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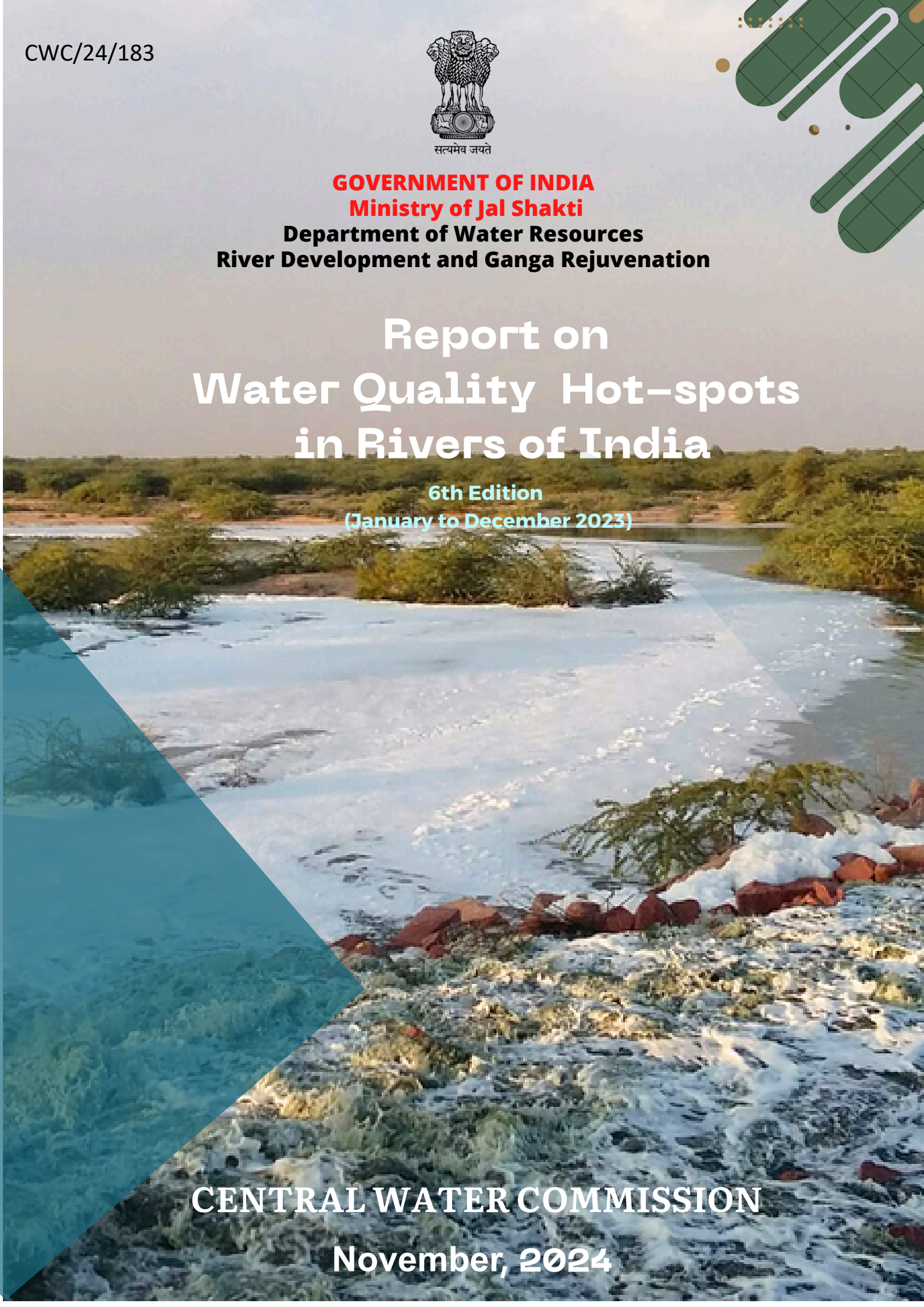
GOVERNMENT OF INDIA
Ministry of Jal Shakti
Department of Water Resources
River Development and Ganga Rejuvenation

Report on Water Quality Hot-spots in Rivers of India

6th Edition
(January to December 2023)



CENTRAL WATER COMMISSION

November, 2024

Shri Rakesh Kumar Verma

Chairman
Central Water Commission
Department of WR, RD, & GR
Ministry of Jal Shakti

Water, the world's most valuable natural resource, is essential for the survival of all living organisms on the earth. With population growth, industrial development, urbanisation & agricultural activities, the demand & consumption for freshwater is rising. This has caused increased utilisation of water from rivers, lakes and other water sources affecting the diversity of flora and fauna. Further, after utilisation by industries, agriculture, human settlements etc., the effluent/discharge is generally poorer in quality/quantity than the original intake. This necessitates creation of treatment facilities, defining standards of effluent discharge, and foremost continuous monitoring of water quality of rivers and other water sources.

Since 1963, Central Water Commission has been involved in water quality monitoring. Central Water Commission has been monitoring the water quality at 782 (as on January, 2023) stations across various rivers and 88 water bodies (April, 2023) in India.

This report, now in its sixth edition, aims to provide insights into the water quality scenario based on standards set by the Ministry of Environment, Forest and Climate Change (MoEFCC), the Central Pollution Control Board (CPCB) and Bureau of Indian Standards (BIS). Previous editions were published in August 2011, November 2017, November 2021 and August 2024. This sixth edition is based on the seasonal average values (Pre-monsoon, Monsoon and Post-monsoon) observed during January-December, 2023 at monitoring stations across India. It is our hope that future editions will be expanded to include additional data from more monitoring stations, accompanied by comprehensive maps and graphs.

Shri Ashok S. Goel

Member (RM)
Central Water Commission
Department of WR, RD, & GR
Ministry of Jal Shakti

Water in its purest form on Earth, comes from rain and snow. This water is available first in the form of surface water through rivers and Lakes. Thus we can say the journey of water on Earth starts in the shape of surface runoff. This surface water forms the lifeline of almost all the human activities as also most of nature's activities. It is the surface water which percolates down and recharges the aquifers and becomes part of Ground Water. Due to the fast pace of industrialization and urbanization, a lot of effluent and sewage is being generated, for a major portion of which there are no effluent treatments. This has resulted in discharge of this sewage into the rivers untreated or only partially treated. Rivers are our lifeline and we all have the responsibility of preserving it, to make our development and consequently quality of life sustainable. Pollution of rivers does not mean that they are polluted from its source to mouth, but there are stretches in some rivers which are polluted and actions are being taken by the Government to bring these stretches to acceptable conditions.

Central Water Commission has been monitoring the quality of river water at 782 stations on different rivers & 88 water bodies, all over India. It all started with the aim of monitoring the water quality parameters for agricultural purposes, but later on many more parameters were added and at present it covers more or less the entire spectrum of water quality. This is the sixth edition of Hot spots report and it is based on the seasonal average values observed during January-December, 2023 covering 759 WQ monitoring stations of CWC.

I would like to place on record my appreciation of Sh. Satish Jain, Deputy Director, RDC-II; Dr. Jakir Hussain, Research Officer, RDC-II; Rajesh Kumar, Research Officer, RDC-II; for excellently bringing out sixth edition of this publication. I also appreciate the sampling, testing and compilation work done by scientific officers of CWC.

Shri Davendra Pratap Mathuria

Chief Engineer (P&DO)
Central Water Commission
Department of WR, RD, & GR
Ministry of Jal Shakti

Water is one of the most important and a basic natural resource on the Earth and it sustain lives of all organism of the Earth. Only 2.5% of surface water is fresh water. The rest is sea water and is undrinkable. Out of the 2.5%, over1.75 % is locked as frozen form and thus remaining 0.75 % of all the water is available for human consumption. Central Water Commission, an apex engineering Organization under the Ministry of Water Resources, River Development and Ganga Rejuvenation is playing an active role in the field not only for water resource development but also in field of water quality.

CWC is monitoring the water quality of rivers since 1960's. Its water quality network consists of 782 water quality stations (as on January, 2023) along with 88 water bodies and a 3-tier laboratory system of 427 Level-I, 18 Level-II and 5 Level-III laboratories across the country. Water quality monitoring in Indian rivers is gaining importance in present day context with increasing urbanization, rapid industrialization and rising standards of living. The present 6th edition of the Report "Water Quality Hot spots in Rivers of India" is based on the seasonal average values observed for 13 parameters (pH, Electrical Conductivity (EC), Fluoride (F^-), Ammonia as N (NH_3-N), Nitrate as N (NO_3-N), Chloride (Cl^-), Total Hardness (TH), Boron (B), Sodium Adsorption Ratio (SAR), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform (TC) and Faecal Coliform (FC) during January-December 2023 at monitoring stations across India. The report brings out the identified locations having concentration of these parameters above the acceptable limits.

I appreciate the hard work done by Sh. Rajat Sharma, Senior Research Assistant (Lead Author) of River Data Compilation-2 Directorate & my appreciation to all field Chief Engineers of CWC for collection and submission of water quality data to River Data Compilation-2 Directorate and thus paving way to publish such a useful report.

CONTRIBUTIONS

A. GUIDANCE:

1. Shri D.P.Mathuria, Chief Engineer (Planning & Development Organization), CWC, NewDelhi.
2. Shri Pankaj Kumar Sharma, Director (River Data Compilation -2 Dte), CWC, New Delhi.
3. Shri Satish Jain, Deputy Director (River Data Compilation -2 Dte), CWC, New Delhi.
4. Dr. Jakir Hussain, Research Officer (River Data Compilation -2 Dte), CWC, New Delhi.
5. Shri Rajesh Kumar, Research Officer, (River Data Compilation -2 Dte), CWC,New Delhi.

B. DATA COMPILATION AND REPORT PREPARATION TEAM:

1. Dr. Jakir Hussain, Research Officer (River Data Compilation -2 Dte), CWC, New Delhi.
2. Rajat Sharma, Senior Research Assistant, (River Data Compilation -2 Dte), CWC, New Delhi (Lead Author).

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EXECUTIVE SUMMARY

The assessment of water quality is an essential measure within environmental monitoring. When water quality is poor, it affects not only the aquatic life but also the surrounding ecosystems. Rivers are unquestionably important parts of the hydrological cycle, mainly because they are fluxes of water and not reservoirs of water. Rivers, along with water, drag off sediments and other suspended materials (biotic and abiotic) that ultimately will reach all the other aquatic environments. The present study (6th Edition) is based on the data of 13 water quality parameters covering 759 water quality monitoring stations in 2023. The eight parameters — pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), total coliform bacteria (TC), free ammonia (NH_3-N), electrical conductivity (EC), boron (B), sodium adsorption ratio (SAR) are important for classification based on the uses defined by the Central Pollution Control Board (CPCB). Fluoride (F^-), Chloride (Cl^-), Total Hardness (TH) and Nitrate (NO_3^--N) are among the parameters defined by the Bureau of Indian Standards (BIS: 10500:2012) for drinking water. Faecal Coliform (FC) is based on the primary water quality criteria for bathing water listed in the Gazette Notification issued by the Ministry of Environment, Forest and Climate Change (MoEFCC) in 2000. These samples were analyzed at 23 water quality laboratories of CWC. The analysis results are compared with the prescribed limits of CPCB deginated best uses, BIS 10500:2012 and MoEFCC standards to find out the hot spot in Indian River in absence of any river specific standards. The parameter-wise summary of the analysis results is given below:

pH

The recommended acceptable pH limit for drinking water sources varies depending on the classification: Class A (without conventional treatment but after disinfection), Class B (outdoor bathing organized) and Class C (after conventional treatment and disinfection). In 2023, a total of 22,746 river water samples were analyzed, with 1,719 samples (7.56%) found to exceed the acceptable pH limit. Twenty-three (23) water quality monitoring stations on 20 rivers exceeded the acceptable pH limit. The pH of the samples ranged from 2.35 to 10.93 throughout January to December 2023. The highest pH value (10.93) was observed at the Panbari water quality monitoring station on the Burisuti River in May 2023.

Acceptable Limit of Designated Best Uses of Water by CPCB (Class A, B, D)	pH 6.5 – 8.5
No of Samples Tested	22746
No. of samples where pH value found beyond acceptable limit	1719
No. of Monitoring stations where average (pre-monsoon/, monsoon / post monsoon) pH value found beyond acceptable limit	23
No. of rivers where pH value found beyond acceptable limit	20

Electrical Conductivity (EC)

The recommended acceptable limit of electrical conductivity as 2250 µS/cm is mentioned in "Designated Best Uses of Water" by CPCB only in Class E- Irrigation, Industrial Cooling, and Controlled Waste Disposal. In 2023, a total of 22,771 river water samples were analyzed, with 147 samples (0.65%) found to exceed the acceptable electrical conductivity

Acceptable Limit of Designated Best Uses of Water by CPCB (Class E)	EC< 2250 µS/cm
No of Samples Tested	22771
No. of samples where electrical conductivity found above acceptable limit	147
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) electrical conductivity found above acceptable limit	06
No. of rivers where electrical conductivity found above acceptable limit	06

limit. Six (06) water quality monitoring stations on 06 rivers exceeded the acceptable electrical conductivity limit (CPCB Class E). The electrical conductivity range was from 12.4 to 21400µS/cm in 2023. The highest electrical conductivity (21400 µS/cm) was observed at the Durvesh water quality monitoring station on the Vaitarna River during February 2023.

Ammonia as N (NH_3-N)

Acceptable Limit of Designated Best Uses of Water by CPCB (Class D)	NH_3-N<1.2 mg/L
No of Samples Tested	17301
No. of samples where ammonia found above acceptable limit	908
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) ammonia found above acceptable limit	42
No. of rivers where ammonia found above acceptable limit	20

The recommended acceptable limit of ammonia as N (NH_3-N) as 1.2 mg/L is mentioned in "Designated Best Uses of Water" by CPCB only in Class D-Propagation of wild life and fisheries. In 2023, a total of 17301 river water samples were analyzed, with 908 samples (5.25%) found to exceed the acceptable limit. Forty-two (42) water quality monitoring stations on 20 rivers exceeded the acceptable ammonia limit (CPCB Class D). The ammonia concentration of the samples ranged from 0.001 to 41.70 throughout January to December 2023. The highest ammonia concentration 41.70 mg/L was observed at KT (Satrapur River) water quality monitoring station on the Godavari River during 2023.

Boron(B)

Acceptable Limit of Designated Best Uses of Water by CPCB (Class E)	B < 2.0 mg/L
No of Samples Tested	11105
No. of samples where ammonia found above acceptable limit	3
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) ammonia found above acceptable limit	0
No. of rivers where ammonia found above acceptable limit	0

The recommended acceptable limit of boron as 2.0 mg/L is mentioned in "Designated Best Uses of Water" by CPCB only in Class E-Irrigation, Industrial Cooling, and Controlled Waste Disposal. In 2023, a total of 11,105 river water samples were analysed with 3 (0.03%) found exceed the acceptable limit (CPCB-Class E). The average values of water quality monitoring stations during the pre-monsoon/monsoon/post-monsoon seasons of 2022 have been found to be within the acceptable limit for boron.

