94-280
1062		BRIJGHAT D/S, GHARMUKTESHWAR	Fortnightly	7.3-7.6	8.2-11.7	1-2.9	240-1300	130-540
2488		U/S ANOOPSHAHAR	Fortnightly	7.1-7.3	7.1-11	1-2.7	170-920	0-0
2489		ANOOPSHAHAR D/S	Fortnightly	7.1-7.4	7.2-10.6	1-2.6	170-1100	0-0
1145		NARORA (BULANDSAHAR)	Fortnightly	7.0-7.4	7.3-10.4	1-2.8	170-930	0-0
2490		KACHHLA GHAT (ALIGARH)	Fortnightly	7.4-7.7	8.4-10.9	1.1-1.6	1.8-480	1.8-350
10151		FARRUKHABAD	Fortnightly	8.0-8.5	6.5-10.9	2.6-3.7	1100-2600	1.8-1.8
1063		U/S KANNAUJ (RAJGHAT)	Fortnightly	8.1-8.6	6.1-10.9	3-3.9	900-2700	1.8-1.8
1066		KANNAUJ D/S	Fortnightly	8.0-8.5	6.3-11.6	2.4-6.3	252-3400	1.8-1.8

Station Code	State name	Station name	Monitoring frequency	pH	DO	BOD	FC	FS
5709		RIVER GANGA NANAMAU GANGA BRIDGE, LUCKNOW MOHAN-HASANGANJ- RASULABAD MARG, KARTI AKBERPUR SENG	Fortnightly	8.1-8.5	6.6-10.1	3-3.3	2300-2700	-
1146		BITHOOR (KANPUR)	Fortnightly	7.8-8.5	6.2-11.2	3-11.6	1700-2700	1.8-45
1067		U/S KANPUR (RANIGHAT)	Fortnightly	7.5-8.7	6.1-11.1	3-4.4	2000-3100	1.8-20
10154		U/s SHUKLAGANJ /BATHING GHAT (BHARAOGHAT)	Fortnightly	7.8-8.5	6.1-10.8	3-4.3	2100-4900	1.8-78
10155		SHUKLAGANJ D/S	Fortnightly	7.5-8.9	6-10.9	3.2-4.6	2100-3400	1.8-20
10156		BATHING GHAT (GOLA GHAT)	Fortnightly	7.8-8.8	5.9-10.6	3.4-13.2	2200-4600	1.8-1.8
10157		BATHING GHAT (JAJMAU BRIDGE)	Fortnightly	7.7-8.5	6-10.4	3.4-4.9	2100-7900	20-20
1068		KANPUR D/S (JAJMAU PUMPING STATION)/JANE VILL.	Fortnightly	7.4-8.6	5.6-10.2	3.7-14.8	4100-17000	1.8-1.8
5710		RIVER GANGA PURANA RAJAPUR, RAJAPUR, KANPUR	Fortnightly	7.8-8.4	6.1-10.4	3.4-3.8	2300-4300	-
5711		RIVER GANGA A/C PANDU RIVER AT MADEVESHWAR BABA TAMPLE DEOMAI	Fortnightly	7.8-8.3	7.5-8.6	2.4-2.7	610-680	-
5712		RIVER GANGA MATA GANGA BRIDGE, NH335, LALGANJ ROAD FATEHPUR	Fortnightly	-	-	-	-	-
1147		DALMAU (RAEBARELI)	Fortnightly	7.7-8.0	7.4-10.5	2.5-3.9	1300-2400	7.8-22
2498		KALA KANKAR (PRATAPGARH)	Fortnightly	7.8-8.0	7.5-10.6	2.4-3.8	1100-2300	6.8-22
2487		KADAGHAT (KAUSHAMBI)	Fortnightly	7.7-8.4	6.9-9.3	2.6-2.9	400-680	-
5713		RIVER GANGA AT GANGA BRIDGE .NH19, DHEEMI	Fortnightly	7.8-7.9	7.8-8.6	3.1-3.2	1700-2200	14-20
1046		PRAYAGRAJ (RASOOLABAD)	Fortnightly	7.8-8.4	7.2-9.2	2.7-2.9	450-920	-
1049		PRAYAGRAJ D/S (SANGAM)	Fortnightly	7.8-8.4	7.1-9.1	2.6-3	680-930	-
5714		RIVER GANGA B/C TAMSA RIVER AT PRACHIN SHIVALAYA DUMDUMA GHAT	Fortnightly	7.7-8.1	7.5-8.7	2.5-2.9	610-780	-
10158		A/C TAMAS RIVER (SIRSA)	Fortnightly	7.4-8.4	7.2-8.9	2.6-3	610-920	-
2485		U/S, VINDHYACHAL (MIRZAPUR)	Fortnightly	7.9-8.4	7.3-9.4	2.2-2.9	700-1300	380-700
2486		D/S, MIRZAPUR	Fortnightly	7.6-8.0	6.6-8.5	3.3-4.5	7900-14000	3400-9400
10153		CHUNAR	Fortnightly	7.7-8.2	7-9	2.8-3.8	5800-11000	630-6300
1070		U/S VARANASI (VISHWA SUNDARI BRIDGE)	Fortnightly	7.8-8.4	7.2-9.6	2.1-2.8	680-1100	310-550
1071		VARANASI D/S (MALVIYA BRIDGE)	Fortnightly	7.6-8.1	6.7-8.5	3.3-4.5	7900-17000	4900-9200
5715		RIVER GANGA B/C GOMTI RIVER AT BALUA GHAT BRIDGE, VARANASI	Fortnightly	7.7-8.0	7-7.8	3.2-4.2	6300-11000	4600-6300
10152		A/C GOMTI RIVER (BHUSAULA)	Fortnightly	7.8-8.2	7-8.8	2.8-3.8	4600-11000	4100-9800

Station Code	State name	Station name	Monitoring frequency	pH	DO	BOD	FC	FS
5716		RIVER GANGA ZAMANIA GANGA BRIDGE, ZAMANIA UP	Fortnightly	7.3-8.2	7.4-8.4	2.8-3.6	4600-7000	2700-4900
1073		TARIGHAT (GHAZIPUR)	Fortnightly	7.7-8.0	6.5-8.2	3.5-4.7	9400-17000	6300-13000
5717		RIVER GANGA BALLIA D/S AT BEYASI BALLIA BRIDGE	Fortnightly	-	-	-	-	-
1074	Bihar	BUXAR, CHAUSA KARMNASA	Fortnightly	7.1-8.3	7-9	1-2.1	2200-54000	2-330
10113		U/S JAIL GHAT, BUXAR (A/C THORA RIVER)	Fortnightly	7.2-8.2	6.9-8.8	1-2.5	780-92000	1.8-490
2551		BUXAR, RAMREKHAGHAT	Fortnightly	7.3-8.4	6.7-8.5	1-2.6	1300-92000	2-1100
3113		BUXAR D/S, NEAR GANGA BRIDGE	Fortnightly	7.3-8.2	6.5-8.9	1-2.6	1300-54000	1.8-220
10162		ARRAHCHAPRA ROAD BRIDGE, U/S DORIGANJ	Fortnightly	7.2-8.3	7.3-8.9	1-2.5	130-35000	1.8-540
2564		RIVER GANGA AT BALUGHAT, DORIGANJ	Fortnightly	7.4-8.4	6.6-9	1-2.8	780-92000	2-1300
10114		MAA AMBIKA ASTHAN, DORIGANJ D/S (SARAN)	Fortnightly	7.4-8.0	6.9-8.8	1.2-2.6	780-92000	2-790
3114		DANAPUR, NEAR PIPAPUL	Fortnightly	7.2-8.4	6.8-9.9	1-2.2	1100-54000	1.8-490
1077		KURJI AT DIGHA GHAT, U/S PATNA	Fortnightly	7.2-8.4	6.9-9.8	1-2.2	2300-92000	2-490
2552		NIT GHANDHI GHAT (PATNA)	Fortnightly	7.1-8.3	6.1-9.5	1-2.5	17000-92000	2-5400
10115		GULBI GHAT (PATNA)	Fortnightly	7.2-8.4	6.3-9	1.2-2.5	13000-92000	2-35000
1079		PATNA D/S (GANGA BRIDGE)	Fortnightly	7.2-8.4	6.1-9.4	1.1-2.6	2300-92000	1.8-2400
3122		MALSALAMI (PATNA)	Fortnightly	7.2-8.3	6.5-9.3	1-2.9	1300-92000	2-1300
4297		GANGA AT KACHCHIDARGAHBIDUPUR ROAD BRIDGE, PAT	Fortnightly	7.1-8.4	6.3-9.5	1-2.3	2300-54000	2-1300
10122		TRIVENI GHAT, B/c OF RIVER PUNPUN	Fortnightly	7.2-8.4	6.1-8.8	1.2-2.6	2300-35000	2-490
2553		FATUHA, A/c OF RIVER PUNPUN	Fortnightly	7.0-8.3	6-8.5	1.3-2.5	2300-92000	2-3500
4301		BAKHYIYARPURTAJPUR BRIDGE ON GANGA, ATHMAGOLA, PAT	Fortnightly	7.4-8.2	7.2-9.4	1-2.3	130-54000	2-110
3115		BARH, NEAR UMATH TEMPLE	Fortnightly	7.4-8.2	7.2-9.1	1.1-2.5	490-92000	2-1300
10130		NAWADAGHAT D/S (WATER INTAKE OF NTPC) BARH	Fortnightly	7.3-8.2	7.3-9.5	1-2.7	490-92000	2-490
10131		U/S BARAHPUR BINDTOLI	Fortnightly	7.4-8.1	7-8.2	1.5-2.2	2300-17000	2-170
1817		U/S MOKAMA	Fortnightly	7.2-8.4	7.2-9.5	1-2.8	2300-92000	1.8-330
1815		MOKAMA D/S (D/S RAJENDRA BRIDGE)	Fortnightly	7.1-8.3	7-9.9	1-2.8	1700-92000	2-330
3123		BARAHIA	Fortnightly	7.2-8.3	6.9-9.4	1-2.6	1300-92000	1.8-330
3116		U/S MUNGER	Fortnightly	7.4-8.3	6.7-10	1-3	3300-92000	2-1300
1818		MUNGER	Fortnightly	7.4-8.3	6.6-9.9	1-2.7	2300-92000	2-1300
3117		U/S SULTANGANJ	Fortnightly	7.2-8.3	6.7-9.8	1-2.5	1300-92000	2-790
2554		SULTANGANJ (BHAGALPUR)	Fortnightly	7.3-8.3	6.3-9.6	1-2.4	2300-92000	2-1300
4398		WATER INTAKE POINT, BHAGALPUR	Fortnightly	7.2-8.1	5.5-9.7	1-2.7	450-54000	1.8-1700
10138		CHAMPANAGAR	Fortnightly	7.2-8.2	6.4-10	1-2.1	2300-92000	2-3500
1819		BHAGALPUR	Fortnightly	7.2-8.3	6.3-9	1-2.9	1300-54000	2-230
3118		D/S BHAGALPUR	Fortnightly	7.2-8.2	5.9-12.1	1.1-5.5	1300-92000	2-3500

Station Code	State name	Station name	Monitoring frequency	pH	DO	BOD	FC	FS
1816		KAHALGAON	Fortnightly	7.0-8.3	6.5-9.2	1-2.6	1300-92000	2-920
10143		KAHALGAON D/S, NEAR CREMATION GHAT	Fortnightly	7.4-8.3	6.7-9.1	1-2.5	2300-92000	2-490
10144	Jharkhand	U/S NEARA LCT GHAT	Fortnightly	7.4-7.8	7-7.5	1.1-1.3	-	-
10145		NEAR JANTA GHAT D/S	Fortnightly	7.5-7.7	7.1-7.5	1.1-1.4	-	-
1059		RAJMAHAL	Fortnightly	7.3-7.7	6.7-7.3	1.1-1.4	-	-
10146		SANGI DALAN	Fortnightly	7.4-7.8	6.9-7.4	1.1-1.3	-	-
5162	West Bengal	RIVER GANGA AT FARAKKA, MUSHIDABAD	Fortnightly	6.7-9.0	5.5-9.8	1.3-2.9	130-1700	23-79
10159		KHAGRA, BEHARAMPORE	Fortnightly	6.8-8.4	6-9.8	1.4-2.9	130-3500	23-170
1080		BEHARAMPORE	Fortnightly	6.7-9.0	5.9-9.9	1.3-2.8	1700-24000	130-1300
10160		GORABAZAR, BEHRAMPORE	Fortnightly	6.8-8.7	6.4-9.5	1.4-2.9	790-17000	110-790
2511		NABADIP, GHOSHPARA NEAR MONIPURGHAT	Fortnightly	7.0-8.6	5.4-9.4	1-2.9	210-3500	49-240
2506		TRIBENI, NEAR BURNING GHAT	Fortnightly	5.9-8.5	5.1-9.7	1-3	240-5400	23-790
10161		SHITALATALA, PALTA	Fortnightly	7.1-8.7	5.1-9.6	1.4-2.9	1700-49000	130-1400
1054		PALTA	Fortnightly	7.1-8.4	5.2-9.9	1.4-2.9	3500-49000	330-1400
1472		SERAMPORE	Fortnightly	7.1-8.4	5.3-9.7	1.4-2.9	5400-54000	330-9400
1053		DAKSHINESHWAR	Fortnightly	6.9-8.1	5-7.5	2.4-3.3	23000-84000	260-540
1470		GARDEN REACH	Fortnightly	6.9-8.0	5-7.8	2-3.9	33000-94000	210-580
1471		SHIVPUR (HOWRAH)	Fortnightly	6.8-7.9	5-7.8	2.4-3.6	31000-79000	170-490
1052		ULUBERIA	Fortnightly	6.8-8.0	5-6.8	2.3-3.1	17000-34000	110-330
1469		DIAMOND HARBOUR	Fortnightly	6.8-8.2	5.2-6.9	2.1-3.2	1300-7800	11-110
1335		GANGA AT PATIKALI NEAR DURGA CHAK	Fortnightly	7.8-8.5	5.4-7.5	1-2.6	3600-7900	170-320

Appendix 6.2: PRIMARY WATER QUALITY CRITERIA FOR BATHING WATER
(Water used for organized outdoor bathing)

CRITERIA		RATIONALE
1. Faecal Coliform (MPN/100 ml)	**500 (desirable) 2500 (Maximum permissible)**	**To ensure low sewage contamination. Faecal coliform and feacal streptococci are considered as they reflect the bacterial pathogenicity.**
2. Faecal Streptococci (MPN/100 ml)	**100 (desirable) 500 (Maximum Permissible)**	**The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal change, changes in flow conditions etc.**
3. pH	**Between 6.5-8.5**	**The range provides protection to the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing.**
4. Dissolved Oxygen (mg/L)	**5 mg/L or more**	**The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment.**
5. Biochemical Oxygen Demand (3rd day, at 27°C) (mg/L)	**3 mg/L or less**	**The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases".**

Appendix 6.3: List of 36 Real Time Water Quality Monitoring Stations on River Ganga, Tributaries and its Drains

S. No	State	Station code	Location	District	Type	Lat	Long	Name of River
1.	Uttar Pradesh	UP-02	Madhya Ganga Barrage	Bijnore	Fixed	29.3732	78.0404	River Ganga
2.	Uttar Pradesh	UP-06	Anupshahar Ghat	Bulandshar	Cross-section	28.3555	78.2717	River Ganga
3.	Uttar Pradesh	UP-08	Narora Barrage	Bulandshar	Fixed	28.1903	78.3953	River Ganga
4.	Uttar Pradesh	UP-09	Kachla Ghat Bridge	Badaun	Fixed	27.9325	78.8580	River Ganga
5.	Uttar Pradesh	UP-14	Bridge at Ghatiya Ghat, Farrukhabad	Farrukhabad	Fixed	27.3987	79.6273	River Ganga
6.	Uttar Pradesh	UP-16	Manimau Bridge, Kannauj	Kannauj	Fixed	27.0111	79.9866	River Ganga
7.	Uttar Pradesh	UP-18	Bithoor Bridge near temple , Kanpur	Bithoor, Kanpur	Floating	26.3658	80.1628	River Ganga
8.	Uttar Pradesh	UP-19	Lav Kush Barrage at Kanpur	Kanpur	Fixed	26.3029	80.1859	River Ganga
9.	Uttar Pradesh	UP-26	Bridge at Shuklaganj, Kanpur	Station at Kanpur	Fixed	26.2814	80.2237	River Ganga
10.	Uttar Pradesh	UP-24	Dhodhi Ghat,near Maharajpur village, Kanpur	Kanpur	Cross-section	26.2242	80.2925	River Ganga
11.	Uttar Pradesh	UP-32	Bridge at Asni Ghat near Asni village, Fatehpur	Fatehpur, Unnao	Floating	26.3260	80.5424	River Ganga
12.	Uttar Pradesh	UP-40	Near Pontoon village, Sirsa village, Allahabad	Sirsa, Allahabad	Floating	25.2678	82.0930	River Ganga
13.	Uttar Pradesh	UP-56	River Ganga, Devkali at SaidpurGhazipur	Ghazipur	Fixed	25.5374	83.1988	River Ganga
14.	West Bengal	WB-10	U/s of Behrampore, bridge at Behrampore	Murshidabad	Fixed	24.0602	88.1468	River Ganga
15.	West Bengal	WB-11	D/s of Murshidabad (d/s of Behrampore)	Murshidabad	Floating	24.0373	88.1368	River Ganga
16.	West Bengal	WB-21	D/s of Serampore, jetty Hasting Jute mill	D/s Srirampore, Hooghly	Fixed	22.4354	88.2135	River Ganga
17.	West Bengal	WB-23	Intake Pumping station of KMDA at Belgharia	Belgharia, Kolkata	Fixed	22.6709	88.3597	River Ganga
18.	West Bengal	WB-27	Mullick Ghat, Howrah Bridge	Howrah	Fixed	22.3495	88.2087	River Ganga
RTWQM stations on Tributaries								
S. No	**State**	**Station code**	**Location**	**District**	**Type**	**Lat**	**Long**	**Name of River**
1	Uttar Pradesh	UP-03	Bridge on Sukratal Ghat	Muzaffarnagar district	Fixed	29.2950	77.5853	River Banganga
2	Uttar Pradesh	UP-10	Shahbad Bridge, Moradabad (D/s)	Moradabad	Fixed	28.5538	79.0481	River Ramganga
3	Uttar Pradesh	UP-13	Tahsipur Village, Kannauj	Kannauj	Floating	27.1097	79.8730	River Kali
4	Uttar Pradesh	UP-17	Bridge at Farrukhabad –Allahganj road, Farrukhabad	Farrukhabad	Fixed	27.4979	79.6961	River Ramganga

S. No	State	Station code	Location	District	Type	Lat	Long	Name of River
5	Uttar Pradesh	UP-29	Bridge 2 at NH25(Hamirpur Road), Kanpur	Station at Hamirpur road, Kanpur	Fixed	26.2214	80.1824	River Pandu
6	Uttar Pradesh	UP-54	Varanasi at bathing ghat 1	Varanasi	Fixed	25.3418	83.0230	River Varuna
7	Uttar Pradesh	UP-55	Near Bridge on Gomti at Rajwari, Varanasi	Varanasi	Floating	25.5055	83.1383	River Gomti
8	West Bengal	WB-5	U/s of Ganga , west near Bridge NH-34	Farrakha	Fixed	24.3027	88.0191	River Falguri
9	West Bengal	WB-6	U/s of Ganga , west near bridge on NH-35	Farrakha	Fixed	24.2895	88.0333	River Maya
RTWQM stations on Drains								
S.No	**State**	**Station code**	**Location**	**District**	**Type**	**Lat**	**Long**	**Name of River**
1	Uttarakhand	UK-8	Jagjeetpur STP drain, Haridwar	Jagjeetpur, Haridwar	Fixed	29.8988	78.1402	Drain
2	Uttar Pradesh	UP-46	Mawaiyanala, Allahabad	Allahabad	Fixed	25.3946	81.8948	Nallah
3	Bihar	BH-7	KurziNalla, Patna	Patna	Fixed	25.6406	85.1051	Nallah
4	Bihar	BH-9	RajapulNalla, Rajapur old pump house	Rajapur old pump house, Patna	Fixed	25.6234	85.1246	Nallah
5	Bihar	BH-10	MandiriNalla, Patna 3a	Station at Patna 3a	Fixed	25.3719	85.8111	Nallah
6	Bihar	BH-11	Anta Ghat Nalla, Patna 3a	Station at Patna 3a	Fixed	25.6218	85.1504	Nallah
7	West Bengal	WB-22	Nalla opposite Ghat (D/s), Srirampur	Srirampore, Hooghly district	Fixed	22.7258	88.3661	Nallah
8	West Bengal	WB-24	BallykhalNalla, Ballykhal bridge	Howrah district	Fixed	22.0393	88.0285	Nallah
9	West Bengal	WB-26	ChitpurNalla, Circular Canal, Chitpur	Kolkata district	Fixed	22.6074	88.3697	Nallah

Appendix 6.4: List of 40 RTWQM stations

S.No.	State	District	No	Location	River	Latitude	Longitude	Type
1	Uttarakhand	Rudraprayag	5	Abandoned old bridge	Ganga (Alakananda)	30.2740	78.9610	Fixed
2		Tehri Garhwal		D/s of Srinagar, Kirtinagar (At ghat)	Ganga (Alakananda)	30.2140	78.7464	Fixed
3		Tehri		D/s of Tehri Dam	Ganga (Alakananda)	30.3719	78.4777	Fixed
4		Dehradun		Distributing Canal, Left Bank, Rishikesh	Ganga	30.0741	78.2903	Fixed
5		Haridwar		D/s of Har Ki Pauri, Dam Kothi, Haridwar	Ganga	29.9423	78.1569	Fixed
6	Haryana	Sonipat	1	D/s of Mohana, Sonipat	Yamuna	28.9870	77.2018	Floating
7	Uttar Pradesh	Baghpat	15	Barnawa, Bagpat (Nearly 100 meters from bridge)	Hindon	29.1142	77.4407	Fixed
8		Rampur		River Kosi, D/s of Kashipur, Darhiyal	Kosi	29.0528	79.0196	Floating
9		Budaun		Dandi Village, Near Beladandi Bridge on River Ram Ganga, Budaun.	Ramganga	28.0277	79.4905	Floating
10		Meerut		D/s Meerut city, Kaul village (Nearly 100 meters from bridge)	Kali (East)	28.8606	77.7956	Fixed
11		Mathura		Upstream of Gokul Barrage, D/s of Mathura city	Yamuna	27.4474	77.7135	Fixed
12		Ghaziabad		Road Bridge on Hindon river, Rajnagar Extension	Hindon	28.6856	77.3920	Fixed
13		Bulandshahar		D/s of Bulandshahr (Nearly 400 meters from bridge)	Kali (East)	28.3971	77.8630	Fixed
14		Auraiya		Marhapur, Auraiya	Yamuna	26.4088	79.4909	Floating
15		Mirzapur		Balu ghat bridge, Chunar	Ganga	25.1316	82.8784	Floating
16		Pratapgarh		Kheerveer Bridge, Kishundaspur Road, Pratapgarh	Sai	25.9191	82.0263	Fixed
17		Fatehpur		Mawai Dham, Amauli, Fatehpur	Yamuna	25.9114	80.2896	Floating
18		Fatehpur		Korra Kanak, Asothar, Fatehpur.	Yumuna	25.7800	80.5778	Floating
19		Prayagraj		Fafamau, Lord Curzon Bridge, Allahabad	Ganga	25.5075	81.8658	Floating
20		Prayagraj		U/s to Sangam at Allahabad	Yamuna	25.4281	81.8558	Floating
21		Ghazipur		D/s of Ghazipur, Abdul Hameed Setu on River Ganga	Ganga	25.5884	83.6065	Fixed

S.No.	State	District	No	Location	River	Latitude	Longitude	Type
22	Bihar	Buxar	10	Chausa, U/s of Buxar (150 Meters Distance)	Ganga	25.5193	83.9007	Floating
23		Saran		Bridge on River Gaghra near Manjhi, Chappra	Ghaghara	25.8232	84.5858	Fixed
24		Saran		Road Bridge on Gandak, Hajipur	Gandak	25.6997	85.1937	Floating
25		Patna		New Bridge, U/s of Patna city, Khurji	Ganga	25.6533	85.0952	Floating
26		Katihar		Road bridge on Kosi, Kursela	Koshi	25.4238	87.2336	Floating
27		Patna		Road bridge at Fathua on Punpun, Patna	Punpun	25.5152	85.2993	Floating
28		Bhojpur		Road bridge on Son, Arrah	Sone	25.5672	84.7961	Floating
29		Bhagalpur		D/s of Bhagalpur, Road Bridge on River Ganga	Ganga	25.2991	87. 0268	Fixed
30		Buxar		Road bridge on River Ganga, D/s of Buxar	Ganga	25.5918	83.9861	Floating
31		Khagaria		Road bridge on Burhi Gandak, Khagaria	Burhi Gandak	25.5010	86.4812	Floating
32	Jharkhand	Dhanbad	3	Birsa Pool, Damodar River Bank,Pathardih	Damodar	23.6670	86.4110	Floating
33		Sahebganj		Sahebganj	Ganga	25.2489	87.6417	Floating
34		Sahebganj		Rajmahal at Malgodam	Ganga	25.0546	87.8381	Fixed
35	West Bengal	Purulia	6	Raghunathpur Thermal power plant Intake well. Salchura. Panchet Reservoir	Damodar	23.6771	86.7425	Fixed
36		Nadia		Nabadwip Bathing Ghat	Ganga (Hooghly)	23.3960	88.3626	Floating
37		Hooghly		Chinsura , Near Hooghly, Road Bridge(Intake well structure)	Ganga (Hooghly)	22.9068	88.4039	Fixed
38		Barddhaman		Durgapur barrage, Road Bridge	Damodar	23.4801	87.3049	Fixed
39		Ramgarh		Damodar river Intake well pump house at Ramgarh city road	Damodar	23.6468	85.5267	Floating
40		Murshidabad		Farakka Barrage, Road Bridge	Ganga	24.8010	87.9220	Fixed

Appendix 6.5

Monthly average water quality data for 18 main stem stations in Year 2023 (36 RTWQM Project)