Fluoride (F^-)

Acceptable Limit as BIS 10500: 2012	F^- < 1.5 mg/L
No of Samples Tested	18272
No. of samples where fluoride found above acceptable limit	94
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) fluoride found above acceptable limit	6
No. of rivers where fluoride found above acceptable limit	5

Bureau of Indian Standard (10500:2012) has recommended the acceptable limit of 1.5 mg/ for fluoride. In 2023, a total of 18,272 river water samples were analyzed, and 94 samples (0.53%) found to exceed the acceptable limit of BIS 10500:2012. Six (06) water quality monitoring stations on 05 rivers exceeded the acceptable fluoride limit of BIS 10500:2012. The fluoride concentration range was from 0.002 to 8.75 mg/L in 2023. The highest fluoride concentration (8.75 mg/L) was observed at the Lingdem Hot Spring water quality monitoring station on the Talang Chu River during August 2023.

Nitrate as N (NO_3^--N)

Acceptable Limit as BIS 10500: 2012	NO_3^- – N < 10.16 mg/L
No of Samples Tested	18008
No. of samples where nitrate found above acceptable limit	737
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) nitrate found above acceptable limit	42
No. of rivers where nitrate found above acceptable limit	27

Bureau of Indian Standard (10500:2012) has recommended that the acceptable limit for nitrate is 45 mg/L or 10.16 mg/L as NO_3^- – N in drinking water. In 2023, a total of 18008 river water samples were analyzed and 737 samples (4.09%) found to exceed the acceptable limit. Forty-two (42) water quality monitoring stations on 27 rivers exceeded the acceptable nitrate limit of BIS 10500:2012. The nitrate concentration range was from 0.006 to 36.37 mg/L in year 2023. The highest nitrate concentration (36.37 mg/L) was observed at the Banpur water quality monitoring station on the (Mathabhanga/ Bhagirathi River) during June 2023.

Chloride (Cl^-)

Acceptable Limit as BIS 10500: 2012	Cl^- < 1000 mg/L
No of Samples Tested	21806
No. of samples where chloride found above acceptable limit	39
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) chloride found above acceptable limit	03
No. of rivers where chloride found above acceptable limit	03

BIS (Bureau of Indian Standard) 10500:2012) has recommended an acceptable limit of 1000 mg/L of chloride in drinking water. In 2023, a total of 21806 river water samples were analyzed and 39 samples (0.18%) found to exceed the acceptable limit. Three (03) water quality monitoring stations on 03 rivers exceeded the acceptable nitrate limit of BIS 10500:2012. The highest chloride concentration (7344 mg/L) was observed at the Luwara water quality monitoring station on the Shetrunji River River during June, 2023.

Total Hardness (TH)

Acceptable Limit as BIS 10500: 2012	TH < 600 mg/L
No of Samples Tested	21557
No. of samples where total hardness found above acceptable limit	80
No. of Monitorin stations where average (pre-monsoon/monsoon/post-monsoon) total hardness found above acceptable limit	03
No. of rivers where total hardness found above acceptable limit	03

BIS (Bureau of Indian Standard) 10500:2012) has recommended an acceptable limit of 600 mg/L of total hardness in drinking water. In 2023, a total of 21557 river water samples were analyzed and 80 samples (0.37%) found to exceed the acceptable limit. Three (03) water quality monitoring stations on 03 rivers exceeded the acceptable total hardness limit of BIS 10500:2012. The total hardness concentration range was from 5.5 to 3238 mg/L in year 2023. The highest nitrate concentration (3238 mg/L) was observed at the Luwara water quality monitoring station on the Shetrunji River during May, 2023.

Dissolved Oxygen (DO)

Acceptable Limit of Designated Best Uses of Water by CPCB (Class B)	DO > 5.0 mg/L
No of Samples Tested	21132
No. of samples where dissolved oxygen found above acceptable limit	3792
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) dissolved oxygen found above acceptable limit	115
No. of rivers where dissolved oxygen found above acceptable limit	61

The recommended acceptable limit of dissolved oxygen as < 5.0 mg/L is mentioned in "Designated Best Uses of Water" by CPCB only in Class B- outdoor bathing (organised). In 2023, a total of 21132 river water samples were analyzed, and 3792 samples (17.94%) found to exceed the acceptable limit. One hundred fifteen (115) water quality monitoring stations on sixty-one (61) rivers exceeded the acceptable limit of dissolved oxygen (CPCB - Class B). The zero DO concentration was observed at 44 water quality stations on the 28 rivers across India during 2023.

Bio-chemical Oxygen Demand (BOD)

Acceptable Limit of Designated Best Uses of Water by CPCB (Class B)	BOD < 3.0 mg/L
No of Samples Tested	18166
No. of samples where BOD found above acceptable limit	4163
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) BOD found above acceptable limit	152
No. of rivers where BOD found above acceptable limit	71

The recommended acceptable limit of biochemical oxygen demand as > 3.0 mg/L is mentioned in "Designated Best Uses of Water" by CPCB only in Class B- outdoor bathing (organised). In 2023, a total of 18166 river water samples were analyzed, and 4163 samples (22.92%) found to exceed the acceptable limit. One hundred fifty-two (152) water quality monitoring stations on seventy-one (71) rivers exceeded the acceptable biochemical oxygen demand (CPCB-Class B). The BOD concentration range was from 0.01 to 149.32 mg/L in year 2023. The highest BOD concentration (149.32 mg/L) was observed at the Singasadanapalli water quality monitoring station on the Ponnaiyar River during August, 2023.

Total Coliform (TC)

Acceptable Limit of Designated Best Uses of Water by CPCB (Class B)	TC < 500 MPN/ 100ml
No of Samples Tested	6908
No. of samples where total coliform found above acceptable limit	6321
No. of Monitoring stations where average (pre-monsoon/monsoon/post-monsoon) total coliform found above acceptable limi	277
No. of rivers where total coliform found above acceptable limit	138

The recommended acceptable limit of total coliforms as > 500 MPN/100 ml is mentioned in "Designated Best Uses of Water" by CPCB only in Class B- outdoor bathing (organised). In 2023, a total of 6908 river water samples were analyzed, and 6321 samples (91.5%) found to exceed the acceptable limit. Two hundred seventy-seven (277) water quality monitoring stations on one hundred thirty-eight (138) rivers exceeded the acceptable total coliform (CPCB-Class B). The highest total coliform level (33,00,00,000 MPN/100 ml) was observed at Delhi Railway Bridge water quality monitoring station on the Yamuna River during March, 2023.

Faecal Coliform (FC)

Primary Water Quality Criteria for Bathing water (MoEF & CC) Gazette Notification, 2000 recommended acceptable limit of faecal coliform as > 500 MPN/100 ml. In 2023, a total of 6908 river water samples were analyzed and 5462 samples (79.1%) found to exceed the acceptable limit. Two hundred fifty-seven (257) water quality monitoring stations on one hundred twenty-five (125) rivers exceeded the acceptable total coliform (CPCB-Class B). The highest faecal coliform value (11,00,00,000 MPN/100ml) was observed at the Delhi Railway Bridge water quality monitoring station on the Yamuna during 2023.

Primary Water Quality Criteria for Bathing water (MoEF & CC) Gazette Notification, 2000	**FC < 500 MPN/ 100ml**
No of Samples Tested	6908
No. of samples where faecal coliform found above acceptable limit	5462
No. of Monitoring stations where faecal coliform found above acceptable limit	257
No. of rivers where faecal coliform found above acceptable limit	125

Sodium Adsorption Ration (SAR)

The recommended acceptable limit of SAR as 26 is mentioned in "Designated Best Uses of Water" by CPCB only in Class E- Irrigation, Industrial Cooling, and Controlled Waste Disposal. In 2023, a total of 20,095 river water samples were analysed with 7 (0.03%) found exceed the acceptable limit (CPCB-Class E). The average values of water quality monitoring stations during the pre-monsoon/monsoon/post-monsoon seasons of 2022 have been found to be within the acceptable limit for boron.

Acceptable Limit of Designated Best Uses of Water by CPCB (Class E)	**SAR < 26**
No of Samples Tested	20095
No. of samples where SAR found above acceptable limit	7
No. of Monitoring stations where SAR found above acceptable limit	0
No. of rivers where SAR found above acceptable limit	0

CHAPTER – 1

1. INTRODUCTION

1.1 Water Quality & its Importance

Water quality, in general, can be defined as the suitability of water to sustain various uses or processes. Any particular use will have specific requirements for the physical, chemical, or biological characteristics of water. The term is most frequently employed by reference to a set of standards against which compliance, generally achieved through water treatment, can be assessed. The most common standards used to monitor and assess water quality convey the health of ecosystems, the safety of human contact, the extent of water pollution, and the condition of drinking water. Water quality significantly impacts water supply and often determines supply options. The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for potability, industrial/domestic use, or restoration (of an environment/ecosystem, generally for the health of human/aquatic life).

The composition of surface and underground waters depends on natural factors (geological, topographical, meteorological, hydrological, and biological) in the drainage basin and varies with seasonal differences in runoff volumes, weather conditions and water levels. Large natural variations in water quality may, therefore, be observed even when only a single watercourse is involved. Human intervention also has significant effects on water quality. Some of these effects result from hydrological changes, such as the construction of dams, draining of wetlands, and diversion of flow. More obvious are the polluting activities, such as the discharge of domestic, industrial, urban, and other wastewaters into the watercourse (whether intentional or accidental) and the spreading of chemicals on agricultural land in the drainage basin. Water quality is influenced by a wide range of natural factors. The most important of these natural influences are geological, hydrological and climatic, as they affect the quantity and quality of water available.

The water quality of Indian rivers is of considerable importance, as these waters serve various purposes, including drinking for domestic and residential water supplies, agriculture (irrigation), hydroelectric power plants, tourism, recreation, and other human or economic uses of water.

The monitoring of river water quality is a crucial aspect of restoring water quality. One of the primary objectives of river water quality monitoring is to evaluate the suitability of river water for drinking purposes, irrigation, outdoor bathing and the propagation of wildlife and fisheries. The physical and chemical quality of river water plays a key role in determining its fitness for drinking. Therefore, the suitability of river water for potable uses, particularly in terms of its chemical quality, must be assessed based on vital characteristics. The Bureau of Indian Standards (BIS), formerly known as the Indian Standard Institute (ISI), has outlined quality standards for drinking water in its document IS 10500:2012 serving as a reference for determining the suitability of river water.

Monitoring and assessing water quality are essential for comprehending the extent and magnitude of the water quality challenge. Unlike water quantity, monitoring water quality is a complex process. Managing the water quality of rivers is a challenging task, with various manmade and natural factors likely to increase complexity in the future. One significant reason is the introduction and use of numerous new chemicals each year in agriculture, chemical industries, pharmaceutical industries etc. The large quantity of these new chemicals, along with the difficulty in quantifying many of them due to certain limitations, makes it challenging to reliably assess the health and environmental consequences. This complexity is further compounded by the continuous introduction of new chemicals, making it difficult to predict the long-term impact on water quality and associated ecosystems.

1.2 Water Quality Hot Spots

As per the Guidelines for Water Quality Monitoring, 2017, a 'Hotspot' is defined as a location or monitoring station where the concentration of a particular parameter exceeds the permissible limits prescribed by the water quality standards in the BIS code IS 10500:2012. In this report, a 'Hotspot' is determined based on the location or Monitoring station where the concentration of a specific parameter surpasses the permissible limits set by the drinking water quality standards in the BIS code IS 10500:2012, 'Designated Best Use Water Quality Criteria' established by the Central Pollution Control Board (CPCB) and Primary Water Quality Criteria for Bathing Water mentioned in the Ministry of Environment, Forest and Climate Change (MoEFCC) Gazette Notification, 2000. The report incorporates data covering 759 water quality monitoring stations in year 2023 of the Central Water Commission (CWC), covering significant rivers in India.

It is based on the average values observed during Pre-monsoon (January to May), Monsoon (June to October) and Post-monsoon (November to December) seasons for the year 2023. River water quality has been evaluated based on 13 parameters: pH, Electrical Conductivity (EC), Fluoride (F^-), Ammonia as N (NH_3-N), Nitrate as N (NO_3^-N), Chloride (Cl^-), Total Hardness (TH), Boron (B), Sodium Adsorption Ratio (SAR), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform (TC) and Faecal Coliform (FC). These parameters are crucial in defining the quality of surface water in rivers. Therefore, the presence of these parameters in river water beyond the permissible limits is considered as river water quality hotspots.

CHAPTER -2

2. INDIAN WATER RESOURCES SCENARIO

2.1 River Basin of India

CWC's under its publication No. 30/88 Water Resources of India, April 1988 has standardized the river basins of India. The country is classified into 20 river basins comprising of 12 major basins and 8 composite river basins.

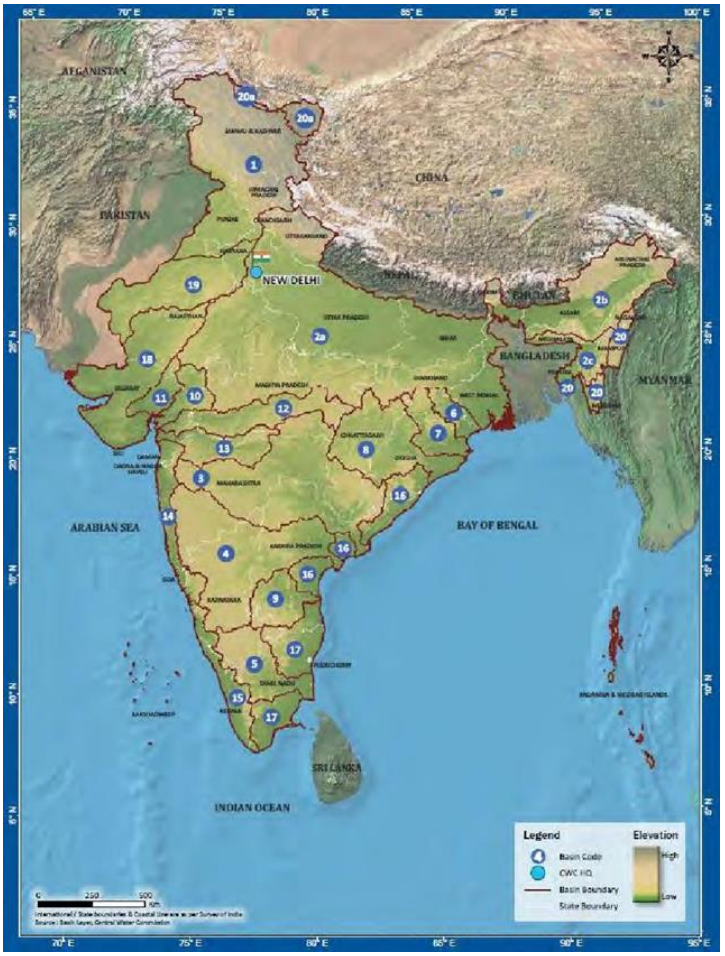
The 12 major basins are: (1) Indus; (2) Ganga-Brahmaputra-Meghna; (3) Godavari; (4) Krishna; (5) Cauvery; (6) Mahanadi; (7) Pennar; (8) Brahmani-Baitarani; (9) Sabarmati; (10) Mahi; (11) Narmada and (12) Tapi. Each of these basins is having a drainage area exceeding 20000 sq.km.

The 8 composite river basins are:

1) Subarnarekha – combining Subarnarekha and other small rivers between Subarnarekha and Baitarni.
2) East flowing rivers between Mahanadi and Pennar.
3) East flowing rivers between Pennar and Kanyakumari.
4) Area of Inland Drainage in Rajasthan Desert.
5) West flowing rivers of Kutch and Saurashtra including Luni;
6) West flowing rivers from Tapi to Tadri.
7) West flowing rivers from Tadri to Kanyakumari.
8) Minor rivers draining into Myanmar (Burma) and Bangladesh.