	Jan-23			Feb-23			Mar-23			Apr-23			May-23			Jun-23			Jul-23			Aug-23			01.09.2023 to 11.09.2023		
Station	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH	BOD	DO	pH
UP02	1.0	7.0	7.1	1.0	7.7	7.1	1.1	8.6	7.4	1.3	8.0	7.3	1.8	6.8	7.1	3.5	6.5	7.0	7.5	6.2	6.9	6.9	7.1	7.3	2.9	6.9	7.2
UP06	2.0	9.3	8.5	2.0	8.9	8.6	2.1	7.0	7.3	2.1	5.9	6.7	1.2	8.2	8.5	2.1	6.7	6.7	2.2	5.9	6.3	2.2	6.7	7.1	2.1	6.9	7.5
UP08	1.3	8.6	8.0	1.2	7.8	7.2	1.3	7.2	7.4	1.1	6.7	6.5	1.4	8.1	6.9	1.1	6.9	6.6	1.8	6.9	6.6	1.9	7.0	7.2	2.2	7.3	7.4
UP09	-	-	7.6	-	-	7.9	2.1	8.0	7.3	2.9	7.4	7.7	2.2	6.9	7.7	1.7	6.4	7.5	-	6.4		1.4	5.9	7.5	2.2	7.2	7.2
UP14	2.5	10.7	7.9	1.9	9.5	7.8	1.8	7.6	7.6	2.0	7.1	7.7	2.0	7.1	7.8	2.2	7.8	7.6	1.6	8.7	7.8	1.7	8.4	7.7	1.7	9.3	8.0
UP16	2.3	9.1	7.9	2.4	9.1	7.6	2.3	7.1	7.3	2.1	5.4	7.9	1.9	5.1	8.2	2.1	8.0	8.3	2.1	8.9	8.0	2.1	8.4	8.1	-	-	8.1
UP18	1.6	8.1	7.9	1.6	7.7	8.1	1.8	5.9	7.6	1.9	8.9	7.5	1.8	9.0	7.7	2.7	7.6	7.7	2.7	7.2	7.7	1.6	7.5	8.1	2.3	7.5	8.1
UP19	2.1	10.0	7.7	2.3	9.5	7.4	2.9	9.4	8.3	2.5	9.0	7.8	2.1	7.1	7.7	2.0	7.1	7.8	2.8	12.0	7.9	-	-	8.0	-	-	-
UP24	2.4	9.4	7.7	2.5	9.4	8.0	2.6	10.1	7.7	2.5	9.7	7.8	3.8	7.0	7.7	2.6	8.9	7.7	2.5	7.9	7.8	2.5	7.9		2.5	7.9	
UP26	1.8	9.0	7.8	1.7	8.1	-	2.0	8.2	8.0	2.0	7.7	7.8	2.3	6.8	7.6	2.3	7.0	7.4	-	-	-	-	-	-	-	-	--
UP32	1.8	10.0	-	2.3	8.6	7.6	2.8	8.8	8.1	2.2	8.8	8.0	2.5	7.8	7.9	2.1	8.0	7.3	2.2	8.0	7.5	1.8	7.7	7.6	2.1	8.0	7.1
UP40	1.8	15.6	8.1	1.8	10.9	7.6	2.1	8.7	7.7	2.6	8.4	7.7	2.4	7.2	7.3	2.1	7.2	7.4	4.2	6.4	7.3	2.8	7.5	7.7	2.2	7.5	8.4
UP56	1.7	10.7	7.8	2.3	8.0	7.8	2.2	7.5	8.1	2.2	6.2	7.5	2.3	5.2	7.9	2.4	6.5	7.6	2.0	5.3	7.2	2.2	8.1	7.6	1.9	6.7	7.9
WB10	2.2	7.5	8.1	2.3	5.8	7.9	2.4	7.5	7.9	2.3	7.8	7.9	2.4	6.8	7.9	2.3	6.6	7.9	3.0	6.7	-	3.3	7.1	8.4	3.2	6.8	8.4
WB11	1.7	7.8	-	1.9	5.8	-	2.0	5.5	-	3.1	6.7	-	3.5	7.0	-	3.5	6.5	-	4.4	6.0	-	4.3	5.9	-	4.8	7.6	-
WB21	2.9	7.0	7.8	3.8	5.7	7.8	2.4	5.3	7.8	2.5	5.7	7.8	2.4	5.5	7.8	3.5	5.4	7.8	3.4	-	7.8	2.9		7.8	2.8	-	8.0
WB23	6.0	7.8	7.9	7.4	6.7	7.8	7.1	5.5	7.8	7.0	6.4	7.8	5.9	7.2	7.8	7.1	7.2	7.8	-	8.4	-	4.2	7.2	7.8	-	-	-
WB27	4.2	6.7	7.9	4.1	6.9	7.5	3.4	6.9	7.3	4.0	6.9	7.4	4.0	6.9	7.3	3.7	6.9	7.2	3.8	6.9	7.0	3.9	7.0	7.4	3.8	4.2	7.8

Appendix 6.6

Average Annual Water Quality of stations located on main stem of River Ganga (January ~December 2023) – 40 RTWQM Project

S. No.	Station code	Station name	DO (mg/l)	BOD (mg/l)	COD (mg/l)	pH	TOC (mg/l)	CL^- (mg/l)	EC (microS/ cm)	Nitrate (mg/l)	Turbidity (NTU)
1	UK51	Abandoned old bridge, Rudraprayag	Not operational								
2	UK53	D/s of Tehri Dam	Not operational								
3	UK54	Distributing Canal, Rishikesh	Not operational								
4	UK55	D/s of Har Ki Pauri, Haridwar	10.03	0.8	5.9	8.3	1.4	7.04	143.2	1.9	196.08
5	UK52	D/s of Srinagar, Kirtinagar	Not operational								
6	UT64	Fafamau, Lord Curzon Bridge, Allahabad	8.3	4.1	17.8	7.9	8.3	63.2	329	7.8	372.7
7	UT65	Balu ghat bridge, Chunar	8.4	4.07	16.06	8.2	8.06	87.8	437	4.7	214.1
8	UT66	D/s of Ghazipur, Abdul Hameed Setu on River Ganga	Not operational								
9	BH74	River Ganga, D/s of Buxar	7.5	3.1	9.3	7.7	4.1	41.5	495.4	2.1	269.2
10	BH75	D/s of Bhagalpur	5.4	1	5.8	7.8	2.8	42.9	351.4	0.5	86.3
11	BH77	U/s of Patna city, Khurji	Not operational								
12	BH72	Chausa, U/s of Buxar	7.1	2.5	10.8	8.2	4.8	44.6	464.2	5.08	130.3
13	JH83	Sahebganj	6.3	2.8	14.7	7.8	5.7	35.1	508.4	6.2	48.8
14	WB86	Farakka Barrage, Road Bridge	7.5	2	8.1	8.2	3.6	27.4	310	5.09	201.8
15	WB87	Nabadwip Bathing Ghat	6.5	1.5	9.8	7.7	5.1	31.3	280.6	1.1	55.7
16	WB88	Chinsura , Near Hooghly	7.1	2.6	14.1	8.2	7.3	26.6	319.3	2.3	259.7
17	JH84	Rajmahal at Malgodam	Not operational								

Appendix 6.7

Monthly average water quality data for 09 tributaries in Year 2023 (36 RTWQM Project)

	Jan-23			Feb-23			Mar-23			Apr-23			May-23			Jun-23			Jul-23			Aug-23			Sep-23		
Station	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**	**BOD**	**DO**	**pH**
UP03	1.5	6.8	7.5	1.2	6.3	7.6	1.4	7.1	7.6	0.6	8.1	7.6	1.3	11.2	7.6	1.4	10.4	7.6	2.6	6.9	7.3	1.5	7.2	7.5	0.9	6.9	-
UP13	2.5	9.3	7.7	2.6	9.5	8	2.8	6.8	7.7	2.5	8	8.1	2	7.7	8.1	1.9	8.2	7.8	2.3	7.6	7.8	2.5	7.2	7.6	3.9	6.3	7.6
UP17	2.2	8.9	7.7	2.8	7.5	7.5	2.7	4.6	7.2	2.8	6	7.2	0.6	10.2	7.3	0.7	10.9	7.2	2.6	11	7.3	-	-	6.7	2	7	6.9
UP55	2.2	9.2	7.8	2.2	11.4	7.7	2.1	10.3	7.9	1.6	9.1	7.9	1.6	8.2	7.9	1.9	8.4	7.8	2.5	7.4	7.7	1.9	7.5	7.6	2.6	7.6	7.8
WB05	2	8.2	7.8	2.3	4.3	7.4	2.2	3.4	6.9	2.4	4.5	7.1	2.8	4.8	7.0	2.7	5.0	7.1	4.7	5.7	7.0	4.0	7.5	7.3	3.8	2.4	7.9
WB06	2.2	7.2	7.6	2.5	3	7.6	2.8	5.8	7.6	2.4	5.1	7.6	2.5	4.8	7.6	2.5	4.7	7.6	3.5	4.8	7.6	3.4	4.5	7.6	3	1.7	7.8

RTWQM stations were operational on 6 tributaries and non-operational on 3 tributaries joining River Ganga.

All parameters are expressed in mg/L except pH.

Appendix 6.8

Average Annual Water Quality of stations located on Tributaries of River Ganga (January ~December 2023) – 40 RTWQM Project

S. No	Station code	Station name	DO (mg/l)	BOD (mg/l)	COD (mg/l)	pH	TOC (mg/l)	Cl-	EC (µS/cm)	Nitrate (mg/l)	Turbidity (NTU)
1	HR56	D/s of Mohana, Sonipat	4.4	5.9	22.3	8.4	10.3	107	461.5	8.2	124.2
2	UT57	Hindon river, Rajnagar Extension	Not operational								
3	UT58	D/s Meerut city, Kaul village	Not operational								
4	UT59	River Kali East, D/s of Bulandshahr	Not operational								
5	UT60	U/s of Gokul Barrage, D/s of Mathura city	1.4	12.4	42.1	8.5	21.3	192.9	1307	11.8	59.2
6	UT61	River Hindon , Barnawa,Bagpat	Not operational								
7	UT63	U/s to Sangam at Allahabad	7.6	4.05	17.8	7.9	8.3	119.8	612.6	5.9	3.6
8	UT67	Kheerveer Bridge, Pratapgarh	Not operational								
9	UT68	Korra Kanak, Asothar, Fatehpur.	8.3	3.5	15.1	8.3	8.3	101.2	668.5	6.5	235.6
10	UT69	Marhapur, Auraiya	7.7	4.4	17.2	8.1	8.5	118.6	770.1	10.7	188.6
11	UT70	Mawai Dham, Amauli, Fatehpur	7.4	3.6	14.8	7.5	7.4	117.8	735.6	9.3	148.5
12	UT71	Dandi Village, Budaun	6.7	3.6	17	7.7	7.6	27.6	493.3	5.8	136.06
13	UT62	River Kosi, D/s of Kashipur, Darhiyal	8.2	2.2	9.4	7.8	4.9	75.9	523.9	3.6	272.4
14	BH73	Bridge on Ghagra near Manjhi, Chappra	6.8	1.7	7.9	8.3	3.5	20.6	276.4	1.8	403.1
15	BH76	Fathua on Punpun, Patna	1	5.6	21.3	8.4	10.6	96.2	626.2	9.1	100.6
16	BH78	Burhi Gandak, Khagaria	7	2.3	9.9	8.1	4.6	31.4	405.3	0.4	19.7
17	BH79	Road bridge on Kosi, Kursela	7.3	2.7	11.8	7.9	6.1	7.1	272.8	3.1	287.4
18	BH80	Road bridge on Son, Arrah	7.4	0.9	5.8	7.8	2.3	10.9	220	2.3	87.1
19	BH81	Gandak, Hajipur	7.7	2.09	9.2	8.1	3.9	9.1	271.3	3.2	169.5
20	WB89	Durgapur barrage, Road Bridge	6.9	1.7	8.4	8.0	3.7	20.8	302.8	2.8	12.3
21	WB90	Damodar river Intake well pump house	6.7	0.9	5.5	8.1	1.9	34.2	392.3	3.4	87.5
22	JH82	Birsa Pool, Pathardih	5.9	1.7	5.9	8.3	2.7	17.9	397.1	3.09	18.9
23	WB85	Raghunathpur Thermal power plant Intake well. Salchura	6.3	1.2	6.2	8.2	2.6	18.7	308.2	0.6	11.7

Note: Force Majeure stations are indicated with (-) in Water Quality Values.