2.2 Indian River System

The Indian River Systems can be divided into four categories:- the Himalayan, the Rivers traversing the Deccan Plateau, the Coastal and those in the inland drainage basin (Figure 1).



The Himalayan Rivers are perennial as they are fed by melting glaciers every summer. During the monsoon, these Rivers assume alarming proportions. Swollen with rainwater, they often inundate villages and towns in their path. The Gangetic basin is the largest River system in India, draining almost a quarter of the country.

The Rivers of the Indian peninsular plateau are mainly fed by rain. During summer, their flow is greatly reduced, and some of the tributaries even dry up, only to be revived in the monsoon. The Godavari basin in the peninsula is the largest in the country, spanning an area of almost one-tenth of the country. The Rivers Narmada and Tapi flow almost parallel to each other but empty themselves in opposite directions. The two Rivers make the valley rich in alluvial soil and teak forests cover much of the land. While coastal River's gush down the peaks of the Western Ghats into the Arabian Sea in torrents during the rains, their flow slow down after the monsoon. Streams like the Sambhar in western Rajasthan are mainly seasonal in character, draining into the inland basins and salt lakes. In the Rann of Kutch, the only River that flows through the salt desert is the Luni.

2.2.1 Indus system

This comprises the river Indus and its tributaries like the Jhelum, Chenab, Ravi, Beas and Sutlej. These originate in the North and generally flow in a West or South-West direction to eventually flow into Arabian Sea through Pakistan.

2.2.2 Ganga-Brahmaputra-Meghna system

The main river Ganga and its tributaries like the Yamuna, Sone, Gandak, Kosi and many others; similarly, main rivers Brahmaputra, Meghna and their tributaries. All these

eventually flow into Bay of Bengal, through Bangladesh. Some of the tributaries of these rivers are larger than other independent rivers. e.g. Yamuna, a tributary of Ganga, has a larger catchment area than the Tapi, a small peninsula river.

2.2.3 Rivers of Rajasthan and Gujarat

Mahi, Sabarmati, Luni etc. These are rivers of arid regions, they carry relatively little flow, some of them flow to Arabian Sea through Gujarat while some are land-locked and their flow is lost through percolation and evaporation in the vast arid regions.

2.2.4 East Flowing Peninsular Rivers

The important members of this group are: Damodar, Mahanadi, Brahmani, Baitarani, Subarnarekha, Krishna, Godavari and Cauvery. They all flow into Bay of Bengal at various places along the Eastern Coast of India.

2.2.5 West Flowing Peninsular Rivers

Narmada and Tapi rivers originate in Central India and flow in a western direction to meet Arabian Sea south of Gujarat.

2.2.6 Western Coast Rivers

There are large number of rivers in the Western Coast - i.e. coastal Maharashtra and Karnataka, and entire Kerala. These rivers are small in length but carry a significant amount of water due to very high rainfall in Western Ghats. They drain only 3% of the India’s land area but carry 11% of India’s water resources.

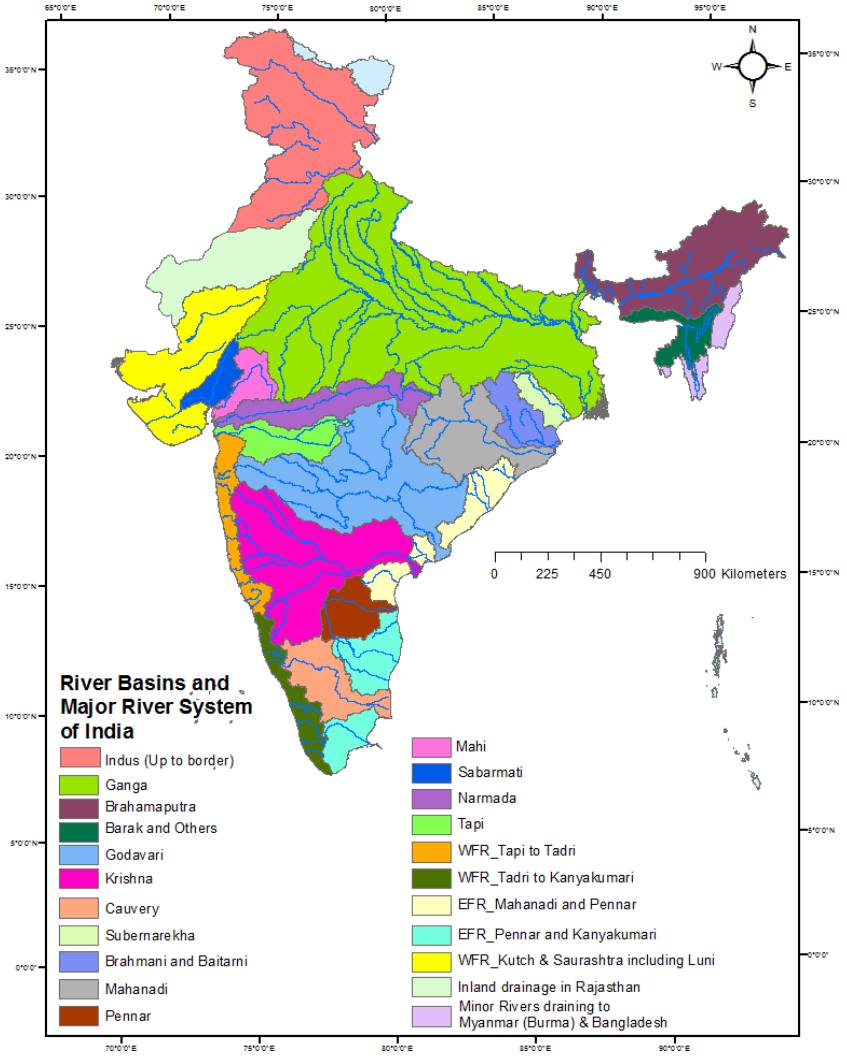


Figure.2 River Basins and Major River Systems of India

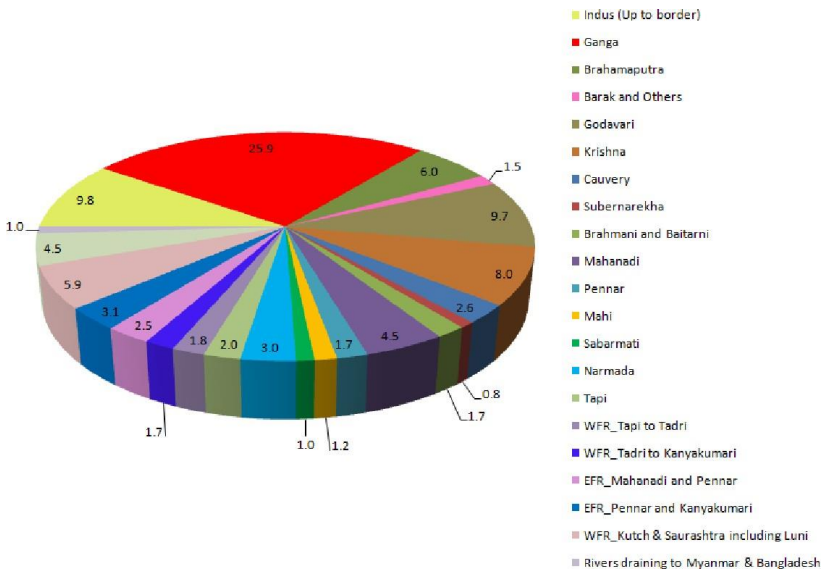


Figure.3 Percentage of geographical area in each basin

Sources:

1. CWC publication Reassessment of Water Availability in India using Space inputs June 2019 from Basin Planning & Management Organization, CWC, New Delhi. India WRIS:
2. India Water Resources Information System

The more details may be assessed by clicking the links given below: (http://old.cwc.gov.in/main/downloads/ReassessmentMainReport.pdf)&(https://indiawris.gov.in/wris)

CHAPTER – 3

3. HYDROCHEMISTRY

Hydrochemistry is an interdisciplinary science that deals with the chemistry of water in the natural environment. Professional fields such as chemical hydrology, aqueous chemistry, hydrochemistry, water chemistry and hydro-geochemistry are all more or less synonyms. The classical use of chemical characteristics in chemical hydrology is to provide information about the regional distribution of water qualities.

Main areas of work are the chemical characterization of the water (which is highly dependent on the regional and geochemical event units), the determination of water-chemical parameters and the assessment of anthropogenic and other influences on the water quality.

At the same time, hydrochemistry can also be of immense help in yielding information about the environment through which water has circulated. It is essential to study the entire system like atmospheric water (rainwater), surface water and ground water simultaneously in evaluating their hydrochemistry and pollution effect.

3.1 Chemistry of Rainwater

The atmosphere is composed of water vapors, dust particles and various gaseous components such as N_2, O_2, CO_2, CH_4, CO, SO_2, NO_2 etc. Pollutants in the atmosphere can be transported through long distances by the wind. These pollutants are mostly washed down by precipitation and partly as dry fall out. Composition of rainwater is determined by the source of water vapors and by the ion, which are taken up during transport through the atmosphere. In general, chemical composition of rainwater shows that rainwater is slightly mineralized with specific electrical conductance (EC) generally below 50 µS/cm, chloride (Cl^-) below 5 mg/l and HCO_3 below 10 mg/l. Among the cations, concentration of Ca, Mg, Na & K vary considerably but the total cations content is generally below 15 mg/l except in samples contaminated with dust. The concentration of sulphates and nitrates in rainwater may be high in areas near industrial hubs.

3.2 Chemistry of Surface Water

Surface water is found extremely variable in its chemical composition due to variations in relative contributions of ground water and surface water sources. The possible causes and consequences of changes in climate, land use and industrial, urban and agricultural pollution can be expected to be indicated by changes in the physical and chemical composition of water in rivers and streams. The mineral content in river water usually bears an inverse relationship to discharge. The mineral content of river water tends to increase from source to mouth, although the increase may not be continuous or uniform. Other factors like discharge of city wastewater, industrial waste and mixing of waters can also affect the nature and concentration of minerals in surface water. Among anions, bicarbonates are the most important and constitute over 50% of the total anions

in terms of milli equivalent per litre (meq/l). In case of cations, alkaline earths or normally calcium predominates but with increasing salinity the hydro chemical facies tend to change to mixed cations or even to Na- HCO_3 type.

3.3 Chemistry of Ground Water

The downward percolating water is not inactive, and it is enriched in CO_2. It can also act as a strong weathering agent apart from general solution effect. Consequently, the chemical composition of ground water will vary depending upon several factors like frequency of rain, which will leach out the salts, time of stay of rain water in the root-zone and intermediate zone, presence of organic matter etc. It may also be pointed out that the water front does not move in a uniform manner as the soil strata are generally quite heterogeneous. The movement of percolating water through larger pores is much more rapid than through the finer pores. The overall effect of all these factors is that the composition of ground water varies from time to time and from place to place.

Before reaching the saturated zone, percolating water is charged with oxygen and carbon dioxide and is most aggressive in the initial stages. This water gradually loses its aggressiveness, as free CO_2 associated with the percolating water gets gradually exhausted through interaction of water with minerals.

The oxygen present in this water is used for the oxidation of organic matter that subsequently generates CO_2 to form H_2CO_3. This process goes on until oxygen is fully consumed.

Apart from these reactions, there are several other reactions including microbiological mediated reactions, which tend to alter the chemical composition of the percolating water. For example, the bicarbonate present in most waters is derived mostly from CO_2 that has been extracted from the air and liberated in the soil through biochemical activity.

Some rocks serve as sources of chloride and sulphate through direct solution. The circulation of sulphur, however, may be greatly influenced by biologically mediated oxidation and reduction reactions. Chloride circulation may be a significant factor influencing the anion content in natural water.

CHAPTER - 4

4. RIVER WATER POLLUTION

The World Health Organisation (WHO) says that polluted water is water whose composition has been changed to the extent that it is unusable. In other words, it is toxic water that cannot be drunk or used for essential purposes like agriculture and which also causes diseases like diarrhoea, cholera, dysentery, typhoid and many more.

River Water pollution occurs when pollutants are discharged directly or indirectly into rivers without adequate treatment of harmful compounds. River Water pollution affects humans, plants and organisms living in these rivers. Water pollutants are damaging not only the individual species and populations, but also the natural biological communities. Moving water dilutes and decomposes pollutants more rapidly than standing water.

The primary reasons for river water pollution are because of three major sources of pollution i.e. industry, agriculture and domestic situated along the rivers. Industries and cities have been located along rivers historically, because rivers provide transportation and have traditionally been a convenient place to discharge waste. Agricultural activities have tended to be concentrated near rivers, because river floodplains are exceptionally fertile due to the many nutrients that are deposited in the soil when the river overflows.

4.1 Sources of Pollution

4.1.1. Point source pollution

Point source pollution refers to the pollution entering the water way through a discrete conveyance like pipes, channels etc., from source such as industry.

4.1.2 Non- point source pollution

Non-point source pollution refers to the pollution that does not enter the water way through a discrete source but accumulative in nature. The pollutants are collected in small amounts from over a large area. These pollutants are:

- Natural contaminants such as dry leaves, dead insects and animals, bird droppings etc.
- Agricultural contaminants such as agricultural runoff containing fertilizers, pesticides etc. The fertilizers and pesticides can be washed through the soil by rain, to end up in rivers.
- Industrial contaminants such as industrial runoff containing industrial wastes.
- Microbial contaminants such as faecal & total coliform.
- Human added contaminants such as organic matter through domestic discharges.

If large amounts of fertilizers or farm waste drain into a river the concentration of nitrate and phosphate in the water increases considerably. Algae use these substances to grow and multiply rapidly turning the water green. This massive growth of algae, called eutrophication, leads to pollution. When the algae die they are broken down by the action of the bacteria which quickly multiply, using up all the oxygen in the water which leads to the death of many animals.

Chemical waste products from industries are discharged in to rivers. Such pollutants include cyanide, zinc, lead, copper, cadmium and mercury. These substances may enter the water in such high concentrations that fish and other animals are killed immediately. Sometimes the pollutants enter a food chain and accumulate until they reach toxic levels, eventually killing birds, fish and mammals.

Factories use water from rivers to power machinery or to cool down machinery. Dirty water containing chemicals is put back in to the rivers. Water used for cooling is warmer than the river itself. Raising the temperature of the water, lowers the level of dissolved oxygen and upsets the balance of life in the water. People sometimes carelessly throw rubbish directly into rivers.

4.2 Effects of Environmental factors on River water quality

River water quality is highly variable by nature due to environmental conditions such as basin lithology, vegetation and climate. In small watersheds spatial variations extend over orders of magnitude for most major elements and nutrients, while this variability is an order of magnitude lower for major basins. Standard river water for use as reference is therefore not applicable. As a consequence, natural waters can possibly be unfit for various human uses, even including drinking.

There are three major natural sources of dissolved and soluble matter carried by rivers: the atmospheric inputs of material, the degradation of terrestrial organic matter and the weathering of surface rocks. These substances generally transit through soil and porous rocks and finally reach the rivers. On their way, they are affected by numerous processes such as recycling in terrestrial biota, recycling and storage in soils, exchange between dissolved and particulate matter, loss of volatile substances to the atmosphere, production and degradation of aquatic plants within rivers and lakes etc. As a result of these multiple sources and pathways, the concentrations of elements and compounds found in rivers depend on physical factors (climate, relief), chemical factors (solubility of minerals) and biological factors (uptake by vegetation, degradation by bacteria). The most important environmental factors controlling river chemistry are:

- Occurrence of highly soluble (halite, gypsum) or easily weathered (calcite, dolomite, pyrite, olivine) minerals.
- Distance to the marine environment which controls the exponential decrease of ocean aerosols input to land (Na^{+}, Cl^{-}, SO_4^{2-}, and Mg^{2+}).
- Aridity (precipitation/runoff ratio) which determines the concentration of dissolved substances resulting from the two previous processes.

- Terrestrial primary productivity which governs the release of nutrients (C, N, Si, K).
- Ambient temperature which controls, together with biological soil activity, the weathering reaction kinetics.

5. WATER QUALITY MONITORING BY CWC

Central Water Commission (CWC) is playing an important role in the field of water quality monitoring of river water and is observing water quality at various rivers since 1960's. As on January, 2023, CWC is observing water quality at 782 key locations in different rivers across the country: 657 on Hydrological Observation network and 125 Water Quality Sampling stations (WQSS). In addition, CWC has started monitoring of water quality of water bodies across India since 01.03.2023. Till date, 88 water bodies have been identified for water quality monitoring purpose across various states of the country (Figure 4).

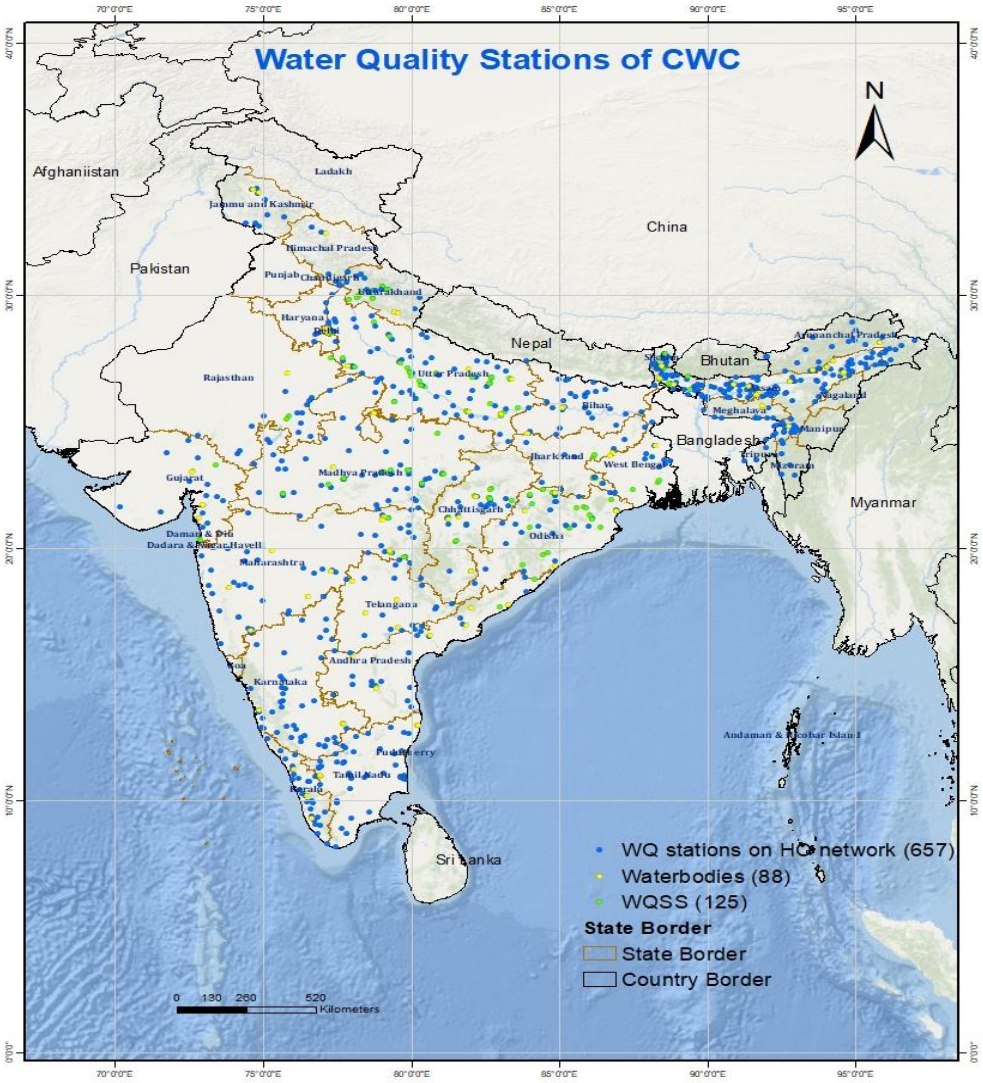


Figure 4: Water quality network of CWC

The details of distribution of WQ monitoring stations among different states and organisations/basins of CWC are given in the tables and figures given below.

Table 1: State–wise distribution of Water Quality Monitoring stations of CWC

S.No.	State	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Andhra Pradesh	4	14	1	2	7	28
2	Arunachal Pradesh	9	9	10	-	2	30
3	Assam	21	26	53	-	11	111
4	Bihar	6	22	1	-	2	31
5	Chhattisgarh	2	18	-	12	4	36
6	Delhi	1	2	-	3	3	9
7	Gujarat	4	9	-	2	6	21
8	Haryana	3	1	-	-	-	4
9	Himachal Pradesh	-	6	-	-	1	7
10	Jammu & Kashmir	3	6	-	-	2	11
11	Jharkhand	4	6	1	6	2	19
12	Karnataka	17	23	2	-	4	46
13	Kerala	2	24		-	3	29
14	Madhya Pradesh	20	24	4	12	2	62
15	Maharashtra	17	25	4	6	10	62
16	Manipur	-	-	1	-	-	1
17	Meghalaya	5	3	1	-	2	11
18	Mizoram	-	5	-	-	-	5
19	Odisha	2	22	1	25	4	54
20	Puducherry	3	-	-	-	-	3
21	Rajasthan	8	8		2	1	19
22	Sikkim	-	11	6	5	1	23
23	Tamil Nadu	21	21	-	-	5	47
24	Telangana	4	8	1	-	4	17
25	Tripura	-	3	2	-	-	5
26	Uttar Pradesh	14	47	4	28	6	99
27	Uttarakhand	5	9		15	3	32
28	West Bengal	7	21	10	7	3	48
	Grand Total	**182**	**373**	**102**	**125**	**88**	**870**

Figure 5: State-wise distribution of Water Quality Monitoring stations monitored by CWC

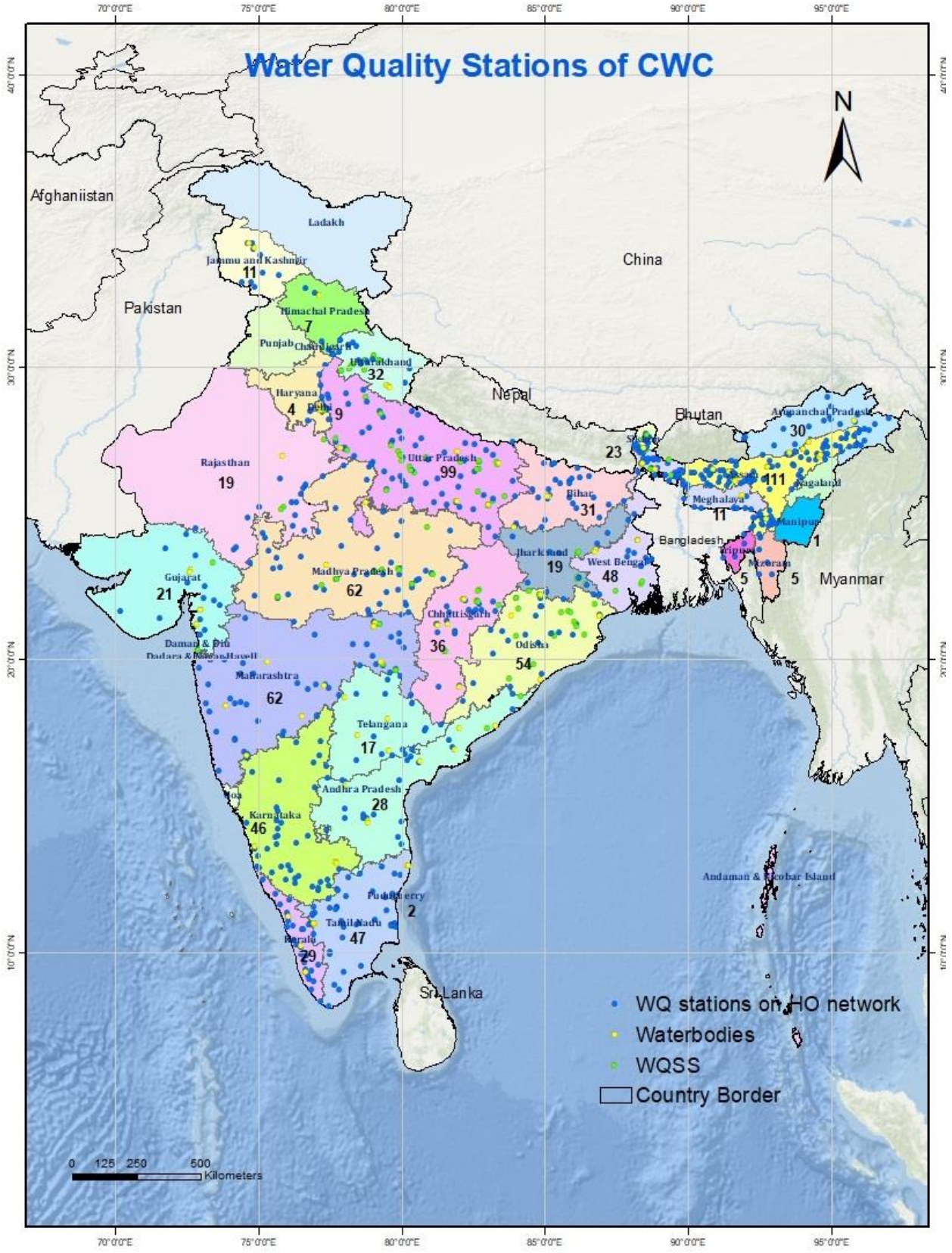


Table 2: Organisation–wise distribution of Water Quality Monitoring stations of CWC

S.No.	Organization	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Barak and Other Basins Organisation, Shillong	7	22	8	-	3	40
2	Brahmaputra Basin Organisation, Guwahati	27	24	58	-	12	121
3	Cauvery and southern rivers Organisation, Coimbatore	35	53	-	-	11	99
4	Indus Basin Organisation, Chandigarh	3	8	-	-	3	14
5	Krishna & Godavari Basin Organisation, Hyderabad	19	34	7	-	15	75
6	Lower Ganga Basin Organisation, Patna	9	33	1	6	5	54
7	Mahanadi and Eastern Rivers Organisation, Bhubaneswar	2	43	1	43	7	96
8	Mahi & Tapi Basin Organisation, Gandhinagar	6	15		2	6	29
9	Monitoring Central Organisation, Nagpur	10	14	1	6	5	36
10	Monitoring South Organisation, Bengaluru	11	17	-	-	3	31
11	Narmada Basin Organisation, Bhopal	8	9	4	11	1	33
12	Teesta & Bhagirathi Damodar Basin Organisation, Kolkata	11	32	18	14	6	81
13	Upper Ganga Basin Organisation, Lucknow	6	32	1	33	5	77
14	Yamuna Basin Organisation, New Delhi	28	37	3	10	6	84
	Grand Total	**182**	**373**	**102**	**125**	**88**	**870**

Figure 6: Organisation-wise distribution of water quality Monitoring stations monitored by CWC.

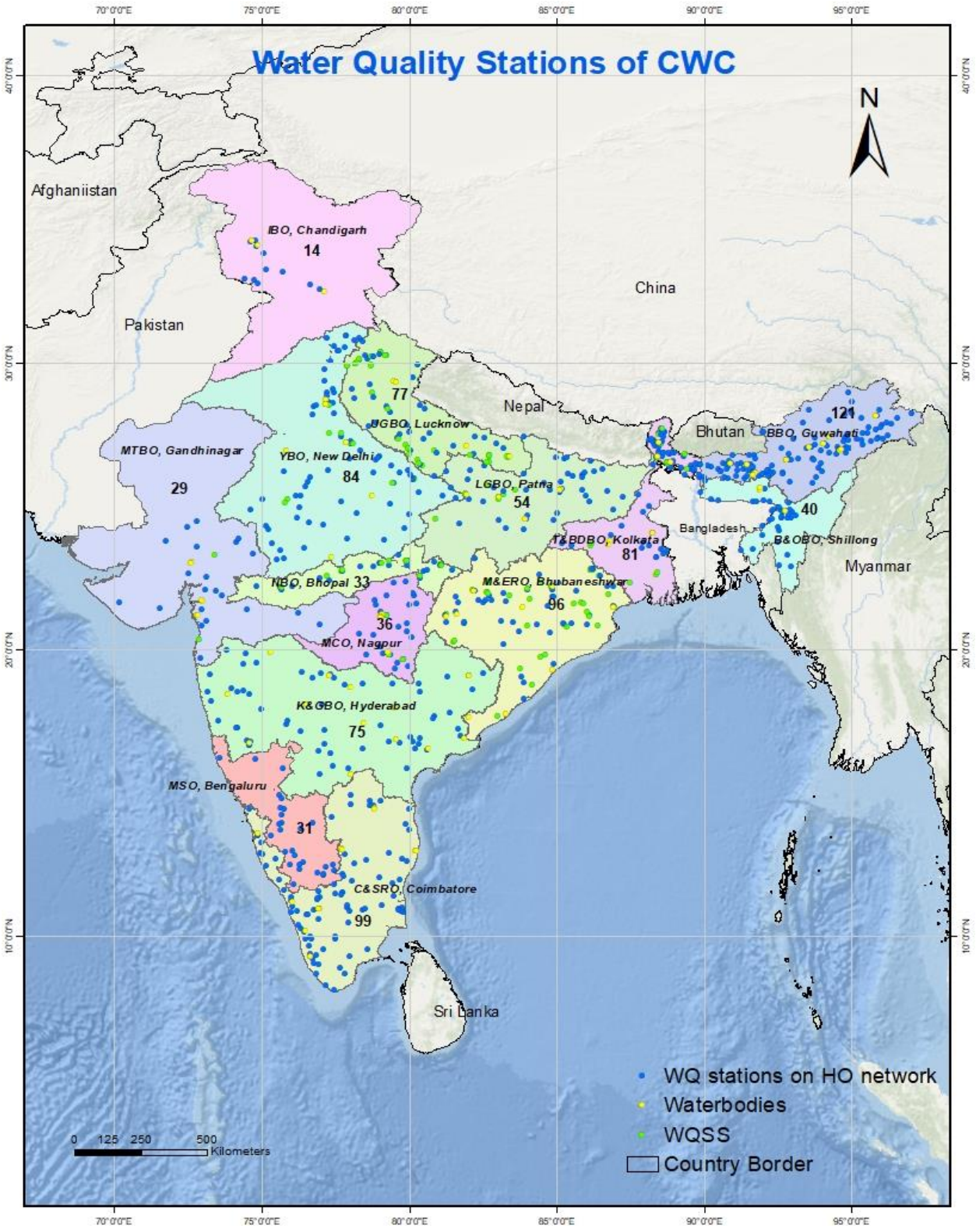
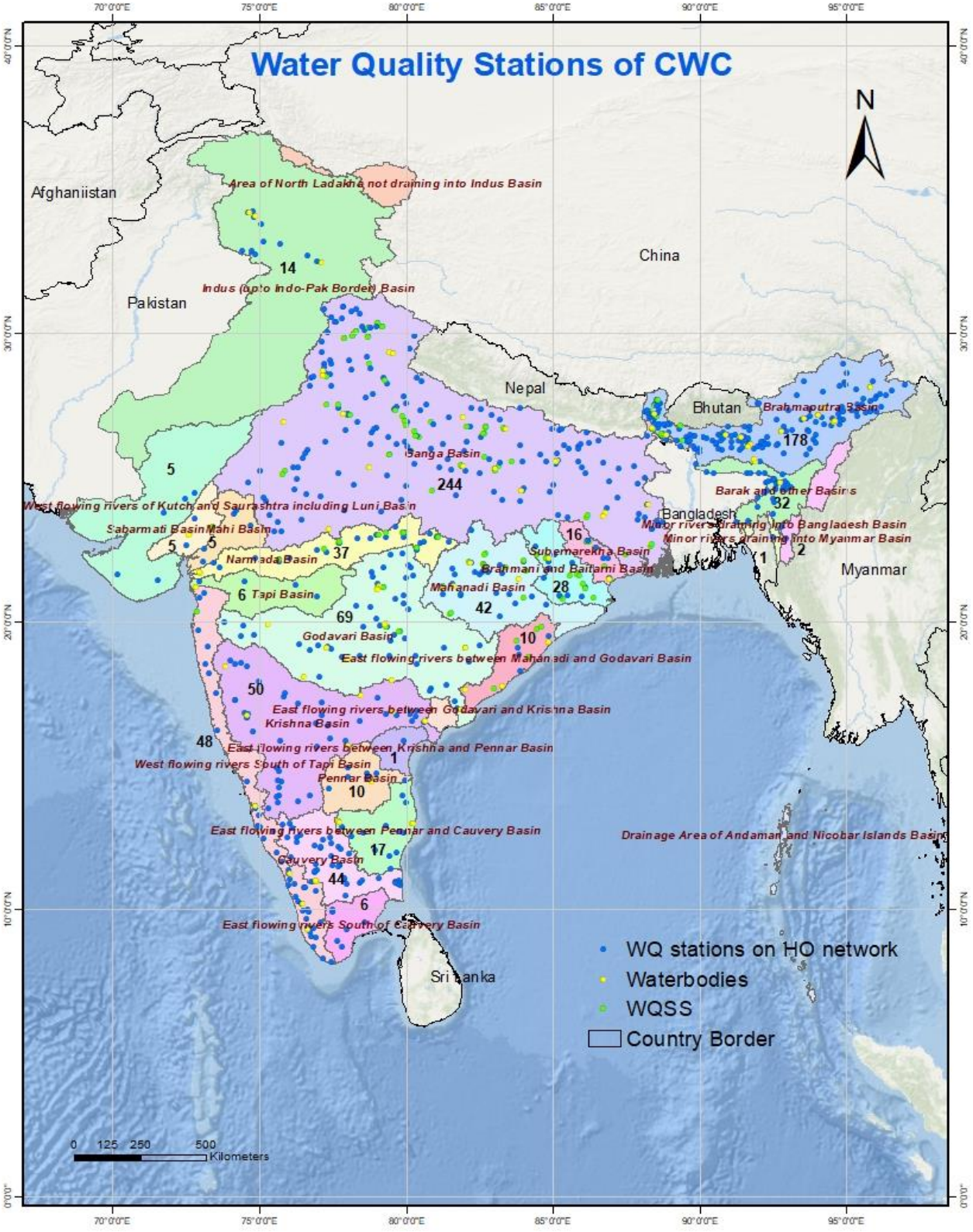