Appendix 6.9

Bio-Monitoring Locations of River Ganga

Sr. No.	Location	State	Latitude	Longitude
1.	Gangotri	Uttarakhand	30.993590	78.945850
2.	Harsil		31.035400	78.751000
3.	Uttarkashi U/S		30.755791	78.464005
4.	Uttarkashi D/S		30.737000	78.352000
5.	Haridwar Barrage		29.971247	78.184200
6.	Jagjeetpur U/S		29.899040	78.141413
7.	Jagjeetpur D/S		29.878530	78.144199
8.	Madhya Ganga Barrage	Uttar Pradesh	29.373889	78.040833
9.	Anupshahr		28.365340	78.278355
10.	Narora Barrage		28.194925	78.403008
11.	Kacchla Ghat, Badaun		27.930736	78.857806
12.	Panchal Ghat, Farrukhabad		27.398415	79.62751
13.	Kannauj D/S		27.010681	79.986332
14.	Bithoor		26.616412	80.273932
15.	Ganga Barrage U/S Kanpur		26.507240	80.317450
16.	Shukla Ganj, Kanpur		26.467560	80.374147
17.	Jajmau, Kanpur		26.432500	80.417777
18.	Deorighat, Kanpur		26.378141	80.490793
19.	Asni Village, Fatehpur		26.057378	80.906673
20.	Bridge on GT Road, Prayagraj		25.437923	81.885484
21.	Prayagraj D/S		25.345649	81.921228
22.	Sirsa, Tamas D/S		25.267700	82.093031
23.	Varanasi U/S		25.255740	83.027717
24.	Varanasi D/S		25.322414	83.034520
25.	Rajwari A/C Gomti		25.537372	83.199939
26.	Buxer U/S	Bihar	25.520400	83.900200
27.	Buxer D/S		25.591800	83.986100
28.	Digha Ghat		25.653310	85.093393
29.	Gandhi Ghat		25.622066	85.171140
30.	Malsalami		25.595747	85.244144
31.	Fatuha		25.509544	85.318221
32.	Sahebganj	Jharkhand	25.248827	87.642486
33.	Rajamahal		25.055257	87.836678
34.	Murshidabad	West Bengal	24.482660	88.056343
35.	Beharampore U/S		24.099475	88.245433
36.	Behrampore D/S		24.062227	88.228161
37.	Srirampore D/S		22.719290	88.364127
38.	Khardakhal D/S		22.722777	88.362222
39.	Ballykhal		22.653221	88.350386

Sr. No.	Location	State	Latitude	Longitude
40.	Belgharia		22.670503	88.360044
41.	Howrah Bridge		22.582878	88.348287
42.	Garden Reach		22.551500	88.286244

U/s - Upstream, D/s - Downstream, A/c - After confluence

Appendix 6.10

Bio-Monitoring Locations of River Yamuna

S. No.	Location	State	Latitude	Longitude
1.	Yamunotri	Uttarakhand	30.998920	78.461917
2.	Syana Chatti		30.905846	78.360220
3.	Dak Pathar B/C		30.504813	77.816621
4.	Dak Pathar A/C		30.498180	77.804000
5.	Paonta Sahib	Himachal Pradesh	30.431554	77.615697
6.	Hathni Kund	Haryana	30.352735	77.595233
7.	Kalanaur		30.067020	77.353307
8.	Panipat U/S		29.385580	77.148696
9.	Panipat D/S		29.254270	77.131625
10.	Sonepat		28.983940	77.200270
11.	Palla	Delhi	28.841447	77.216713
12.	Nizamuddin		28.592880	77.273044
13.	Okhla D/S		28.533295	77.330724
14.	Palwal	Haryana	28.655498	77.294873
15.	Mathura U/S	Uttar Pradesh	27.566949	77.710498
16.	Mathura D/S		27.456360	77.713451
17.	Agra U/S		27.250489	77.861338
18.	Agra D/S		27.179355	78.117263
19.	Bateshwar		26.934660	78.542110
20.	Etawah		26.753720	79.019147
21.	Auraiya		26.427950	79.480519
22.	Hamirpur		25.958850	80.160884
23.	Pateora Danda		25.918600	80.222530
24.	Chilla ghat		25.771905	80.524065
25.	Benda ghat		25.708880	80.605040
26.	Prayagraj B/C River Ganga		25.423350	81.879813

U/s - Upstream, D/s - Downstream, B/C - Before confluence, A/C - After Confluence

Appendix 6.11: Action required to improve water quality of River Hindon and its tributaries namely Rivers Dhamola, Krishni and Kali-West in Saharanpur and Shamli districts

Saharanpur and Shamli District

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
1.	Hindon (At origin)	Not available	Not available	(DO-10.8 mg/l BOD & COD- NIL) • River Hindon originates from around 3 to 4 km from Barsani Falls inside a dense forest area. • River is recharged by small freshwater streams from its origin to Barsani Falls. • Freshwater was observed at the origin.		No industrial unit identified	No sewage discharge	Inadequate flow in river	• Restoration of flow to be considered. • Vegatation development in catchment of river Hindon along its course.
2.	Hindon (at Kaluwala village) (~ 5.5 km)	Not available	Not available	• Pond fed by waterfall has clean water full of fishes		No industrial unit identified	No sewage discharge	Pond is silted	• Restoration of pond via desiltation. • The desilted material should be used for strentheging the enbankments and the embankments should be vegetated. • Embankments of river Hindon should be vegetated all along the course.
3.	Hindon (at Pur ka Tanda)	Not available	Not available	• Bunds have been constructed on the River Hindon at Pur ka Tanda, Saharanpur by the		No industrial unit identified	No sewage discharge	Dry stretch	• Restoration of flow to be considered.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
	(~ 21 km)			Irrigation Department to revive the river • River is dry at this location					• Increase in source of freshwater by making check dams
4.	Hindon (at Khujnawar bridge and Harora village) (~ 46 km)	Not available	Not available	• River was found dry.		No industrial unit identified	No sewage discharge	• Dry stretch • River bed encroached.	• Restoration of flow to be considered. • Removal of encroachment in river bed. • Increase in source of freshwater by making check dams.
5.	Hindon (at Janta Road Bridge) (~ 47.5 km)	Not available		***Round I:*** DO-NIL, BOD-291 mg/l, & COD:763 mg/l ***Round II:*** DO-NIL, BOD-369 mg/l & COD: 612 mg/l (Stagnant polluted wastewater)		Slaughter House and Board Mills namely Anant Board Mill, Balaji Board Mill, Ekta Board Mill, and Krishna Board Mill	No sewage discharge	• High impact due to industrial discharge. • First polluted stretch observed at Janta Road Bridge, before that river stretch is dry. • River bed encroached.	• Action on industries discharging untreated/partially treated effluent in the catchment area. • Removal of encroachment in river bed.
6.	Hindon	Sewage from Gagelheri and Dinapur village through drains at U/s of	Not available	DO-NIL, BOD-80 mg/l & COD-305 mg/l	Not available	No industrial unit identified	Sewage from Gagelheri and Dinapur village	• Untreated sewage discharge (water quality deteriorated) • River bed encroached.	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. • Removal of encroachment in river bed.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
		Daya Sugar Mill							
7.	Hindon	Daya Sugar Mill drain (~ 48.5 km*)	Dry	Not available	DO-NIL, BOD-73 mg/l & COD-292 mg/l	GPI-01 (Daya sugar Naya Bans, Saharanpur)			
8.	Hindon	Nagdehi drain (~ 56 km)	***Round I:*** Dry ***Round II:*** BOD-34 mg/l & COD-103 mg/l ***Round III:*** Flow-0.74 MLD, BOD-237 mg/l & COD-349 mg/l	Dry	Dry	02 GPIs (Dairy & Textile) & 01 Non-GPI (Board Mill) (*Conforming area*) 01 Unit (Board Mill)	Sewage under Saharanpur-Dehradun road bridge	• Drain water quality deteriorated due to industrial and untreated sewage discharge • River stretch dry. • River bed encroached.	• Removal of solid waste. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. • Action on industries discharging untreated/partially treated effluent in the Nagdehi drain. • Desilting of river bed. • Removal of encroachment in river bed.
9.	Hindon	Star Paper Mill drain (~ 60 km)	***Round I:*** Flow-23.76 MLD, BOD-61 mg/l, COD-181 mg/l & TDS-2796 mg/l ***Round II:*** BOD-83 mg/l, COD-195	Dry Dry	***Round I:*** DO-0.8 mg/l, BOD-61 mg/l & COD-181 mg/l (The only water source at this river location is discharge of	GPI-01 (Star Paper Mill) (*Conforming area*)	Sewage from Shantagarh area	Impact due to industrial and untreated sewage discharge	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. for treatment of Star Paper Mill drain.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
			mg/l, TDS-3404 mg/l & Chloride-1261 mg/l ***Round III:*** Flow-20.75 mg/l, **Color-107 Hazen,** BOD-198 mg/l, COD-338 mg/l, TDS-3024 mg/l & Chloride-1147 mg/l		Star Paper Mill drain, therefore, it has the same characteristic as of drain)				
River Dhamola									
10.	Dhamola (Origin at Sansarpur village)	Not available	Not available	• Dhamola River originates from a pond in Sansarpur village • Pond is dry • The river is recharged by groundwater at Salempur Bhugdi village		No industrial unit identified	No sewage discharge	Dry stretch	• Restoration of flow to be considered. • Pond should be desilted and the desilted material should be used for strentheging the enbankments and the embankments should be vegetated. • Embankments of river Dhamola should be vegetated all along the course.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
11.	Dhamola	Madh Village drain (~ 20 km)	Flow-1.71 MLD, BOD-17 mg/l & COD-100 mg/l	***Round I:*** DO-8.04 mg/l, BOD-1.6 mg/l & COD- 7 mg/l ***Round II*** DO-13.9 mg/l, BOD-3 mg/l & COD-14 mg/l	Not available	No industrial unit identified	Sewage from Madh village	-	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc.
12.	Dhamola	Numaesh camp drain (~ 26 km)	***Round I:*** Flow- 10 MLD, BOD-76 mg/l & COD-197 mg/l ***Round II:*** BOD-63 mg/l & COD-258 mg/l	***Round I:*** DO-0.36 mg/l & BOD-23 mg/l	***A/c of both drains*** ***Round I:*** DO-0.95 mg/l, BOD-37 mg/l & COD- 117 mg/l ***Round II:*** DO-NIL, BOD-42 mg/l & COD- 155 mg/l	No industrial unit identified	Sewage from Numaish Camp Area	• Impact due to industrial and untreated sewage discharge. • First polluted stretch of river Dhamola.	• Removal of solid waste. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc.
13.	Dhamola	Kamdhenu complex drain (~ 26 km)	***Round I:*** BOD-204 mg/l, COD-545 mg/l, TSS-1066 mg/l, TDS-1496 mg/l, Cd-7.09 mg/l,			04 Nos. GPIs (Textile)	Sewage from Balmiki Basti		• Action on industries discharging untreated/partially treated effluent into Kamdhenu Complex Drain. • Removal of solid waste. • Decentralized low-cost treatment system like stabilization pond,

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
			Cu-15.95 mg/l & Fe-97.05 mg/l ***Round II:*** BOD-28 mg/l, COD-142 mg/l & Fe-6.49 mg/l						Constructed Wetland, oxidation ditches etc. • New STP along with sewage network with future projection shall be installed.
14.	Dhamola	Paondhoi drain (~ 28 km)	BOD-64 mg/l & COD-170 mg/l	Not available	A/c of both drains at Sadoli Hariya ***Round I:*** DO-NIL, BOD-22 mg/l & COD-126 mg/l ***Round II:*** DO-NIL, BOD-47 mg/l & COD-159 mg/l	No industrial unit identified	Sewage from Saharanpur city	Impact due to untreated sewage discharge.	• Interception, diversion and treatment of sewage. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc.
15.	Dhamola	Kishanpur drain (~29 km)	Flow-95 MLD, BOD-206 mg/l & COD-347 mg/l	Not available		No industrial unit identified	Sewage from Saharanpur city and Ram Nagar market area		
16.	Hindon	Dhamola (~ 52 km from origin to confluence of river Hindon)	Flow-250.56 MLD, BOD-8 mg/l, COD-86 mg/l	Not approachable, lean flow in river	***Round I:*** DO-NIL, BOD-7 mg/l & COD-92 mg/l	04 Nos. GPIs (Textile)	Sewage discharge from Madh village, Numaish camp area, Saharanpur city and Ram	• River is polluted. • Mixed impact from industrial and untreated	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. in river Hindon b/c and a/c of river Dhamola.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
					Round II: DO-NIL, BOD-24 mg/l & COD- 95 mg/l		Nagar market area	sewage discharge.	• Upgradation and ensuring compliance of 38 MLD STP at Saharanpur near Mahilpur Road. • Action on industries discharging untreated/partially treated effluent into river Dhamola. • New CETP with adequate capacity shall be installed for industrial clusters in catchment of river Dhamola & KD Complex drain.
17.	Hindon	Bajaj Sugar Mill drain (~ 90 km)	***Round I:*** BOD-20 mg/l, COD-82 mg/l ***Round II:*** BOD-74 mg/l, COD-211 mg/l	Not applicable	At Village Maheshpur ***Round I:*** DO-0.9 mg/l, BOD-14 mg/l & COD- 77 mg/l ***Round II:*** DO-0.35 mg/l, BOD-21 mg/l & COD-83 mg/l	02 Nos. GPI (Bajaj Hindustan Sugar Mill & Distillery)	No sewage discharge	River is polluted	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. • Desiltation of drain.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
River Kali-West									
18.	Kali-West (Originate from wetlands at Gangali and Kalalhati village)	Not available	Not available	• Wetland at origin is eutrophicated.		No industrial unit identified	No sewage discharge	River bed is silted and encroached by farmers	• Restoration of flow to be considered. • Rejuvenation of wetland • Desiltation of river bed and the desilted material should be used for strentheging the enbankments and the embankments should be vegetated. • Embankments of river Kali-West should be vegetated all along the course. • Removal of encroachment in river bed.
19.	Kali-West (Shivpur village)	Not available	Not available	• River feeds into a pond at Shivpur village. (water quality sample not collected)		No industrial unit identified	Domestic sewage from nearby villages	• Pond is highly silted and polluted due to discharge of sewage from nearby villages.	• Desiltation of pond. • The desilted material should be used for strentheging the enbankments and the embankments should be vegetated.
20.	Kali-West (Dharampur)	Not available	Not available	Not available	Not available	No industrial unit identified	No sewage discharge	• River bed is encroached by farmers • Inadequate flow in river • Highly eutrophicated	• Removal of encroachment in river bed. • Desilting of river bed. • The desilted material should be used for strentheging the enbankments and the embankments should be vegetated.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
									• Restoration of flow to be considered.
21.	Kali-West (u/s Rastam village)	Ganga Canal	Not available	• DO-10.2 mg/l, BOD-1.1 mg/l & COD-6 mg/l were found in river Kali-West. • Fresh water discharged into river Kali-West from Ganga canal.		No industrial unit identified	No sewage discharge	River is not polluted	-
22.	Kali-West (Chandpur village) (~ 9 km)	Not available	Not available	A small fresh water stream joins the river 5 km upstream of the location. (water quality sample not collected)		No industrial unit identified	No sewage discharge	-	-
23.	Kali-West (Miragpur village) (~ 12 km)	Not available	Not available	DO-9.92 mg/l, BOD- 3 mg/l & COD-10 mg/l were found in river Kali-West.		No industrial unit identified	No sewage discharge	River is not polluted	-
24.	Kali-West	Deoband drain (~ 16 km)	Flow-12.51 MLD, BOD-21 mg/l & COD-77 mg/l	-	At Sapla Khatri village ***Round I:*** DO-2 mg/L, BOD-1.1 mg/L & COD-7 mg/l ***Round II:*** DO-0.7 mg/L, BOD-6	No industrial unit identified	Domestic sewage from Deoband town	Water quality of river Kali-West deteriorated in terms of dissolved oxygen	• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. on Deoband drain.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
					mg/L & COD-25 mg/l				
25.	Kali-West	Sheela drain at Lakhnauta (Haridwar) (~ 22 km) (Sheela drain was monitored at Lakhnauta, Uttarakhand before confluence of channel of Ganga canal with the drain)	Flow-20.04 MLD, **BOD-365 mg/L, COD 702 mg/L**	***Round I:*** DO-1.2 mg/L, BOD-5 mg/l & COD-28 mg/l	***Round I:*** DO-1 mg/L, BOD-4 mg/L & COD-20 mg/l	12 (nos.) industries namely Finolex Kebles Ltd., Roorkee, Carborandom Universal Ltd., Roorkee, Inwing Industries, Sagar Paper Mills, UMRB Electronics, ASAHI India Glass Ltd. (AIS), AIS outglass, Air Liquid India Facility, Roorkee, Aroma-Craft & Tissue Pvt. Ltd., Aadharshree Paper Mills Pvt. Ltd., Uttaranchal Pulp & Paper Pvt. Ltd., Saraswati Paints Pvt. Ltd.	Domestic sewage from nearby villages (Libaheri, Jhabrera, Tikkolakala, Kbalpura etc.) and Roorkee	Impact in terms of dissolved oxygen which might affect the aquatic life	• Action on industries discharging untreated/partially treated effluent into Sheela drain • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. on Sheela drain b/c to river Kali-West.
River Krishni									
26.	Krishni (Origin at Savalpur Navada)	Not available	Not available	• Krishni river originates from the wetland at Savalpur Navada near Krishni village in Saharanpur district.		No industrial unit identified	Sewage from surrounding village	-	• Restoration of pond via desiltation and floating wetlands.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
				• The source of water is a spring that feeds the river Krishni					• The desilted material should be used for strengthening the enbankments and the embankments should be vegetated. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc.
27.	Krishni	Thaska drain (~ 36 km*)	BOD-98 mg/L, COD 354 mg/L	River dry before confluence	DO- NIL, BOD-98 mg/l & COD-354 mg/l (The only water source at this river location is discharge of Thaska drain, therefore, it has the same characteristic as of drain)	Conforming GPI-03 (Sugar, Milk processing, Distillery)	Sewage from Nanauta town to Village Bhanera Khemchand	• First polluted stretch observed D/s Thaska drain before that river is dry. • Polluted stretch from D/s Thaska drain to D/s Shamli drain due to industrial and untreated sewage discharge. • Drain was highly eutrophicated.	• Removal of solid waste. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. • Action on industries discharging untreated/partially treated effluent into Thaska drain. • Constructed Wetland in Thaska drain B/c with river Krishni or in river Krishni A/c with Thaska drain.
28.	Krishni	Sikka drain (~ 75 km*)	BOD-48 mg/L, COD 256 mg/L, TDS-1948 mg/L,	DO-NIL, BOD-57 mg/l & COD-228 mg/l	Not available	Non-conforming GPI-01(Maruti papers Pvt. Ltd.)	Domestic sewage from Village Sikka and Jalalpur		• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key Issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
29.	Krishni	Shamli drain (~92 km*)	Flow-93.41 MLD, BOD-48 mg/L & COD- 254 mg/L	Not applicable	DO-NIL, BOD-57 mg/L & COD- 297 mg/l	Non-conforming GPI-02 (Distillery & Sugar); Conforming GPI-01 (Pulp & paper)	Domestic sewage from Shamli town		• Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. • Action on industries discharging untreated/partially treated effluent into Shamli drain. • New STP along with sewage network with future projection shall be installed. • Proper tapping and diversion structure for tapping of drain. • Constructed Wetland in Shamli drain B/c with river Krishni or in river Krishni A/c with Shamli drain.