Table 3: Basin-wise water-quality Monitoring stations monitored by CWC

S.No.	Basin	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Barak and Others Basin	6	18	7	-	1	32
2	Brahmani and Baitarni Basin	-	11	1	15	1	28
3	Brahmaputra Basin	34	44	76	7	17	178
4	Cauvery Basin	17	24	-	-	3	44
5	EFR bertween Pennar and Cauvery	8	4	-	-	5	17
6	EFR between Krishna and Pennar	-	1	-	-	-	1
7	EFR between Mahanadi and Godavari	-	4	-	5	1	10
8	EFR South of Cauvery	2	4	-	-	-	6
9	Ganga Basin	48	115	6	56	19	244
10	Godavari Basin	19	26	4	6	14	69
11	Indus (Up to border) Basin	3	8	-	-	3	14
12	Krishna Basin	14	27	3	-	6	50
13	Mahanadi Basin	1	22	-	15	4	42
14	Mahi Basin	2	3	-	-	-	5
15	Narmada Basin	8	11	4	11	3	37
16	Pennar Basin	4	4		-	2	10
17	River draining into Bangladesh Basin	-	1	-	-	-	1
18	River draining into Myanmar Basin	-	2	-	-	-	2
19	Sabarmati Basin	1	1	-	1	2	5
20	Subarnarekha Basin	1	6	-	8	1	16
21	Tapi Basin	1	3	-	-	2	6
22	WFR of Kutch and Saurashtra including Luni Basin	2	3	-	-	-	5
23	WFR South of Tapi	11	31	1	1	4	48
	Grand Total	**182**	**373**	**102**	**125**	**88**	**870**

Figure 7: Map showing the basin-wise distribution of water quality Monitoring stations monitored by CWC.



The water quality samples collected at these monitoring stations are analysed at laboratories of CWC. At present, CWC follows a three-tier laboratory system which consists of Level I, II and III types of laboratories for providing analytical facilities for the analysis of river water samples collected from water quality monitoring stations covering all the important river basins of India.

The three-tier laboratory system consists of:

1. **Level-I Laboratories:** 427 level-I laboratories located at field water quality monitoring monitoring stations on various rivers of India for monitoring of 6 in-situ parameters: Colour, Odour, Temperature pH, Electrical Conductivity and Dissolved Oxygen (a map showing 427 Level-I labs can be seen at figure-8).
2. **Level-II Laboratories:** 18 level-II laboratories located at division offices to analyse 25 physico-chemical and bacteriological parameters of river water.
3. **Level-III Laboratories:** 5 regional labs located at New Delhi, Varanasi, Hyderabad, Coimbatore and Guwahati for analysis of 41 parameters including trace & toxic metals and pesticides.

Out of 23 level-II/III laboratories of CWC, 22 laboratories of CWC have got accreditation by National Accreditation Board for Testing and Calibration Laboratories (NABL) in the field of testing in accordance with Standard ISO/IEC 17025:2017. A map showing level-II/III labs can be seen at figure-9. The details of monitoring parameters in each level labs are depicted in table-4.

Table 4: List of Water Quality Parameters monitored by CWC

Sl. No.	Level-I	Level-II	Level-III
1	Temperature	Temperature	Temperature
2	Colour	pH	pH
3	Odour	Electrical Conductivity	Electrical Conductivity
4	pH	Dissolved Oxygen (DO)	Dissolved Oxygen (DO)
5	Electrical Conductivity	Turbidity	Turbidity
6	Dissolved Oxygen (DO)	Biochemical Oxygen Demand (BOD)	Biochemical Oxygen Demand (BOD)
7		Chemical Oxygen Demand (COD)	Chemical Oxygen Demand (COD)
8		Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS)
9		Sodium	Sodium
10		Calcium	Calcium
11		Magnesium	Magnesium
12		Potassium	Potassium
13		Carbonate	Carbonate
14		Bicarbonate	Bicarbonate
15		Chloride	Chloride
16		Sulphate	Sulphate
17		Fluoride	Fluoride
18		Boron	Boron
19		Ammoniacal Nitrogen	Ammoniacal Nitrogen
20		Nitrate	Nitrate
21		Nitrite	Nitrite
22		Phosphate	Phosphate
23		Silicate	Silicate
24		Total Coliform	Total Coliform
25		Fecal Coliform	Fecal Coliform
26			Arsenic
27			Cadmium
28			Chromium
29			Copper
30			Iron
31			Lead
32			Nickel
33			Mercury
34			Zinc
35			Alpha Benzenehexachloride (BHC), Beta BHC, Gama BHC (Lindane)
36			OP-Dichlorodiphenyltrichloroethane (OP DDT), PP-DDT
37			Alpha Endosulphan, Beta Endosulphan
38			Aldrin, Dieldrin
39			Carbaryl (Carbamate)
40			Malathion, Methyl Parathion
41			Anilophos, Chloropyriphos

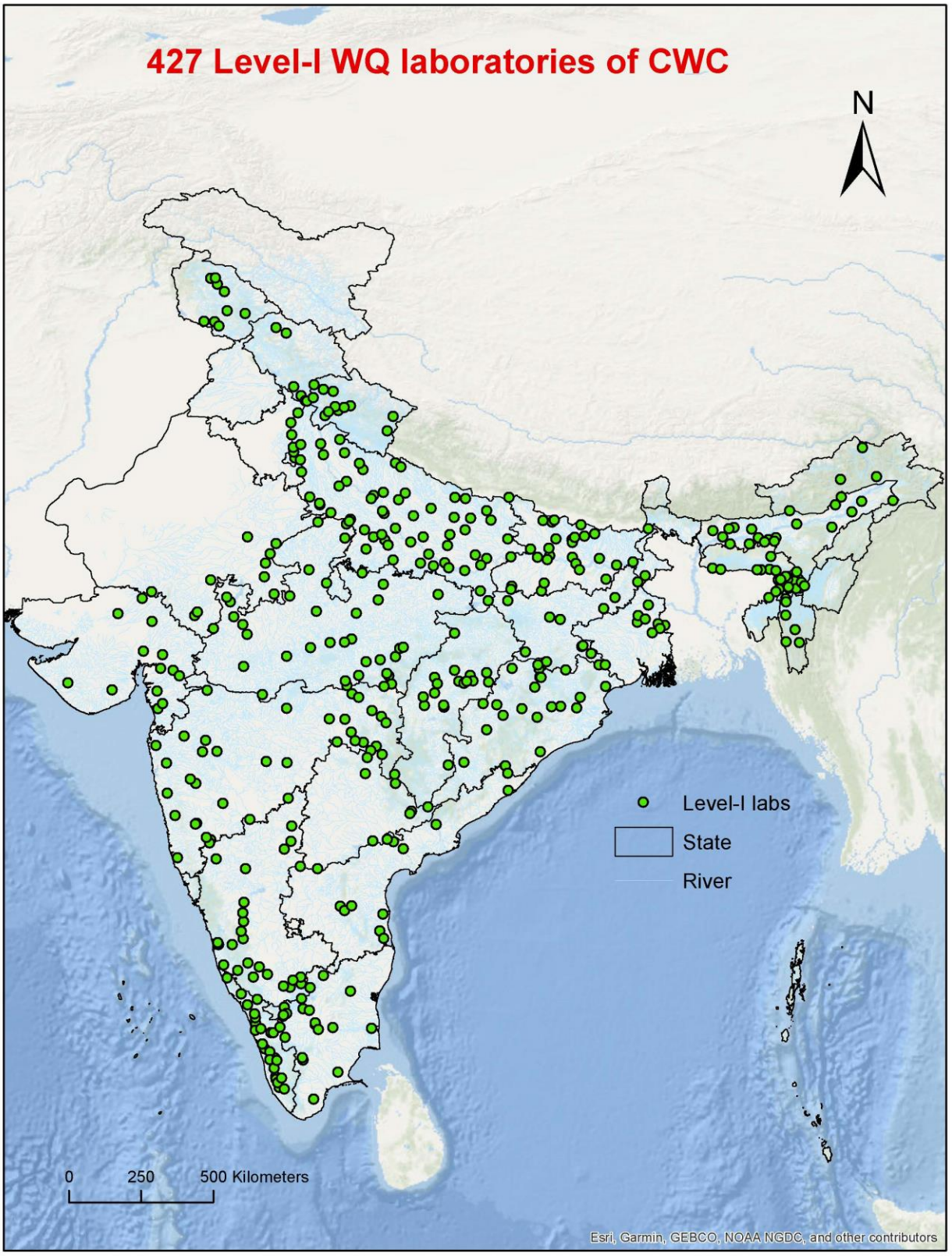


Figure 8: Level-I Water quality laboratories of CWC

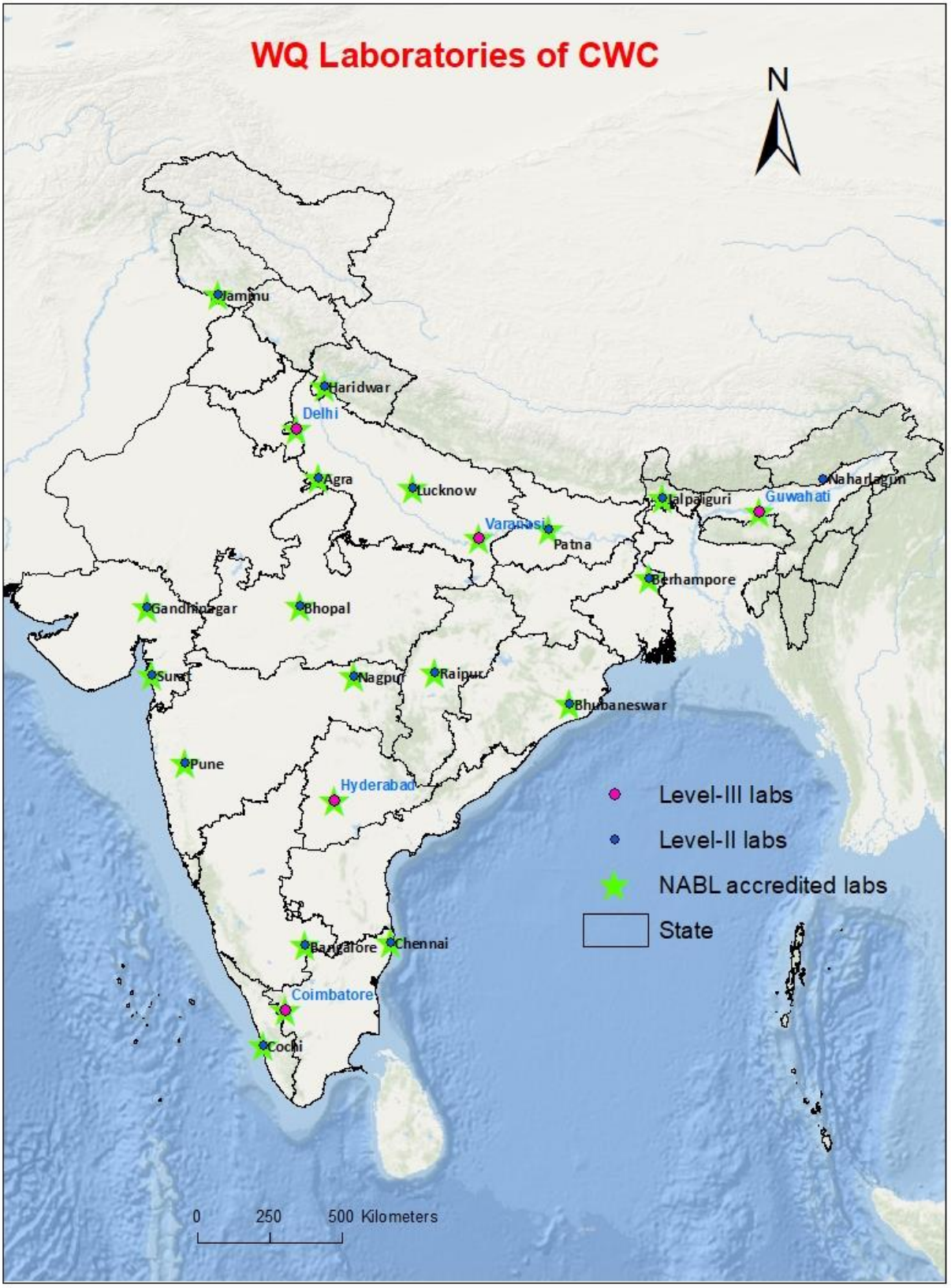


Figure 9: Level-II/III Water quality laboratories of CWC

CHAPTER – 6

6.1 River Water Quality Hot Spots in India

The river water quality monitoring is most essential aspect of restoring the water quality. One of the main objectives of the river water quality monitoring is to assess the suitability of river water for drinking purposes, irrigation, outdoor bathing and propagation of wildlife, fisheries. The physical and chemical quality of river water is important in deciding its suitability as a source of drinking water after treatment/bathing etc. As such the suitability of river water for potable uses with regard to its chemical quality has to be deciphered and defined on the basis of some vital characteristics of the water. River water quality is very important for aspect in India. The physico-chemical parameters like pH, Electrical Conductivity (EC), Fluoride (F^-), Ammonia as N (NH_3-N), Nitrate as N (NO_3^--N), Chloride (Cl^-), Total Hardness (TH), Boron (B), Sodium Adsorption Ratio (SAR), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform (TC) and Faecal Coliform (FC) are important constituents defining the quality of river water in surface water. Therefore, presence of these parameters in river water beyond the value for permissible limit has been considered as river water quality hot spots. The best use classification is essential, for maintaining the quality of river water of the particular stretch. The study is based on average values of 13 parameters observed during Pre-monsoon (January to May), Monsoon (June to October) and Post-monsoon (November to December) seasons for the year 2023.

In this study identification of hot spot in Indian river wrt pH, Electrical Conductivity (EC), Ammonia as N (NH_3-N), Boron (B), Sodium Adsorption Ratio (SAR), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Total Coliform (TC) parameters are done based on Class B, D & E of Designated best uses of water by Central Pollution Control Board (CPCB) (Table.4). In addition to above parameters, hotspots identification in Indian River w.r.t. Fluoride (F^-), Nitrate as N (NO_3^--N) , Chloride (Cl^-), Total Hardness (TH) parameters are done based on BIS (Bureau of Indian Standards) IS 10500: 2012 (Table.5) for drinking water as a benchmark in absence of any standard for these parameters for drinking waters.Faecal Coliform (FC) is based on the Primary Water Quality Criteria for Bathing Water mentioned in the Ministry of Environment, Forest and Climate Change (MoEFCC) Gazette Notification, 2000.

6.2 Study Area

A total number of 759 water quality monitoring stations in year 2023 covering all the important rivers of country were studied for water quality hotspots in rivers of India.

The coverage of WQ monitoring stations with respect to various parameters are given as shown below:

(A) For pH, Electrical Conductivity and Chloride in figure-10.

(B) For Total Coliform and Faecal Coliform in figure-11.

(C) For Ammonia-N in figure-12.

(D) For Boron in figure-13.

(E) For Sodium Absorption Ratio (S.A.R.) in figure-14.

(F) For Fluoride in figure-15.

(G) For Nitrate-N in figure-16.

(H) For Dissolved Oxygen (D.O.) in figure-17.

(I) For BiochemicalOxygen Demand (B.O.D.) in figure-18.

(J) For Total Hardness (TH) in figure-19.

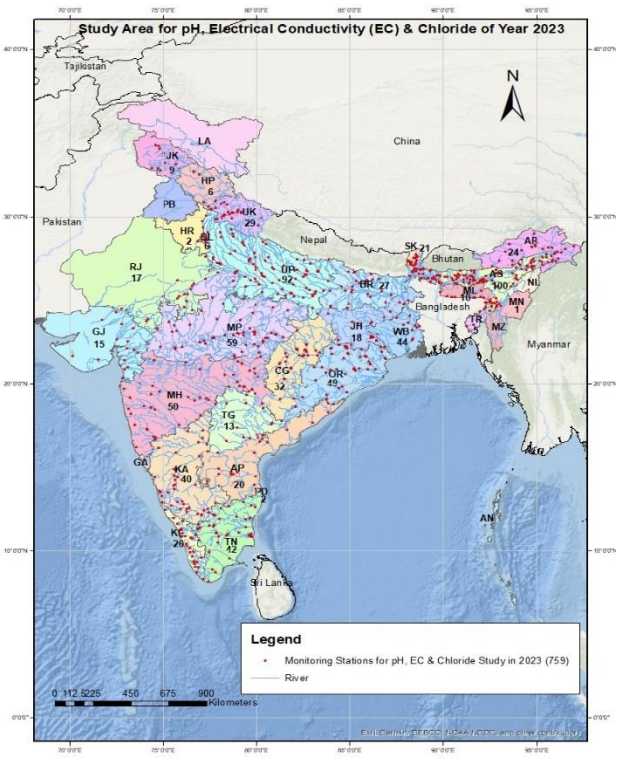


Fig 10: Study area of 759 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 (For pH, Electrical Conductivity & Chloride)

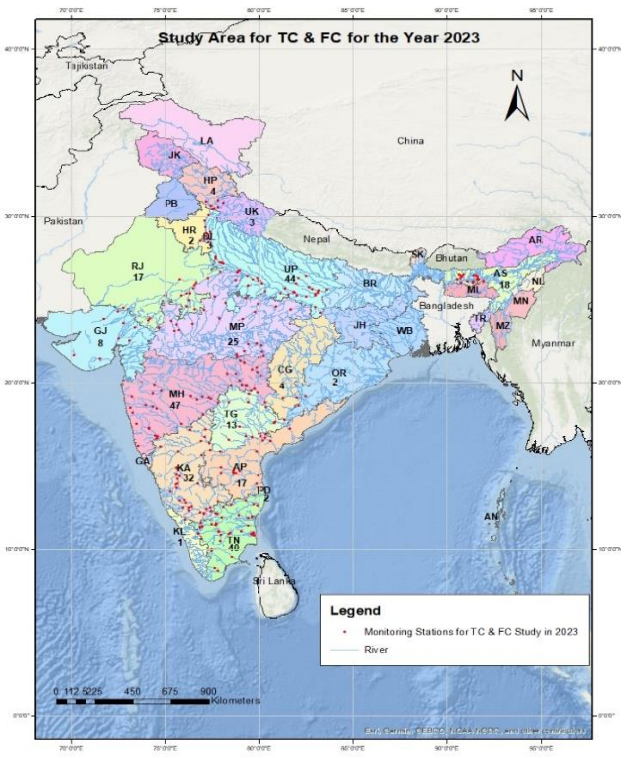


Fig 11: Study area of 282 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for TC & FC

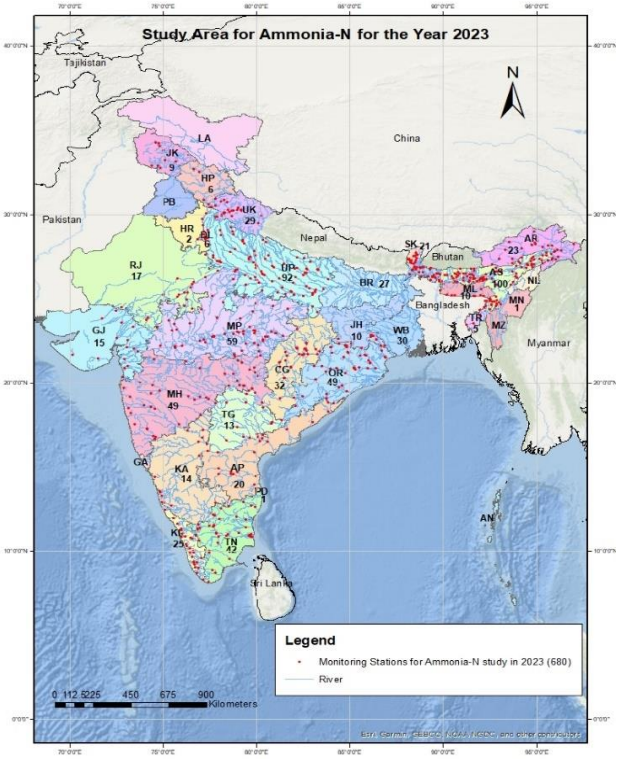


Fig 12: Study area of 680 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Ammonia-N

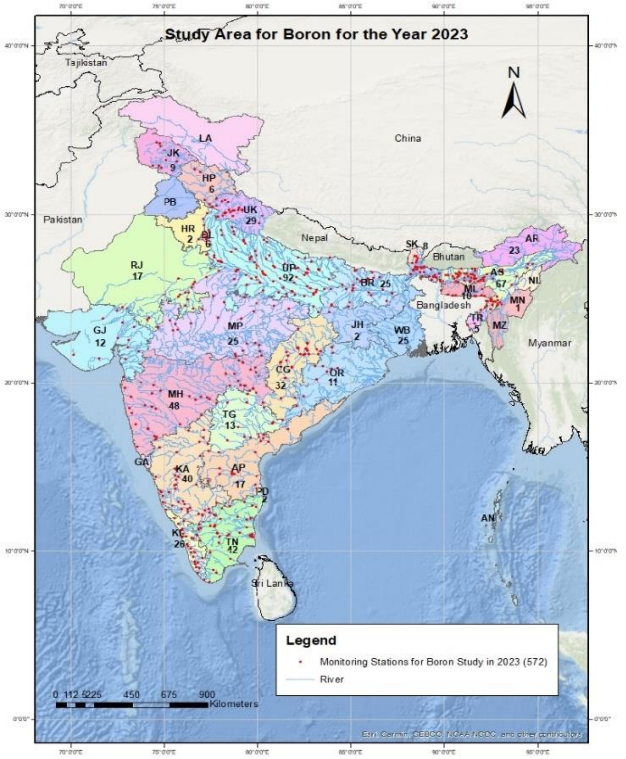


Fig 13: Study area of 572 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Boron

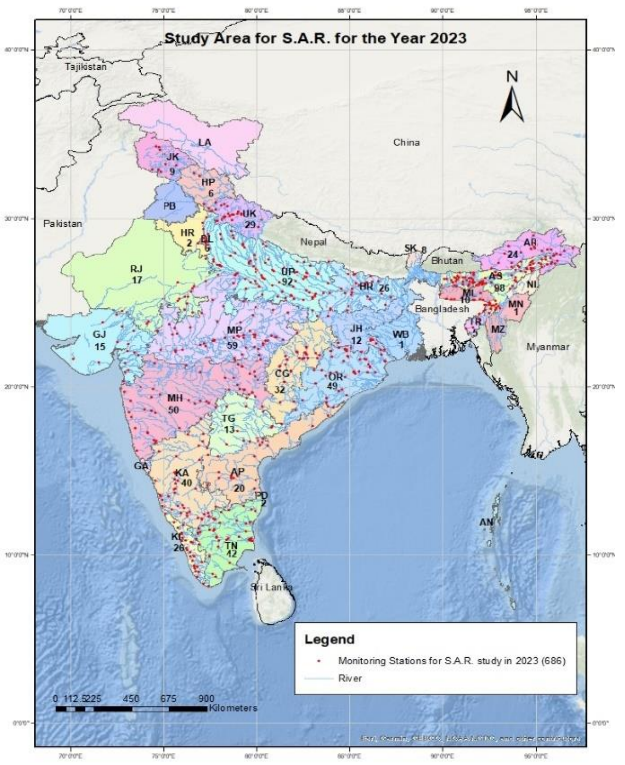


Fig 14: Study area of 686 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for S.A.R

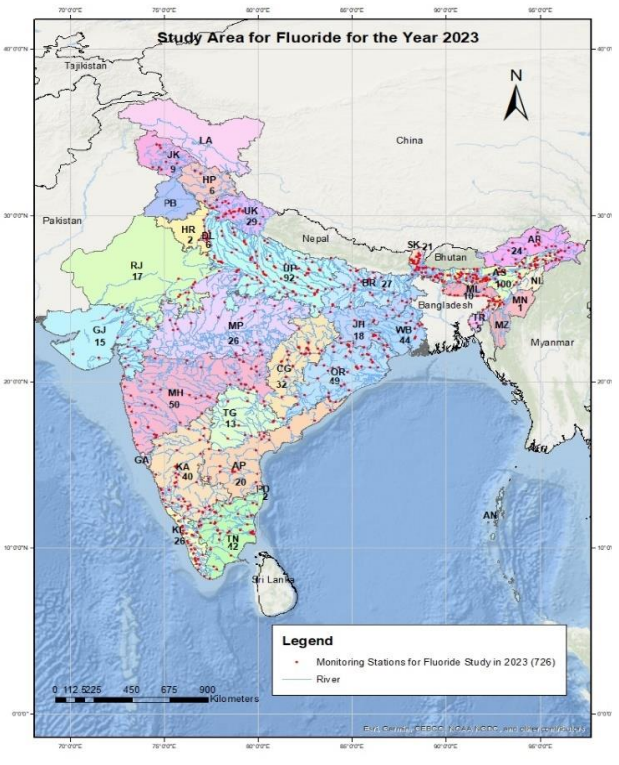


Fig 15: Study area of 726 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Fluoride

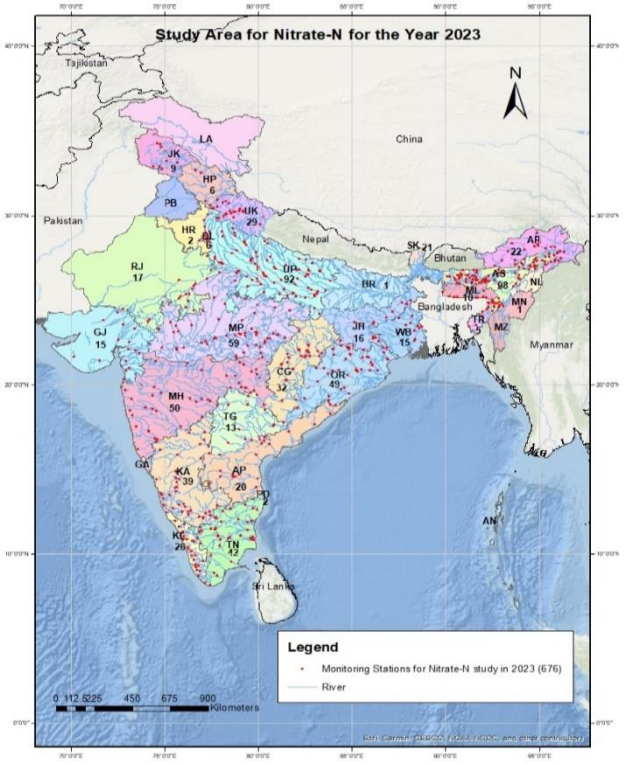


Fig 16: Study area of 676 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Nitrate-N