Appendix 6.12: Action required to improve water quality of river Hindon in Muzaffarnagar district

Muzaffarnagar District

S. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD, COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
1.	Hindon	Titawi village drain (Untapped) 151.5 Kms	At Titawi village ***Round I*:** Flow-4.93 MLD, BOD-197 mg/l & COD-399 mg/l ***Round II:*** Flow-2.34 MLD, BOD-190 mg/l & COD-373 mg/l	At Titawi village ***Round I:*** DO-0.6 mg/l, BOD-13 mg/l & COD-51 mg/l ***Round II:*** DO-0.66 mg/l, BOD-7 mg/l & COD-47 mg/l	At Titawi village ***Round I:*** DO-NIL, BOD-5 mg/l & COD-36 mg/l ***Round II:*** DO-0.6 mg/l, BOD-13 mg/l & COD-54 mg/l	Indian Potash Limited, Titawi (Sugar Industry)	Domestic sewage from Titawi village	Impact observed-Insufficient dissolved oxygen in river	• Installed ETP shall be upgraded at Indian Potash Limited, Titawi to improve quality of treated effluent. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. on Titawi village drain.
2.	Hindon	Dhobi Ghat drain-Budhana town (Untapped) 188.1 Kms	***Round I:*** BOD-180 mg/l & **COD-455 mg/l** ***Round II:* BOD-574 mg/l, COD-1435 mg/l &** TSS-1551 mg/l (*Flow in the drain could not be measured due to less flow*)	Not available	Not available	No industrial unit identified	Domestic sewage from Parsi Basti, Budhana	Industrial impact observed-Discharge of wastewater containing high BOD and COD in river through Dhobi Ghat drain	• Removal of solid waste. • Action on industries discharging untreated/partially treated effluent into Dhobi Ghat drain. • To expedite construction of 10 MLD Budhana STP & tap Dhobi Ghat drain to the STP.
3.	Hindon	Sabzi Mandi drain-Budhana town (Untapped)	***Round I:*** BOD-115 mg/l & COD-273 mg/l ***Round II:*** BOD-267 mg/l, **COD-800 mg/l** & TSS-771 mg/l	Not available	Not available	No industrial unit identified	Domestic sewage from Sabji Mandi, Luhsana village, Mandwada	Industrial impact observed-Discharge of wastewater containing high COD in river	• Removal of solid waste. • Action on industries discharging untreated/partially treated effluent into Sabzi Mandi drain.

S. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD, COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
		188.2 Kms	(*Flow in the drain could not be measured due to dumping of solid waste*)				village, Budhana	through Sabzi Mandi drain	• To expedite construction of 10 MLD Budhana STP & tap Sabzi Mandi drain to the STP.
4.	Hindon	Shamshan Ghat drain-Budhana town (Untapped) 188.4 Kms	***Round I:*** BOD-130 mg/l & COD-368 mg/l ***Round II:*** BOD-159 mg/l & COD-344 mg/l (*Flow in the drain could not be measured due to dumping of solid waste*)	Not available	***Round I:*** DO-NIL, BOD-9 mg/l & COD-51 mg/l ***Round II:*** DO-0.5 mg/l, BOD-10 mg/l & COD-47 mg/l	No industrial unit identified	Domestic sewage from Sabji Mandi, Luhsana village, Mandwada village, Budhana	River impacted (Insufficient dissolved oxygen in river) Insufficient dissolved oxygen in river	• Removal of solid waste. • To expedite construction of 10 MLD Budhana STP & tap Shamshan Ghat drain to the STP. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. in river Hindon a/c of Shamshan Ghat drain. • Constructed Wetland in river Kali-West A/c with three drains of Budhana namely Dhobi Ghat drain, Sabzi Mandi drain and Shamshan Ghat drain.

Appendix 6.13: Action required to improve water quality of river Kali-West in Muzaffarnagar district

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
1.	Kali-West	Maleera village drain (Untapped) 40.8 Kms	BOD-54 mg/l & COD-187 mg/l (*Flow in Maleera village drain was less which could not be measured*)	DO-5.3 mg/l, BOD-5 mg/l & COD-9 mg/l	DO-4.7 mg/l, BOD-6 mg/l & COD-18 mg/l	No industrial unit identified	Sewage from Maleera village	River impacted (deterioration in dissolved oxygen)	Decentralized low cost treatment system like stabilization pond, constructed wetlands, oxidation ditches, etc. to treat wastewater of Maleera village drain.
2.	Kali-West	Badhai Khurd drain (Untapped) 48.7 Kms	At village Rankhandi, Saharanpur: ***Round I:*** Flow-41.85 MLD, BOD-45 mg/l & COD-161 mg/l ***Round II:*** Flow-6.75 MLD, BOD-104 mg/l & COD-298 mg/l B/c with river Kali-West, Muzaffarnagar: Flow-33.32 MLD, BOD-30 mg/l & COD-106 mg/l	Not available	At Mimlana village (DO-4 mg/l, BOD-7 mg/l & COD-19 mg/l) At Khanjahanpur village (DO-0.9 mg/l, BOD-7 mg/l & COD-24 mg/l)	Triveni Engg. & Industries Ltd, Deoband (Sugar Industry) *(Conforming)*	Sewage from Deoband, Bahadurpur, Rankhandi, Thamana, Aakhlour, Badhai Kalan, Hoshiyarpur, Badhai Khurd, Said Nagla, Kacholli towns	River impacted (Low level of dissolved oxygen in river at Khanjahanpur village due to low flow and shallow depth)	Decentralized low cost treatment system like stabilization pond, constructed wetlands, oxidation ditches, etc. to treat wastewater of Badhai Khurd drain.
3.	Kali-West	Niyazupura drain (Untapped) 56.5 Kms	***Round I:*** Flow-17.5 MLD, BOD-119 mg/l & COD-398 mg/l ***Round II:*** Flow-17.07 MLD, BOD-230 mg/l & COD-552 mg/l	***Round I:*** DO-0.4 mg/l, BOD-6 mg/l & COD-13 mg/l ***Round II:*** DO-0.7 mg/l, BOD-12 mg/l & COD-32 mg/l	Not available	No industrial unit identified	Sewage from Niyazupura town	River impacted (Low level of dissolved oxygen in river due to low flow and shallow depth)	• Removal of solid waste. • Decentralized low cost treatment system like stabilization pond, constructed wetlands, oxidation ditches, etc. to treat wastewater of Niyazupura drain.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
4.	Kali-West	Laddawala drain (Tapped with overflow) 56.6 Kms	***Round I:*** Flow-92.27 MLD, BOD-163 mg/l & **COD-504 mg/l** ***Round II:*** *Origin (*BOD-222 mg/l & COD-508 mg/l) & b/c river Kali-East (Flow-65.94 MLD, BOD-259 mg/l, COD**-1150 mg/l** & TSS-1230 mg/l) • Inadequate tapping arrangement at Laddawala drain leads to overflow of sewage reaching to river Kali-West. • Huge amount of municipal solid waste is dumped into river through Laddawala drain.	Not available	DO-NIL, BOD-38 mg/l & COD-115 mg/l	No industrial unit identified	Sewage from Laddawala, Ramleela Tila, Abkari Mohalla, Hanumanpuri	Industrial impact observed (Discharge of wastewater containing high COD and solid waste in river through Laddawala drain)	• Complete tapping of Laddawala drain to 32.5 MLD STP. • Removal of solid waste. • Action on industries discharging untreated/partially treated effluent into Laddawala drain.
5.	Kali-West	Shamli Road drain (Untapped) 57.6 Kms	***Round I:*** BOD-202 mg/l & **COD-694 mg/l** ***Round II:*** BOD-117 mg/l & COD-291 mg/l (*Flow in the drain could not be measured as drain was flowing*	DO-NIL, BOD-25 mg/l & COD-60 mg/l	Not available	No industrial unit identified	Sewage from Shamli Road area	Industrial wastewater discharge (River stretch polluted-DO is NIL)	• Removal of solid waste. • Action on industries discharging untreated/partially treated effluent into Shamli Road drain.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			via closed pipeline and dumping of solid waste)						
6.	Kali-West	Khadarwala drain (Tapped with overflow) 57.8 Kms	BOD-164 mg/l & **COD-568 mg/l** • *Inadequate tapping arrangement at Khadarwala drain leads to overflow of sewage reaching to river Kali-West.* • *Flow in the drain could not be measured as drain was flowing via closed pipeline.*	Not available	Not available	No industrial unit identified	Sewage from Krishnapuri and Khalapar towns	Discharge of wastewater containing high COD and solid waste in river through Khadarwala drain	• Complete tapping of Khadarwala drain. • Removal of solid waste.
7.	Kali-West	Krishnapuri drain (Tapped with overflow) 57.9 Kms	BOD-122 mg/l & COD-444 mg/l • *Inadequate tapping arrangement at Krishnapuri drain leads to overflow of sewage reaching to river Kali-West.* • *Flow in the drain could not be measured as drain was flowing via closed pipeline.*	Not available	Not available	No industrial unit identified	Sewage from Krishnapuri and Khalapar towns	-	• Complete tapping of Krishnapuri drain. • Removal of solid waste.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
8.	Kali-West	Suzroo village drain (Suzroo village drain + Nai-Basti Khalapar drain + treated sewage of 32.5 MLD STP) (Untapped) 60.3 Kms	Flow-25.92 MLD, BOD-111 mg/l, **COD-571 mg/l** & Fe-26.8 mg/l	DO-NIL, BOD-28 mg/l & COD-103 mg/l	DO-NIL, BOD-18 mg/l & COD-72 mg/l	No industrial unit identified	Untreated sewage from Suzroo village drain, Nai-Basti Khalapar drain and treated sewage of 32.5 MLD Waste Stabilization Pond based STP	Polluted river stretch (DO is NIL)	• Tapping of sewage from Suzroo village & Nai-Basti Khalapar to 32.5 MLD STP. • Removal of solid waste. • Ensuring compliance and upgradation of 32.5 MLD Waste Stabilization Pond based STP.
9.	Suzroo village drain (Suzroo village drain + Nai-Basti Khalapar drain + treated sewage of 32.5 MLD STP) (Untapped)	Suzroo village drain (2^{nd} order & untapped)	Flow-6.48 MLD, BOD-63 mg/l & COD-224 mg/l	Not available	Not available	No industrial unit identified	Suzroo village	Untreated sewage discharged into river via Suzroo village drain	• Removal of solid waste. • Adoption of decentralized low cost treatment system like stabilization pond, constructed wetlands, oxidation ditches, etc. to treat wastewater of Suzroo village drain.
		Nai Basti Khalapar drain (2^{nd} order & untapped)	Flow-17.59 MLD, BOD-36 mg/l & COD-135 mg/l	Not available	Not available	No industrial unit identified	Sewage from Nai-Basti Khalapar area	Untreated sewage discharged into river via Nai-Basti Khalapar drain	• Removal of solid waste. • Adoption of decentralized low cost treatment system like stabilization pond, constructed wetlands, oxidation ditches, etc. to treat wastewater of Nai Basti Khalapar drain.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
10	Kali-West	Dhandera drain (Untapped) 74.8 Kms	At origin (near Tehri Pulp & Paper Ltd.) Flow-0.58 MLD, BOD-20 mg/l & COD-90 mg/l *Drain at this location receive discharge from Tehri Pulp & Paper Ltd. In downstream, an irrigation canal from Chandpur village meets Dhandera drain, which was found dry at the confluence, with no fresh water being discharged into the drain*. D/s Bhopa Road (near Silvertoan Papers Ltd.) Flow-19.3 MLD, BOD-30 mg/l, COD-137 mg/l & TDS-1080 mg/l B/c Jatt Mujhera drain Flow-54.23 MLD, **BOD-948 mg/l, COD-2011 mg/l, TDS-2808 mg/l & TSS-1188 mg/l**	DO-NIL, BOD-26 mg/l & COD-65 mg/l	DO-NIL**, BOD-348 mg/l & COD-1001 mg/l**	45 units in catchment of Dhandera drain (32), Jatt Mujhera drain (5), Kukra drain (2) & Begrajpur Industrial drain (6)	Sewage from towns/colonies located at Bhopa Road, Jansath Road, and Sahawali & Sandhawali villages (via Kukra drain).	Industrial impact observed (DO is NIL & significant increase in BOD and COD in river due to discharge of high BOD, COD, TSS & TDS bearing wastewater into river via Dhandera drain)	• Action on industries discharging untreated/partially treated effluent into Dhandera drain. • Upgradation of ETPs installed in industries located in catchment of the drain. • Series of CWs in Dhandera drain B/c with river Kali-West.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			Round 1: Flow-148.18 MLD, **BOD-547 mg/l, COD-1322** mg/l & TDS-1856 mg/l ***Round 2:*** Flow-112.13 MLD, **BOD-968 mg/l, COD-2214 mg/l, TDS-2452 mg/l & TSS-1622 mg/l** *(Drain carry effluents from industries located on Bhopa Road, Jolly Road, Jansath Road, Meerut Road and Begrajpur industrial area)*						
11	Dhandera drain (Untapped)	Jatt Mujhera drain (2rd order & untapped)	At origin (D/s Bindal Duplex Pvt. Ltd.) BOD-103 mg/l, COD-280 mg/l & TDS-1096 mg/l *(Drain contained very less flow which could not be measured)*	Not available	Not available	05 non-conforming GPIs (Pulp & Paper and Distillery)	No discharge of domestic sewage/STP/ CETP	Industrial impact observed (discharge of high BOD, COD, TSS & TDS bearing wastewater into river via Jatt Mujhera drain)	• Action on industries discharging untreated/partially treated effluent into Jatt Mujhera drain.
			B/c Dhandera drain Flow-8.06 MLD, **BOD-2230 mg/l, COD-4264 mg/l,**	Not available	Not available				