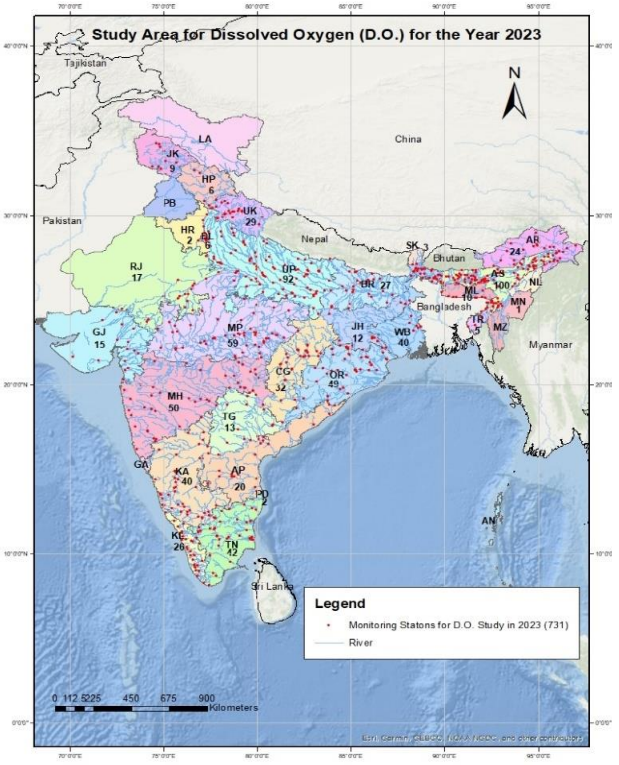


Fig 17: Study area of 731 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Dissolved Oxygen (DO)

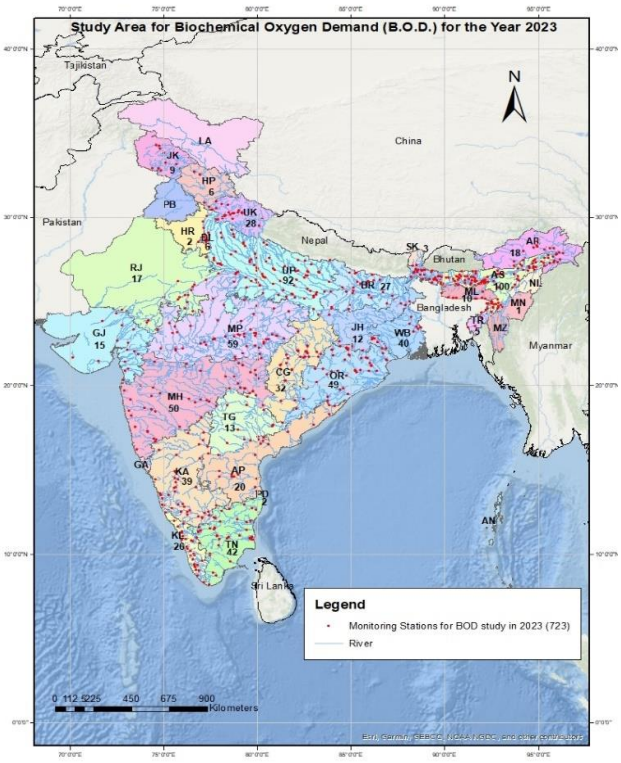


Fig 18: Study area of 723 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Biochemical Oxygen Demand (BOD)

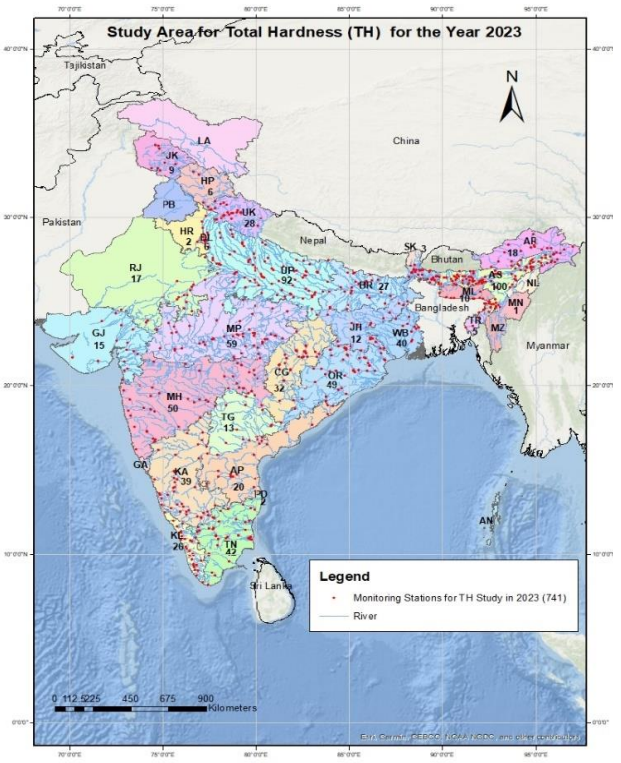


Fig 19: Study area of 741 Water Quality (WQ) Monitoring stations on important rivers of India in year 2023 for Total Hardness (TH)

6.3 Water Quality Standard in India

Central Pollution Control Board (CPCB) has identified water quality requirements in terms of certain chemical characteristics, known as primary water quality criteria (Table 5). Based on this classification, the natural water has been categorized as Class-A Drinking Water Source without conventional treatment but after disinfection; Class-B Outdoor bathing (Organized); Class-C Drinking water source after conventional treatment and disinfection; Class-D Propagation of Wild life and Fisheries; Class-E Irrigation, Industrial Cooling, Controlled Waste disposal. Further BIS vide its document BIS 10500:2012 has recommended water quality standards for drinking water (Table 6).

Table 5: Designated Best Uses of Water by CPCB

Designated Best Use	Class	Criteria
Drinking Water Source withoutconventional treatment but afterdisinfection	A	1. Total Coliforms Organism MPN/100 ml shallbe 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/L or more 4. Biochemical Oxygen Demand 5 days 20 °C, 2mg/L or less
Outdoor bathing (Organised)	B	1. Total Coliforms Organism MPN/100 ml shall be500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 3mg/L or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100ml shall be5000 or less 2. pH between 6 and 9 3. Dissolved Oxygen 4 mg/L or more 4. Biochemical Oxygen Demand 5 days 20 °C, 3mg/Lor less
Propagation of Wild life and Fisheries	D	1. pH between 6.5 and 8.5 2. Dissolved Oxygen 4 mg/l or more 3. Free Ammonia (as N) 1.2 mg/L or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	1. pH between 6.0 and 8.5 2. Electrical Conductivity at 25 °C micro mhos/cm,maximum 2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2 mg/L
	Below -E	Not meeting any of the A, B, C, D & E criteria

Table 6: Drinking Water Quality Standards, BIS: 10500, 2012

S. No.	Characteristic	Requirement (Acceptable Limit)	Permissible limit in the absence of Alternate source
Essential Characteristics			
1	Colour, Hazen units, Max	5	15
2	Odour	Agreeable	Agreeable
3	Taste	Agreeable	Agreeable
4	Turbidity NTU, Max	1	5
5	pH Value	6.5 -8.5	No relaxation
6	Total Hardness (as $CaCO_3$) mg/L, Max.	200	600
7	Iron (as Fe), mg/L, Max	1.0	No relaxation
8	Chlorides (as Cl), mg/L, Max	250	1000
9	Residual free chlorine, mg/L, Minimum	0.2	1.0
Desirable Characteristics			
10	Total Dissolved solids, mg/L, Max	500	2000
11	Calcium (as Ca) mg/L, Max.	75	200
12	Magnesium (as Mg) mg/L, Max	30	100
13	Copper (as Cu), mg/L, Max	0.05	1.5
14	Manganese (as Mn) mg/L, Max	0.1	0.3
15	Sulphates (as SO_4), mg/L, Max	200	400
16	Nitrate (as NO_3) mg/L, Max.	45	No relaxation
17	Fluorides (as F), mg/L, Max	1.0	1.5
18	Ammonia (as total ammonia-N) mg/L	0.5	No relaxation
19	Mercury (as Hg), mg/L, Max	0.001	No relaxation
20	Cadmium (as Cd), mg/L, Max	0.003	No relaxation
21	Selenium (as Se), mg/L, Max	0.01	No relaxation
22	Total Arsenic (as As), mg/L, Max	0.01	No relaxation
23	Cyanides (as CN), mg/L, Max	0.05	No relaxation
24	Lead (as Pb), mg/L, Max	0.01	No relaxation
25	Zinc (as Zn), mg/L, Max	5	15
26	Anionic detergents (as MBAS), mg/L, Max	0.2	1
27	Total Chromium (as Cr), mg/L, Max	0.05	No relaxation
28	Polynuclear aromatic hydrocarbons (as PAH), mg/L, Max	-	-
29	Mineral oil, mg/L, Max	0.5	No relaxation
30	Pesticides mg/L, Max	Absent	0.001
33	Alkalinity mg/L, Max	200	600
34	Aluminum (as Al) mg/L, Max	0.03	0.2
35	Boron mg/L, Max	0.5	1.0

MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION
New Delhi, the 25th September, 2000

Primary Water Quality Criteria for Bathing Waters:

In a water body or its part, water is subjected to several types of uses. Depending on the types of uses and activities, water quality criteria have been specified to determine its suitability for a particular purpose. Among the various types of uses there is one use that demands highest level of water quality or purity and that is termed as Designated Best Use in that stretch of water body. Based on this, water quality requirements have been specified for different uses in terms of primary water quality criteria. The primary water quality criteria for bathing water are specified along with the rationale.

Table 7: PRIMARY WATER QUALITY CRITERIA FOR BATHING WATER
(Water used for organised outdoor bathing)

CRITERIA		RATIONALE
1.Faecal Coliform MPN/100 ml	500 (desirable) 2500 (Maximum Permissible)	To ensure low sewage contamination. Faecal coliform and faecal 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.
2. 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.
3. Dissolved Oxygen	5 mg/1 or more	The minimum dissolved oxygen concentration of 5 mg/1 ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment.
4. Biochemical Oxygen demand 3-day,27°C	3 mg/1 or less	The Biochemical Oxygen Demand of 3 mg/1 or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases.

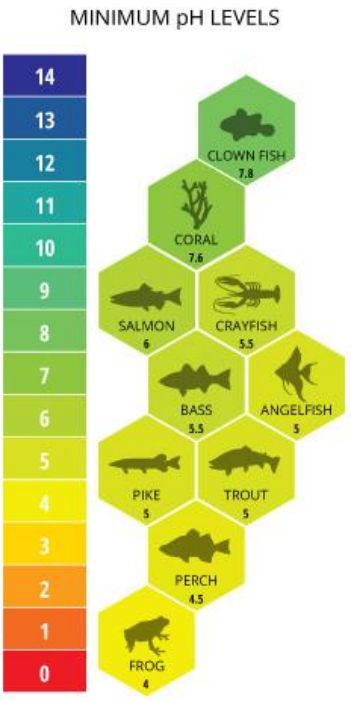
6.4 Water Quality Parameters

6.4.1 pH

The term pH stands for the power of hydrogen, and it is a measure of the acidity or alkalinity of a solution. The numerical value of pH is determined by the molar concentration of hydrogen ions (H+) present in the solution. The pH scale ranges from 1 to 14, where water with a pH of 7 is considered neutral, pH values below 7 are acidic, and pH values above 7 are considered basic or alkaline (Langland & Cronin, 2003). pH value done by taking the negative logarithm of the H+ concentration (-log(H+)).

$$pH = - \log_{10}[H^+] \text{ or } \log[1/H^+]$$

pH in water can be influenced by various factors, both natural and man-made. Natural changes in pH occur due to interactions with surrounding rock, particularly carbonate forms, and other materials. Precipitation, especially acid rain, and discharges from wastewater or mining operations can also cause fluctuations in pH levels. Additionally, the concentration of carbon dioxide (CO2) in water can influence pH levels (Hickin, 1995).



The pH of water is important because it affects the health of aquatic organisms and the solubility and toxicity of chemicals and heavy metals in the water. Most aquatic creatures prefer a pH range of 6.5-9.0, though some can live in water with pH levels outside of this range. If the pH of water is too high or too low, the aquatic organisms living within it will die (EPA, 2012).

Humans can tolerate a wider range of pH levels than aquatic organisms, but there are still concerns. pH values greater than 11 can cause skin and eye irritations, as does a pH below 4. A pH value below 2.5 will cause irreversible damage to skin and organ linings. Lower pH levels increase the risk of mobilized toxic metals that can be absorbed, even by humans, and levels above 8.0 cannot be effectively disinfected with chlorine, causing other indirect risks. In addition, pH levels outside of 6.5-9.5 can damage and corrode pipes and other systems, further increasing heavy metal toxicity (Fink, 2005). Therefore, it is important to maintain the pH levels of water within the recommended range of 6.5-8.5, as per CPCB's designated best uses of water (Class A and B).

6.4.2 Electrical Conductivity (EC)

Conductivity is a measure of water's ability to conduct an electrical flow, and it is directly related to the concentration of ions present in the water (Wetzel, 2001). These ions come from dissolved salts and inorganic materials like alkalis, chlorides, sulfides, and

carbonate compounds. The more ions present in the water, the higher its conductivity (Langland & Cronin, 2003). Conversely, the fewer the ions in the water, the lower its conductivity. Compounds that dissolve into ions are known as electrolytes (Palermo, 2008).

Salinity and conductivity have a strong correlation, and conductivity is used in algorithms to estimate salinity and TDS, both of which affect water quality and aquatic life. Salinity is specifically important because it affects dissolved oxygen solubility. The higher the salinity level, the lower the dissolved oxygen concentration (DWFS,2014). Temperature affects conductivity by increasing ionic mobility and the solubility of salts and minerals. This can be seen in diurnal variations as a body of water warms up due to sunlight, and conductivity increases, and then cools down at night, decreasing conductivity NSIDC. (2014).

Heavy rainfall or other severe weather events can contribute to flooding, and the effect on conductivity depends on the water body and surrounding soil. In areas with dry and wet seasons, conductivity usually drops overall during the wet season due to the dilution of the water source though the overall conductivity is lower for the season, there are often conductivity spikes as water initially enters a floodplain. If a floodplain contains nutrient-rich or mineralized soil, previously dry salt ions can enter solution as it is flooded, raising the conductivity of water (Sallenave, 2011). A sudden increase or decrease in conductivity in a body of water can indicate pollution. Agricultural runoff or a sewage leak will increase conductivity due to the additional chloride, phosphate, and nitrate ions. In both cases, the additional dissolved solids will have a negative impact on water quality (ESCT, 2013).

Most aquatic species have adapted to specific salinity levels, and salinity values outside of a normal range can result in fish kills due to changes in dissolved oxygen concentrations, osmosis regulation, and TDS toxicity (McManus & Woodson, 2012; Beskenis, 2006; Guiry, 2014).

6.4.3 Dissolved Oxygen (DO)

The amount of gaseous oxygen dissolved in water is known as dissolved oxygen, which enters the river water through diffusion from the atmosphere and as a by-product of aquatic plants' photosynthesis (Wetzel, 2001). The presence of dissolved oxygen in the aquatic habitat is crucial for the survival of organisms living in water bodies, including fish and invertebrates. Animals require oxygen to survive, and fish, for instance, can't survive for long in water with less than 5 mg/L of dissolved oxygen (EPA, 2014). Most aquatic plants, fish and zooplankton need oxygen in water in order to breathe. Good oxygen levels are critical for the health of a river system. Slow flowing, polluted river water is often associated with low oxygen conditions, which cannot support much life.