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			TSS-1230 mg/l & TDS-4148 mg/l						
	Dhandera drain (Untapped) *At Jansath Road (a/c with Jatt Mujhera drain)*	-	***Round 1:*** Flow-66.99 MLD, pH-5.9, Colour-146 Hazen, **BOD-922 mg/l, COD-2106 mg/l, TSS-1357 mg/l, TDS-3548 mg/l, Fe-26.72 mg/l, Pb-0.13 mg/l, Mn-3.31 mg/l & Zn-5.43 mg/l** ***Round 2:*** **BOD-1114 mg/l, COD-2413** mg/l, TDS-3164 mg/l & TSS-924 mg/l *(Formation of sludge blanket and solid waste deposition)*	Not available	Not available	32 non-conforming units (GPIs-29 & non-GPIs-3) comprising of Pulp & Paper, Slaughter House, Tannery, Pharmaceuticals & Food Processing industries	No discharge of domestic sewage/STP/ CETP	Industrial impact observed (discharge of high BOD, COD, TSS, TDS and metals bearing wastewater into river via Dhandera drain)	• Action on industries discharging untreated/partially treated effluent into Dhandera drain.
	Dhandera drain (Untapped)	Kukra drain (2nd order & untapped)	Near village Sandhawali (b/c with Dhandera drain) Flow-26.47 MLD, BOD-62 mg/l & COD-219 mg/l	Not available	Not available	02 non-conforming GPIs (Pulp & Paper)	Sewage from Sahawali & Sandhawali towns	Impact observed (discharge of untreated sewage into river via Kukra drain	• To expedite construction of proposed 22 MLD STP to treat the sewage of Kukra drain & tap the drain to the STP.
	Dhandera drain (Untapped) *(A/c Kukra drain at*	-	**BOD-495 mg/l, COD-2080 mg/l, TDS-2076 mg/l & TSS-1838 mg/l**	Not available	Not available	45 units in catchment of Dhandera drain (32), Jatt Mujhera drain (5), Kukra drain (2)	No discharge of domestic sewage/STP/ CETP	Industrial impact observed (discharge of high BOD, COD, TSS &	• Action on industries discharging untreated/partially treated effluent into Dhandera drain.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
	Meerut-Haridwar Bypass Road)		*(Flow not measured due to unapproachable site)*			& Begrajpur Industrial drain (6)		TDS bearing wastewater into river via Dhandera drain)	
12	Dhandera drain (Untapped)	Begrajpur Industrial Area drain (2nd order & untapped)	B/c Dhandera drain ***Round 1:*** Flow-1.92 MLD, **pH-2.3, Colour-146 Hazen, BOD-936 mg/l, COD-3444 mg/l, TDS-7884 mg/l,** Fe-27.96 mg/l, Pb-0.24 mg/l, Mn-3.72 mg/l & Zn-6.48 mg/l ***Round 2:*** Flow-1.73 MLD, **pH-<2, BOD-187 mg/l, COD-474 mg/l, TDS-2584 mg/l, Fe-8.91 mg/l, Pb-0.7 mg/l, Mn-10.9 mg/l & Zn-17.67 mg/l** *(Acidic fumes felt in Begrajpur Industrial Area drain)*	Not available	Not available	06 conforming non-GPIs (Pharmaceuticals & Dyeing)	No discharge of domestic sewage/STP/ CETP	Industrial impact observed (discharge of highly acidic and high color, BOD, COD, TDS and metals bearing wastewater into river via Begrajpur Industrial Area drain)	• Action on industries discharging untreated/partially treated effluent into Begrajpur Industrial Area drain.
13	Kali-West	Mansoorpur drain (Untapped) 75.5 Kms	***Round 1:*** Near Husenpur Bopara village (**pH-4.9, BOD-571 mg/l, COD-1426 mg/l & TDS-1000 mg/l)**	Not available	***Round 1:* DO-NIL, BOD-65 mg/l & COD-293 mg/l**	02 non-conforming GPIs (Sugar-01 & Distillery-01)	Sewage from Mansoorpur Sugar Mill Road area	Industrial impact observed on river (DO-NIL & high BOD/COD)	• Removal of solid waste. • Action on industries discharging untreated/partially treated effluent into Mansoorpur drain.

S. No.	River/Drain	Tributary/Drains/ Canal	Drain (Flow, BOD, COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			(Flow could not be measured due to deposition of solid waste) ***Round 2:*** Origin (BOD-60 mg/l & COD-222 mg/l) Near Husenpur Bopara village (Flow-3.13 MLD, **BOD-579 mg/l, COD-1261** mg/l, TDS-2188 mg/l) B/c river Kali-West (Flow-0.98 MLD, **BOD-404 mg/l, COD-870 mg/l, TDS-2024 mg/l** & Fe-15.13 mg/l)	***Round 2:*** DO-NIL, **BOD-111 mg/l & COD-436 mg/l**	***Round 2:*** DO-NIL, **BOD-87 mg/l & COD-302 mg/l**				
14	Kali-West	Pur Baliyan drain (Untapped) 76.4 Kms	***Round 1:*** Flow-1.99 MLD, BOD-188 mg/l & COD-425 mg/l ***Round 2:*** Origin (BOD-174 mg/l, COD-479 mg/l & TDS-1328 mg/l) B/c river Kali-West (Flow-2.51 MLD, **BOD-252 mg/l & COD-520 mg/l**)	Not available	***Round 1:*** DO-NIL, BOD-175 mg/l & COD-374 mg/l ***Round 2:*** DO-NIL, BOD-96 mg/l & COD-272 mg/l	No industrial unit identified	Sewage from Pur Baliyan village	River impacted (DO is NIL & high BOD and COD)	• Removal of solid waste, animal waste & cow dung at origin of the drain. • Decentralized low-cost treatment system like stabilization pond, Constructed Wetland, oxidation ditches etc. in river Hindon in Pur Baliyan drain.

Appendix 6.14: Action required to improve water quality of river Hindon in Meerut and Baghpat districts

Meerut and Baghpat Districts

Sl. No.	River	Tributary/ Drains/Canal	Drains/Canal (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c	A/c	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
1.	Hindon	Kali-West (~196.04 km)	Flow-285.24 MLD, DO-NIL, **BOD-138 mg/l, & COD-336 mg/l**	***Round II:*** DO-NIL, BOD-11 mg/l & COD-50 mg/l (~195.43 km)	***Round II:*** DO-NIL, **BOD-123 mg/l & COD-287 mg/l** (~203.49 km)	Discharge from industrial units located in the catchment of river Kali West.	Sewage discharged from Muzaffarnagar city and nearby town/villages	• High impact due to discharge of R. Kali-West carrying industrial and domestic wastewater (water quality deteriorated) • Polluted stretch from b/c & a/c of Kali West	• Action on industrial units discharging untreated/partially treated effluent. • Domestic sewage diverted to nearby STP. • Treatment of domestic sewage of nearby villages by using decentralize low cost sewage treatment system. • Constructed Wetland in river Kali-West B/c with river Hindon near Baparsi village, Meerut.
2.	Krishni	Ramala drain (Baghpat) (~118.57 Km)	At Budhpur village Flow-0.6 MLD, BOD-11 mg/l & COD-59 mg/l	**Near Budhpur village** DO-NIL, BOD-16 mg/l & COD-71 mg/l	**Near Gopalpur Khandwa** DO-NIL, BOD-16 mg/l, & COD-74 mg/l	**GPI-01 No.** M/s Ramala Sahkari Chini Mill (Conforming area)	Sewage discharging from Ramala village and Budhpur village and agricultural	• Untreated sewage discharge and agricultural runoff (water quality deteriorated).	Treatment of domestic sewage of nearby villages by using decentralize low cost sewage treatment system.

Sl. No.	River	Tributary/ Drains/Canal	Drains/Canal (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c	A/c	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
							runoff and there is possibility of discharge from sugar Mill	• Polluted stretch from b/c & a/c of Ramala drain.	
3.	Hindon	River Krishni (Baghpat) (~223.13 km)	At Gopalpur Khadana (Baghpat) DO-NIL, BOD-16 mg/l, & COD-74 mg/l	Near Barnawa village (Baghpat) DO-NIL, BOD-59 mg/l & COD-185 mg/l (~221.13 km)	Near Kalina Village (Meerut) DO-NIL, BOD-52 mg/l & COD-159 mg/l (~230.43 km)	Discharge from industrial units located in the catchment of river Krishni.	Sewage discharging from nearby village	• River is polluted. • Discharge of Untreated sewage. • Polluted stretch from b/c & a/c of river Krishni.	Treatment of sewage of nearby villages by using decentralize low cost sewage treatment system.
4.	Hindon	Sardhana drain at Kalina village (Meerut) (~230.63 km)	At Kalina Village ***Round I:*** Flow- 33.43 MLD, **Color-370 Hazen BOD-263 mg/l, COD-770 mg/l &** Fe-4.527 mg/l At Kalina Village ***Round II:*** Flow- 16.85 MLD, Colour- 5 Hazen**, BOD- 460 mg/l, COD- 1555 mg/l, TSS-1173** & **Fe-10.74 mg/l**	At Kalina Village ***Round I:*** DO-NIL, BOD-52 mg/l & COD-159 mg/l ***Round II:*** DO-NIL, **BOD-110 mg/l & COD-286 mg/l** (~230.43 km)	At Kinauni Vill. (b/c of Kinauni drain) ***Round I:*** DO-NIL, **BOD-147 mg/l & COD-268 mg/l** (~234.13 km) At Kinauni Vill. (a/c of Sardhana drain & Kinauni Drain-Dry) ***Round II:*** DO-NIL, **BOD-163 mg/l & COD-348 mg/l**	**GPIs-03 Nos.**: (Paper-01, &Textile-02) **Non-GPI-01 No.**: Dairy-01 04(nos.) industries namely M/s Sardhana Paper, M/s Shri Babubali Trader, M/s Shree Krishna Processing, & M/s Sardhana Dairy, Sardhana Road Meerut.	• Discharge of sewage from Sardhana town, Kalina Village and nearby village and Industrial effluents. • Drain was filled with Municipal Solid Wastes at various locations • Large number of dairy farm along drain and deposition	• High impact due to discharge of industrial effluent and disposal of cattle dung, solid waste and sewage. • Polluted stretch from b/c & a/c of Sardhana drain.	• Action on industries discharging untreated/partially treated effluent. • Treatment of sewage of nearby villages by using decentralize low cost sewage treatment system. • Solid waste should be removed from the drain. • Cow dung and animal wastes should be

Sl. No.	River	Tributary/ Drains/Canal	Drains/Canal (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c	A/c	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
					(~234.63 km)		of huge quantity of animal dung in the drain.		removed from drain and follow up of guideline by dairy farms for disposal of animal dung. • STP of adequate capcity in Sardhana town. • Tapping of drains & inventory of industrial units in the catchment of drain. • Constructed Wetland in Sardhana drain B/c with river Hindon.
5.	Hindon	Kinauni drain (~234.51 km)	At Kinauni village **Round 1:** Dry **Round 2:** Dry	Near Kinauni village **Round 1:** DO-NIL, BOD-147 mg/l & COD-268 mg/l (~234.45 km) **Round 2:** Sampling not done	Near Kinauni village **Round 1:** DO-NIL, BOD-140 mg/l & COD-288 mg/l **Round 2:** DO-NIL, BOD-163 mg/l & COD-348 mg/l (~234.63 km)	**GPI-02 No.** (Conforming area) M/s Bajaj Hindustan Ltd, (Sugar Unit) Village Kinauni, Meerut M/s Bajaj Hindustan Ltd, (Distillery Unit) Village Kinauni, Meerut	No significant flow, bed of drain was wet indicating industrial discharge	-	Inventory of drains carrying domestic wastewater from Kinauni village and treatment of sewage by using decentralized low cost sewage treatment system.

Sl. No.	River	Tributary/ Drains/Canal	Drains/Canal (Flow, BOD COD or any specific pollution)	Water quality of river stretch		Pollution sources		Key issues	Action Points
				B/c	A/c	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
6.	Hindon	Upper Ganga canal (~249.33 km)	Not available	Near Pura village **Round 1:** DO-NIL, BOD-113 mg/l & COD-215 mg/l (~244.73 km)	at Amirpur Baleni **Round 1:** DO-5.96 mg/l, BOD-10 mg/l & COD-30 mg/l (~251.63 km)	No industrial unit identified	Upper Ganga canal is a fresh water source from river Ganga.	• Small drains from Pura village discharging into river. • Improvement observed in river water quality due to release of fresh water from Upper Ganga Canal.	• Inventory of drains discharging from Pura village and Amirpur Baleni. and treatment of sewage by using decentralize low cost sewage treatment system. • Constructed Wetland in river Hindon before intrusion of freshwater from the Upper Ganga Canal.

Appendix 6.15: Action required to improve water quality of river Hindon in Ghaziabad district

Ghaziabad District

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
1	Hindon	Jawli drain (First Order) Untapped (Approx. 300.13 km)	***Round I:*** BOD-33 mg/L, COD-107 mg/L, **TDS-2216 mg/L Chloride-1049** mg/L ***Round II:*** BOD-55 mg/L, COD-221 mg/L, **TDS-4600 mg/L Mn-4.056** mg/L Flow could not be measured because depth measurement not possible/less flow	Not available ***Round II:*** DO: 1.03 mg/l BOD: 3 mg/l COD: 25 mg/l Pb: 0.23 mg/l	***Round I:*** DO: 2.32 mg/l BOD: 4 mg/l COD: 21 mg/l ***Round II:*** DO: 0.87 mg/l BOD: 3 mg/l COD: 27 mg/l Pb: 0.25 mg/l	**Total-44** 43 GPIs: Textile dying (07), Yarn/Textile processing (36) 1 Non-GPI: Yarn/Textile processing (01)	Carries discharge of CETP Tronica city and sewage from nearby villages	• Polluted stretch due to industrial impact. • Low DO observed may be due to stagnant water of the river	• Removal of Solid waste • Action on industries in catchment of the drain • Upgradation and ensuring compliance of CETP Tronica city. • Constructed Wetlands on Jawali drain B/c with river Hindon.
2	Hindon	Raj Nagar extension drain (First Order) Untapped (Approx. 307.09 km)	Flow-48 MLD, BOD- 36 mg/L, COD- 117 mg/L **TDS-1020 mg/L**	DO: 0.57 mg/l BOD: 4 mg/l COD: 38 mg/l Pb: 0.15 mg/l	DO: 0.71 mg/l BOD: 4 mg/l COD: 30 mg/l Pb: 0.51 mg/l	No industrial unit identified	Carries treated sewage from Noon Nagar Morty 56 MLD STP, and sewage from open drains	Low impact observed due to untreated sewage discharge	• Removal of Solid waste. • Interception & diversion of drain to Noon Nagar Morty 56 MLD STP before confluence of treated sewage.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
									• Ensuring compliance of Noon Nagar Morty 56 MLD STP.
3	Hindon	Karedha Drain (First Order) Untapped (Approx. 309.44 km)	***Round I:*** BOD-167 mg/l, **COD-538 mg/l**, TSS-522 mg/l, **TDS-2376 mg/l, Chloride-1039 mg/l,** NH_3-N- 54 mg/l, **Fe-111.17 mg/l, Pb- 3.37 mg/l, Zn- 6.315mg/l** ***Round II (1st Occasion):*** BOD-139 mg/L, **COD-529 mg/L, TDS-2608 mg/L Pb- 0.251 mg/l** ***Round II (2nd Occasion):*** BOD-158 mg/L, **COD-639 mg/L, TDS-1980 mg/L** Fe-8.167 mg/l Pb- 0.149 mg/l (Flow measurement not possible because no straight line	DO: 0.85 mg/l BOD: 5 mg/l COD: 22 mg/l	Not available	**Total – 10** 9 GPIs: Paper (01), Yarn/Textile processing (07) Metal Surface Treatment (01) 1 Non-GPI: Textile (01) (Washing and digital printing of fabric) Paper printing, automobile service, furniture moulding and fabrication, glass printing, MS wire drawing, electrical cable manufacturing and processing units were observed operating in catchment of drain	Sewage from Karedha area	• Polluted stretch from U/s Karedha drain to D/s Hindon Vihar drain. • Mixed impact due to discharge of untreated sewage and industrial discharge.	• Removal of Solid waste • Action on industries in catchment of the drain • Inventory of non-GPI water polluting industries in catchment of drain including metal recycling/processing /fabricating/galvanizing/painting/moulding. • Constructed Wetland on Karedha drain B/c with river Hindon.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			stretch available and there was dumping of solid waste)						
4	Hindon	Hindon Vihar Left (First Order) Untapped (Approx. 310.73 km)	***Round I:*** Flow-11.41 MLD, BOD- **181** mg/l, **COD- 574 mg/l, TDS-1344 mg/l** ***Round II:*** Flow-16.6 MLD, **BOD- 302 mg/l, COD- 803 mg/l,** TSS-601 mg/l	***Round II*** U/s Hindon Vihar Drain **DO: NIL BOD: 13 mg/l** COD: 60 mg/l Fe-4.77 mg/l	***Round I*** D/s Karedha + Hindon Vihar Drain DO: 1.41mg/l BOD: 3 mg/l COD: 21 mg/l ***Round II*** D/s Hindon Vihar Drain **DO: NIL BOD: 13** mg/l COD: 74 mg/l Fe-3.75 mg/l	No industrial unit identified	• Hindon Vihar left and right are concrete drains that conjoint together and form Hindon Vihar drain that ultimately discharges into the river Hindon after joining. After joining, the sampling is not possible due to non-approachability • Carry **domestic sewage** from household of Hindon vihar area • Large amount of cow dung observed		• Removal of Solid waste • Remediation using low-cost decentralized wastewater treatment systems such as series of constructed wetlands in both Hindon Vihar drains. • Inventory of water polluting industries in catchment of both Hindon Vihar drains. • Series of Constructed Wetlands in river Hindon A/c with Hindon Vihar drain.
5	Hindon	Hindon Vihar Right (First Order) Untapped (Approx. 310.73 km)	***Round I:*** Flow-15.65 MLD, **BOD- 639 mg/l, COD- 2018 mg/l, TSS-4766 mg/l,** Fe-38.021 mg/l, Pb- 0.124 mg/l ***Round II:*** Flow-7.85 MLD, **BOD- 168 mg/l**, **COD- 656 mg/l** TSS-639 mg/L						
6	Hindon	Kaila Bhatta Drain (First Order) Untapped	Flow-33.97 MLD, BOD- 71 mg/l, COD- 278 mg/l, **TDS-1736 mg/l,**	Not available	(*Downstream Hindon Barrage*) DO: 5.44* mg/l BOD: 6 mg/l	**Total-15** 12 GPIs: Pharmaceutical (02), Metal Surface	Carry sewage from Nava Jeevan Leprosy Colony, Madhopura area	Improvement in river water quality	• Action on industries in catchment of the drain • Remediation using low-cost

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
		(Approx. 313.07 km)			COD: 22 mg/l *Increased DO maybe due to turbulence and churning of water release from barrage	Treatment (08), Textile (01), Tannery (01) 3 Non-GPI: Pharmaceutical (01), Engineering (01) and Others paper board (01)			decentralized wastewater treatment system on kaila Bhatta drain.
7	Hindon	Arthala Drain (First Order) Untapped (Approx. 313.63 km)	BOD- 52 mg/l, COD- 208 mg/l, **TDS-2256 mg/l, Fe-65.021 mg/l, Pb- 0.198 mg/l**	Not available		**Total – 2** 1 GPI: Distillery- Mohan Meakin Ltd. Mohan Nagar Ghaziabad 1 Non-GPI: Metal Surface Treatment- Balaji wire Pvt ltd., 139-A, Anand Ind. Estate, Mohan Nagar, Ghaziabad.	Carry sewage from Arthala village	-	• Action on industries in catchment of the drain. • Remediation using low-cost decentralized wastewater treatment system on Arthala drain.
8	Hindon	Indirapuram Drain (First Order) Untapped (Approx. 316.86 km)	Colour- 98 Hazen, BOD- 88 mg/L, COD- 285 mg/L, **TDS-1320 mg/L**	U/s Indirapuram Drain DO: 6.4 mg/l BOD: 5 mg/l COD: 21 mg/l	Not available	No industrial unit identified	Carries combined discharge from 03 STPs in Indirapuram i.e. 74 MLD, 56 MLD and 56 MLD (***Sahibabad drain, which is an industrial drain, is also tapped to 74 MLD STP at*	-	• Ensuring compliance and upgradation of all STPs whose wastewater is carried by Indirapuram drain. • Action on industries in catchment of the Sahibabad drain**.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
							Indirapuram. All three STPs located in Indrapuram are non-complying w.r.t. discharge standards.)		• Constructed Wetlands on Indirapuram drain B/c with river Hindon. • CETP of adequate capacity shall be installed.
9	Hindon	Pratap Vihar Drain (First Order) Untapped (Approx. 317.03 km)	Flow-27.91 MLD, Colour- 123 Hazen, BOD- 102 mg/L, COD- 422 mg/L	Not available		No industrial unit identified	Domestic sewage from household of Pratap vihar area	-	• Remediation using low-cost decentralized wastewater treatment systems on Pratap Vihar drain. • New STP along with sewage network with future projection shall be installed. • Interception & diversion of Pratap Vihar drain to STP.
10	Hindon	Rahul Vihar Drain (First Order) Untapped (Approx. 317.24 km)	***Round I*** Colour- 145 Hazen **BOD- 206 mg/L,** **COD- 736 mg/L,** **TDS- 2664 mg/L,** TSS- 734 mg/L, **Chloride-1940** mg/L, Fe-3.254 mg/l ***Round II***	Not applicable ***Round II***	***Round I*** D/s Indirapuram + Pratap Vihar + Rahul Vihar drain DO: 2.25 mg/l **BOD: 15 mg**/l COD: 44 mg/l ***Round II***	Industrial impact observed but no industrial unit identified	Domestic sewage from household of Rahul Vihar area	• Integrated impact from untreated wastewater carried by prior drains namely Indirapuram, Pratap Vihar and Rahul Vihar drain • Deterioration of water quality in stretch from U/s	• Removal of Solid waste. • Action on industries in catchment of the drain. • Remediation using low-cost decentralized wastewater treatment systems on Rahul Vihar drain.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			BOD- 176 mg/L, **COD- 743 mg/L, TDS- 2784 mg/L,** TSS- 550 mg/L, **Chloride-1213** mg/L, Fe-5.084 mg/l (Flow measurement not possible because no straight line stretch available and due to solid waste dumping)	U/s Rahul Vihar drain DO: 4.2 mg/l BOD: 11 mg/l COD: 45 mg/l	D/s Rahul Vihar drain DO: NIL **BOD: 28 mg/**l COD: 139 mg/l			to D/s Rahul Vihar drain	• Series of Constructed Wetlands in river Hindon A/c with Rahul Vihar drain.
11	Dasna Drain (First Order)	Bhoorgarhi – Kalugarhi Drain (Second Order) Untapped *Kalugarhi drain joins Bhoorgarhi drain and forms Dasna drain*	Colour-167 Hazen BOD-97 mg/L, COD-329 mg/L, TDS-1552 mg/L, Fe-7.698 mg/l Flow could not be measured because depth measurement not possible	Not available		**Total – 7** 07 GPIs: Pulp & Paper (01), Tannery (02), Metal Surface Treatment (01), Slaughter House (03)	Untreated sewage from households of Bhoorgarhi village and Kalugarhi village	-	• Removal of Solid waste • Action on industries in catchment of the drain. • Remediation using low-cost decentralized wastewater treatment systems on Dasna drain.
12	Dasna Drain (First Order)	B.S. Road Drain (Second Order) Untapped	BOD- 84 mg/L, COD- 259 mg/L Fe-5.296 mg/l	Not available		No industrial unit identified	Carry untreated sewage from B.S. Road Industrial area	-	• Removal of Solid waste.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
			Flow could not be measured because depth measurement not possible						• Inventorization of small-scale industrial units.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
1	Shahdara drain (First Order of River Yamuna)	Sahibabad Drain (Second Order of River Yamuna) Tapped	Flow-111.81 MLD (overflow)** BOD-155 mg/L, COD-489 mg/L, TDS-2408 mg/L, Fe-14.971 mg/l **97 MLD measured from tapping channel + 5 MLD approx. from Vaishali drain + 10% considered for overflow + 5 MLD approx. from Vaishali drain; Total 111.8 MLD (97+5=102 MLD is tapped to 74 MLD Indirapuram STP and rest is discharged into Shahdara drain)	Not available		**Total – 75** 73 GPIs: Dairy (02), Engineering (01), Metal Surface Treatment (19), Pharma (01), Pulp & Paper (01), Slaughter house and Meat (06), Yarn/Textile processing (41), Textile Dyeing (02) 2 Non-GPI: Metal Surface Treatment (01), Yarn/Textile processing (01)	• Domestic sewage of unauthorized and authorized colonies, and solid waste being dumped by the residents nearby • Tapped into 74 MLD STP Indirapuram that is non-complying • Visually black coloured sewage at inlet of Indirapuram 74 MLD STP	Carry mixed untreated effluent into recipient drain	• Removal of Solid waste. • Action on industries in catchment of the drain. • New STP along with sewage network with future projection shall be installed. • CETP of adequate capacity shall be installed.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
2	Shahdara drain (First Order of River Yamuna)	Indirapuri Drain (Second Order of River Yamuna) Untapped	BOD- 90 mg/L, COD- 242 mg/L, TDS-2112 mg/L, Mn-3.668 mg/l, Sulphate-182 mg/L	Not available		Not reported/ No industrial unit identified	Domestic sewage of unauthorized and authorized colonies, and solid waste being dumped by the residents nearby	Carry mixed untreated effluent into recipient drain	• Removal of Solid waste. • Inventorization of small-scale industrial units. • New STP along with sewage network with future projection shall be installed.
3	Shahdara drain (First Order of River Yamuna)	Banthala drain (Third Order of River Yamuna) Untapped ***Location near receiving Industrial effluent***	***Round I:*** pH-2.5 BOD- 234 mg/L, COD- 460 mg/L TDS- 13060 mg/L TSS- 833 mg/L Sulphate-471 mg/L Cr-12.698 mg/l Cu-52.199 mg/l Fe-6035.98 mg/l Pb-2.398 mg/l Mn- 58.199 mg/l Ni-19.798 mg/l Zn-791.793 mg/l Co-0.98 mg/l ***Round II:*** Flow-2.3 MLD pH-<2 COD- 633 mg/L TDS- 19352 mg/L TSS- 756 mg/L Fe-15.86 mg/l Pb-0.265 mg/l	Not available		Illegal industrial units operating in the catchment of Banthala drain: Soap manufacturing unit (01) (Non-operational); Metal processing (04) treatment by using acids; Garment washing unit without ETP (01). **Ponding of wastewater near soap factory was observed. Samples of wastewater were collected and analysis results showed BOD-762 mg/l, COD-1748 mg/l, TSS-1118 mg/l, TDS-3004	Solid waste dumping was observed.	Carry mixed untreated effluent into recipient drain	• Removal of Solid waste. • Inventory of water polluting industries (GPIs & non-GPIs). • Action on unauthorized industrial units. • Identification and action against the source of discharge of high metal bearing acidic effluent into Banthala drain. • Preparation of an action plan for interception, diversion and treatment of Banthala drain. • CETP of adequate capacity shall be installed.

Sl. No.	River	Tributary/ Drains/Canal	Drain (Flow, BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/ Domestic sewage from towns		
4	Shahdara drain (First Order of River Yamuna)	Banthala drain (Third Order of River Yamuna) Untapped ***Location before confluence with Indirapuri drain***	***Round I*** BOD- 175 mg/L, COD- 611 mg/L TDS- 1604 mg/L TSS- 862 mg/L Sulphate-136 mg/L Fe-12.483 mg/l ***Round II*** BOD-119 mg/l COD- 673 mg/L TDS- 1580 mg/L TSS- 568 mg/L Sulphate-150 mg/L Fe-19.34 mg/l Mn-2.041 mg/l	Not available		mg/l, Chloride-485 mg/l, Sulphate-650 mg/l and high concentrations of metals (Cr-2.378 mg/l, Cu-10.53 mg/l, Fe-1732 mg/l, Pb-0.724 mg/l, Mn-12.84 mg/l, Ni-12.84 mg/l and Zn-168.6 mg/l) which indicated that industries in the catchment discharge wastewater outside their premises which formed a pond of wastewater on land in the vicinity of Banthala drain			

Appendix 6.16: Action required to improve water quality of river Hindon in Noida and Greater Noida districts

Noida & Greater Noida Districts

Sl. No.	River	Tributary/ Drains/Canal	Drain/River (flow , BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
1.	Hindon (323.01 km)	Dasna Drain near Yusufpur village	**Flow- 412.06** MLD BOD-73 mg/l COD-356 mg/l (*High organic load is contributed by Dasna drain i.e. 30.07 TPD)*	DO- NIL BOD-9 mg/l COD-48 mg/l	DO-NIL BOD-29 mg/l COD-93 mg/l	**Conforming Area** **GPI-01**(Pulp & Paper)/ **Non-GPI-03** (Metal Surface Treatment)	Sewage from Ghaziabad town	River water quality is deteriorating due to the impact of drain discharge into river which carried industrial and sewage discharge.	• Action on industries discharging untreated effluent in the catchment area.
2.	Dasna Drain	Gaur City (2nd Order-Meets to Dasna Drain)	Flow- Not Measured due to unapproachable site BOD-90 mg/l COD-280 mg/l	**Not available**	**Not available**	**Not available**	Sewage from Gaur city's residential areas.	Impact was observed as high BOD due to sewage discharges.	• Action on industries discharging untreated effluent in the catchment area. • STP may shall install for treatment of sewage discharges from Gaur City residential area. • Series of Constructed Wetlands on Dasna drain B/c with river Hindon.

Sl. No.	River	Tributary/ Drains/Canal	Drain/River (flow , BOD COD or any specific pollution)	Polluted river stretch		Pollution sources		Key issues	Action Points
				B/c (in case of drain)	A/c (in case of drain)	Industrial Unit (GPI/Non-GPI and Conforming/ Non-Conforming area)	STP/CETP/Domestic sewage from towns		
3.	Hindon (355.68 km)	Hawaliya Drain	Flow- Not Measured due to unapproachable site BOD-19 mg/l COD-97 mg/l *It originates from Surajpur wetland which carries industrial area site-B & site-4 and residential areas like-Gamma-1 Knowledge park-II etc*	**Not available**	DO-NIL BOD-22 mg/l COD-74 mg/l	**Conforming Area** **GPI-16** (Textile/Dyeing, Paper Mill, Tannery)/ **Non-GPI-47** (Metal Surface Treatment, Security Hologram Stickers, Dyeing, Paint & Varnishes, Yarn/Textile Processing, Anodizing, Beverage (Carbonated, Soft Drinks, Soda., Food Industry, Plastic Moulded Components with Electroplating, Rice Mill, Automobile, Slaughter House)	Sewage from Gr. Noida and nearby villages	Low Impact	• Action on industries discharging untreated effluent in the catchment area. • Adoption of interim bio/phyto-remediation measures in the drain. • Remediation of unchannellized sewage through Constructed Wetland system.
4.	Hawaliya Drain	Kot Escape (2nd Order)	Flow-Not Measured BOD-5 mg/l COD-57 mg/l	**Not available**	**Not available**	**Conforming Area** **GPI-01** (Power Plant)/	Sewage from NTPC dadri, Kot Village, kasana, omnicorn, Sigma, Xu and 137 MLD STP Kasana.	No Impact	• Remediation of unchannellized sewage through Constructed Wetland system.
5.	Yamuna	Hindon (approx. 357.55 Km)	**Not available**	DO-Nil BOD- 17 mg/l COD-67 mg/l	DO-Nil BOD- 14 mg/l COD-52 mg/l	**Not available**	Discharge of River Hindon.	No Impact	No Action required

DEDICATED TEAM

Head Office Delhi

S. No	Name of official	Designation
WQM-II Division		
1.	Sh. C. B. Chourasia	Scientist E
2.	Dr. Pankaj Kumar	Scientist D
3.	Dr. Raj K. Singh,	
4.	Ms. Manu Jindal	Scientist B
5.	Dr. Abhas Kumar Maharana	
6.	Dr. Prabhat Ranjan	
7.	Ms. Shraddha Lonarkar	Research Associate-III
8.	Ms. Garima Dublish	
9.	Mr. Vipin Kumar	
10.	Dr. L. N. Gupta	
11.	Ms. Anshul Kumari	
12.	Dr. Firoz Ahmad	
13.	Ms. Shivangi C. Goswami	Research Associate-II
14.	Dr. Jyoti Sharma	
15.	Sh. Ashwani Kumar Singh	
16.	Ms. Yogita Mishra	
17.	Dr. Chandravir Narayan	Research Associate-I
18.	Dr. Vivek Rana	
19.	Dr. Swati Singh	
20.	Dr. Richa Bhardwaj	
21.	Dr. Divya Raghuvanshi	Senior Research Fellow
22.	Ms. Sonam	
23.	Mr. Ankit Shukla	
24.	Ms. Anubha Agarwal	
25.	Ms. Kusum	
26.	Mr. Saurabh Garg	
WQM-I Division (Real Time Water Quality Monitoring System)		
27.	Sh. Vishal Gandhi	Divisional Head
28.	Dr. Brajesh Srivastava	Scientist C
29.	Dr. Priyanka Chaudhary	
30.	Dr. Khyati Mittal	Research Associate-II
31.	Ms. Meetali Sharma	Taxonomist

S. No	Name of official	Designation
Bioscience Laboratory (Biomonitoring)		
32.	Sh. Z. Changsan	Scientist F and Divisional Head
33.	Dr. Jaya Sharma	Research Associate-III
34.	Dr. Anu Goel Gupta	Research Associate-III

Regional Directorate – Lucknow

(*Monitoring of 31 STPs, 4 CETPs and 256 drains in Uttar Pradesh*)

S. No	Name of official	Designation
Regional Director – Sh. D. K. Soni		
1	Dr. Prashant Singh	Scientist D
2	Dr. Sarvesh Rai	Scientist C
3	Sh. Ram Balak Singh	
4	Sh. Sanjay Kumar	
5	Dr. Poonam Tiwari	Research Associate-III
6	Dr. Poonam Pandey	
7	Dr. Vijaya Singh	
8	Sh. Rajesh Kumar	Research Associate-II
9	Dr. Anand Kumar Soni	
10	Dr. Lal Ji Verma	
11	Sh. Sandeep Yadav	
12	Dr. Kristina Medhi	
13	Dr. Ravi Prakash Misra	
14	Sh. Darmnath Prajapati	Research Associate-I
15	Sh. Shivam Singh	
16	Dr. Rajnish Kumar Sharma	
17	Ms. Deepika Rai	Senior Research Fellow
18	Mr. Arvind Kumar	
19	Mr. Ravinder Singh	
20	Dr. Raj Laxmi	
21	Mr. Vijay Kumar Mishra	
22	Sh. Prateek Srivastava	
23	Sh. Sumit Gangwar	

Regional Directorate – Kolkata

(*Monitoring of STPs, CETPs and drains in Bihar, Jharkhand and West Bengal*)

S. No.	Name of official	Designation
Regional Director – Sh. M. K. Biswas		
1	Dr. Vishnu V. Kanuri	Scientist C
2	Smt. Amrita Talpatra	Research Associate-III
3	Sh. Vaddem Kiran Kumar	
4	Sh. Sudhanshu C. Mohapatra	
5	Dr. Moumita Choudhary	Research Associate-II
6	Dr. Suvanka Dutta	Research Associate-I
7	Ms. Sangeeta Sunar	
8	Syed Yakub Ali	
9	Sh. Anirben Kundu Chowdhury	
10	Ms. Sarmistha Saha	
11	Mr. Girija Shankar Mishra	
12	Ms. Supriyo Goswami	
13	Ms. Pallavi Mukharjee	
14	Dr. Bipasha Dinda	Senior Research Fellow
15	Ms. Priti Saha	
16	Sh. Raktim Mandal	
17	Sh. Kumar Ayush	
18	Sh. Ajeet Verma	
19	Ms. Sayantani Sengupta	

CENTRAL POLLUTION CONTROL BOARD

Ministry of Environment, Forest & Climate Change,

GOVERNMENT OF INDIA

Parivesh Bhawan, East Arjun Nagar, Delhi – 110032, India

Website: www.cpcb.nic.in

Scan this QR code to visit our website for more information