The low level of dissolved oxygen in water indicates contamination and is an important factor in determining water quality, pollution control, and treatment processes. The level of dissolved oxygen in natural and wastewater depends on the physical, chemical, and biochemical activities occurring in water bodies. Oxygen is considered poorly soluble in

water, and its solubility is related to temperature and pressure. The introduction of organic waste, especially domestic and animal sewage, industrial waste from paper mills, leather manufacturing, slaughterhouse sewage, and crop wastewater, significantly reduces the DO in river water. The wastes from these industries cause oxygen demand, and they're broken down and decomposed by bacteria into oxygen. Most oxygen-demanding waste is organic.

Low oxygen in water can be fatal to fish and other organisms living in water. A minimum of about 4 mg/L of DO is required for the survival of living organisms in water. Oxygen-depleting substances reduce the available DO. During the summer months, the rate of biological oxidation is significantly increased, yet the DO concentration is at its minimum due to higher temperatures. The DO concentration, temperature, and photosynthesis rate are interdependent and vary diurnally. The decrease in the DO concentration during nights due to the inhibition of photosynthetic activity and the increase in DO concentration due to active photosynthesis of microalgae during the daytime have been observed (Saba et al., 2017).

6.4.4 Biochemical oxygen Demand (BOD)

Biochemical Oxygen Demand (BOD) is a crucial parameter that quantifies the amount of dissolved oxygen required by aerobic biological organisms to break down organic materials within a river water sample (Armiento, 2016). Diverse sources contribute to BOD, encompassing municipal and industrial wastewater discharges, agricultural runoff, and leachate from landfills. Within rivers, oxygen consumption arises from a combination of aquatic animal respiration, decomposition processes, and various chemical reactions. Wastewater discharged from sewage treatment plants often contains organic substances, which are decomposed by microorganisms, consuming oxygen in the process. Additionally, stormwater runoff from farmland or urban streets, feedlots, and malfunctioning septic systems can introduce oxygen-consuming wastewater.

Several factors influence BOD, including the type and quantity of organic material present, temperature, pH, dissolved oxygen concentration, and the presence of bacteria.

CPCB has recommended a concentration of 3.0 mg/l of biochemical oxygen demand for outdoor bathing. Water having above 3.0 mg/l BOD concentration is not suitable for outdoor bathing. In pristine conditions, rivers generally exhibit a 5-day carbonaceous BOD below 1 mg/L. In moderately polluted scenarios, BOD values fall within the range of 2 to 8 mg/L. Rivers cross the threshold into severe pollution when BOD values exceed 8 mg/L (Grover and Wats, 2013).

The impact of high BOD on the aquatic ecosystem is significant because it can lead to the death of aquatic life. The high levels of BOD can deplete the dissolved oxygen levels in the water, which can cause fish and other aquatic life to suffocate. Additionally, the high levels of BOD can cause the water to become cloudy and murky, making it difficult for aquatic life to thrive.

6.4.5 Total Hardness (TH)

The definition of water hardness is based on the measured content of divalent metal cations, with dissolved calcium (Ca++) and magnesium (Mg++) being the two primary divalent cations found in most waters. In natural water sources, calcium and magnesium are typically bound to bicarbonate, sulfate or chloride. The main sources of water hardness are sedimentary rocks, seepage and runoff from soils. Generally, hard waters originate from areas with thick topsoil and limestone formations, with groundwater tending to be harder than surface water. The two main industrial sources of water hardness are the inorganic chemical and mining industries. (Sawyer & McCarty, 1967; Biesecker & George, 1972).

To classify water hardness, general guidelines are as follows: 0 to 60 mg/L as CaCO3 is considered soft water; 61 to 120 mg/L as moderately hard water; 120 to 180 mg/L as hard water; and more than 180 mg/L as very hard water.

The hardness of water is harmful to the boilers and hot water pipes as the deposition of salts occur, which can reduce their efficiency. The hard water is not good for washing as it is difficult for hard water to form lather with soap (Ramya et al 2015). The World Health Organisation states that hard water has no known adverse health effects (Akram, 2018). There are no serious health effects associated with drinking hard water. However solid water acts as a dietary supplement as it contains calcium and magnesium that strengthens bones and teeth (Sengupta, 2013). Hard water contains high concentration of dissolved minerals therefore millions of people think that these dissolved minerals have positive effects on the health of its drinkers ((Sawyer & McCarty, 1967; Biesecker & George, 1972).

6.4.6 Nitrate (NO_3^-)

Nitrate is a compound that can be found in the environment naturally and synthetically under various conditions. The amount of nitrogen present or both nitrogen and oxygen are used to measure nitrate in drinking water, which is the principal form of combined nitrogen that is present in natural waters. It serves as a nutrient that stimulates plant growth. However, excessive amounts of nitrogen may lead to the proliferation of macrophytes or phytoplankton. Nitrates can be contributed to freshwater through the discharge of sewage and industrial waste, as well as run-off from agricultural fields. Nitrate is the final product of the oxidation of ammonia. Effluents such as sewage contain high levels of ammonia, which can increase nitrate concentrations in receiving waters. High levels of nitrate in river waters may indicate pollution, even though this form of nitrogen can be used as a source of nutrients for plants and encourage plant proliferation (Hamzaraj et al., 2014).

The standard for nitrate in drinking water is 10.16 mg/L nitrate as N (NO_3^--N) or 45 mg/L nitrate (NO_3^-). Nitrate in drinking water can cause Methemoglobinemia or blue baby syndrome, which is a significant health problem associated with nitrate.

6.4.7 Fluoride (F^-)

Fluoride is a natural element that is commonly found in water sources, soil, and various foods. It is the 13th most abundant element, commonly occurring in the minerals fluorspar (CaF_2), cryolite (Na_3AlF_6) and fluorapatite ($3Ca_3(PO_4)_2$ $Ca(F,Cl)_2$) while industrial wastes, use of extensive fertilizers and brick kilns are examples of the anthropogenic sources (Cotton & Wilkinson, 1988; Mackay & Mackay, 1989).

Fluoride is beneficial for dental health because it helps strengthen tooth enamel and makes teeth more resistant to acid attacks from bacteria and sugars. However, excessive fluoride intake can lead to health issues (CPHA, 1979). The maximum permissible limit of Fluoride as per IS 10500-2012 for drinking water is 1.5 mg/L. Excessive exposure to fluoride during tooth development, especially in childhood, can lead to a cosmetic issue known as dental fluorosis. This condition results in changes in tooth enamel color and, in more severe cases, pitting or mottling of the teeth. Prolonged exposure to very high levels of fluoride, usually through drinking water with concentrations well above recommended levels, can lead to skeletal fluorosis. This condition affects the bones and joints and can cause pain and limited mobility (Hussain et al., 2010).

6.4.8 Chloride (Cl^-)

Chloride (Cl^-) ion is a major inorganic anion found in water and wastewater, occurring naturally in all types of water. It is widely distributed in nature, mainly as the sodium (NaCl) and potassium (KCl) salts, and constitutes about 0.05% of the lithosphere (NRCC, 1977). The greatest amount of chloride found in the environment is in the oceans. The salty taste produced by chloride concentrations is variable and dependent on the chemical composition of water. The presence of chloride in river water can be attributed to various sources, such as the dissolution of salts in soil, discharge of effluents from chemical industries, sewage discharge, contamination from refuse leachates, and sea water intrusion in coastal areas. Each of these sources leads to local contamination of river water. Chloride concentration serves as an indicator of sewage pollution in fresh water regions, with the discharge of domestic sewage being the most significant source of chlorides in the waters.

Chloride is an essential element and the main extracellular anion in the body. It is a highly mobile ion involved in maintaining proper osmotic pressure, water balance, and acid–base balance. Small amounts of chlorides are required for normal cell functions in plant and animal life. Fish and aquatic communities cannot survive in high levels of chlorides. The World Health Organization (WHO), Bureau of Indian Standard, and other regulatory bodies provide guidelines for safe levels of chloride in drinking water, typically below 250 milligrams per liter (mg/L) (WHO, 1979).

High chloride concentrations in water can affect the aesthetic quality of the water, imparting a salty taste. While this doesn't pose a direct health risk, it can lead to consumer dissatisfaction with the water's taste and smell. Individuals with certain health conditions, such as hypertension (high blood pressure) or cardiovascular diseases, may

need to monitor their salt intake, including chloride. High chloride levels in water can contribute to increased sodium intake. Excessive chloride in water can have negative effects on aquatic ecosystems, particularly in freshwater environments, and can harm aquatic life, including fish and other organisms sensitive to changes in water quality (CNHW, 1983).

6.4.9 Boron (B)

Boron is a naturally occurring element found in the earth's crust and found in fruits, vegetables, and water sources. It binds to oxygen, forming borates, and is released into the environment through natural processes and human-made activities. Boron is essential for plant growth, but the required amount is relatively low. If boron exceeds a specific tolerance level, it may lead to injury. The range between boron deficiency and toxicity for many crops is narrow. To sustain an adequate supply of boron, at least 0.02 ppm of boron in irrigation water may be necessary, while boron levels should be lower than 0.3 ppm to avoid toxicity. Higher boron concentrations may require an evaluation of the intended crop's boron tolerance. Boron toxicity is not a widespread issue, but it can be a crucial parameter for assessing irrigation water quality. Plants grown in soils high in lime may tolerate higher boron levels than those grown in non-calcareous soils. Boron is weakly adsorbed by soils, meaning its root-zone concentration may not directly vary with the degree of boron concentration in irrigation water during plant growth. Symptoms of boron injury may include leaf 'burning,' chlorosis, and necrosis, although some boron-sensitive species may not exhibit obvious symptoms.

6.4.10 Ammonia (NH_3)

Ammonia is a commonly found pollutant in aquatic environments around the world (CEPA, 1999; Camargo & Alonso, 2006). Ammonia occurs naturally in water bodies, arising from the microbiological decomposition of nitrogenous compounds in organic matter. Fish and other aquatic organisms also excrete ammonia. Ammonia may also be discharged directly into water bodies by some industrial processes or as a component of domestic sewage or animal slurry. Ammonia can also arise in waters from the decay of discharged organic waste. Natural (unpolluted) waters contain relatively small amounts of ammonia, usually < 0.02mg/L as N. The presence of ammonia in freshwater has been associated with the acidification of rivers and lakes, eutrophication, and direct toxicity to aquatic organisms (CEPA, 1999; Camargo & Alonso, 2006; Baker et al., 1991). Ammonia exists in aqueous solutions in two forms, ionized (NH_4^+) and unionized (NH_3) and the unionized fraction is toxic to freshwater fish at very low concentration. The relative proportions of ionized and unionized ammonia in water depend on temperature and pH and to a lesser extent on salinity. The concentration of unionized ammonia becomes greater with increasing temperatures and pH and with decreasing salinity.

The toxicity of this compound on aquatic organisms will depend on the chemical form of ammonia, pH, and temperature. Furthermore, it will depend on the time of exposure (Francis-Floyd, 2009). This compound damages the gills, liver, kidney, spleen and other

organ tissues of fish, therefore causing breathing difficulties (Benli et al., 2008; Schram et al., 2010). This may lead to physiological alterations and, eventually, exhaustion or death (Schram et al., 2010). Ammonia can cause cell damage and can also affect the antioxidant defence system, thus altering the levels of oxidative stress in fish (EPA, 2013; Sinha et al., 2014). Ammonia can also alter fish behaviour. Fish exposure to sub-lethal concentrations of ammonia can reduce swimming activity (Wicks et al., 2002), foraging behaviour (Tudorache, 2008), and the ability to flee from predators (Tudorache, 2008; McKenzie, 2009).

6.4.11 Sodium Absorption Ratio (S.A.R.)

The sodium adsorption ratio (SAR) is a crucial parameter for managing soil quality in agriculture. It determines the suitability of irrigation water by analyzing the concentrations of different cations, including the primary alkaline and earth alkaline cations in the water. The SAR indicates the relative proportion of sodium to other cations in the water, which affects the soil structure's potential for degradation. If the soil contains excessive sodium, it can lead to sodicity, causing soil structure degradation and higher erosion rates. The SAR value is significant as it predicts the potential for sodium accumulation in the soil. Higher SAR values indicate a higher risk of soil problems due to sodium accumulation, such as decreased permeability and soil structure degradation. Sodic soils, resulting from excessive sodium, can also lead to poor water infiltration, drainage problems, and decreased crop yields (Laxmi et al., 2022).

6.4.12 Total Coliforms (TC) and Faecal Coliforms (FC)

Coliforms are one of the most useful indicator organisms which are easily detectable. Total Coliforms represent a group of 16 species of bacteria that are found in soil, vegetation, animal wastes and human sewage. Their presence gives an idea about the pollution level of the water bodies. Coliforms are called indicators because their presence give an indication of the possibility of presence of other microorganisms including harmful pathogens. Fecal coliforms represent a sub category of TC with 6 species including the harmful E. Coli bacteria. These are determined by the Most Probable Number (MPN) method. MPN method is a statistical, multi-step assay consisting of presumptive, confirmed and completed phases.

CHAPTER – 7

7.1 Results and Comparison with Hot Spots reported in 2022

7.1.1 pH

The pH value is expressed as the ratio of $[H^+]$ to $[OH^-]$ (hydroxide ion concentration). The Bureau of Indian Standards (BIS) recommends a desirable pH range of 6.5 to 8.5 for drinking water. This limit is also set by the Central Pollution Control Board (CPCB) for various water classes: Class A (drinking water source after disinfection), Class B (organized outdoor bathing), Class D (wildlife propagation), and Class E (fisheries and irrigation), all defined within the 6.5 to 8.5 range. Water samples from various monitoring stations across different rivers in India were analyzed for pH during the pre-monsoon, monsoon, and post-monsoon seasons, and the data were compared to the CPCB's recommended pH limits.

pH values across various monitored sites during the pre-monsoon, monsoon, and post-monsoon seasons show significant variability. This indicates diverse environmental conditions and potential anthropogenic influences. In 2023, the minimum pH value observed was 4.15 at Kharkhana, Myntdu River, Meghalaya, and the maximum pH value was 8.92 at Bhind, Kunwari River, Madhya Pradesh. Throughout the study period, 23 water quality stations at 20 rivers (Seetha, Hasdeo, Kalisindh, Kunwari, Musi, Sabarmati, Gomti, Seonath, Manimala, Mahi, Myntdu, Arkavathy, Kuttyadi, Pampa, Tungabhadra, Gundlakamma, Karuvannur, Sai, Som, Ponnaiyar) recorded pH levels that exceeded the acceptable limit.

During the pre-monsoon season, pH values ranged from 4.15 at Kharkhana (Myntdu River, Meghalaya) to 8.92 at Bhind (Kunwari River, Madhya Pradesh). This wide range reflects the diverse nature of rivers, with 20 sites exceeding the acceptable pH limit, either above or below the acceptable range of pH 6.5-8.50. In the monsoon season, pH levels ranged from 5.95 at Kharkhana (Myntdu River, Meghalaya) to 8.81 at Koggedoddi (Arkavathy River, Karnataka). Despite the narrower range compared to the pre-monsoon season, 14 sites still exceeded the acceptable pH limit. Similarly, during the post-monsoon season, pH values varied from 4.27 at Kharkhana (Myntdu River, Meghalaya) to 8.65 at Rangeli (Som River, Rajasthan). Although the range is slightly narrower than in other seasons, 11 sites still surpassed the acceptable pH limit.

Comparision between 2022 & 2023:

The comparison of pH hot spots between 2022 and 2023 reveals significant trends across the different seasons: Pre-Monsoon, Monsoon, and Post-Monsoon.

YEAR	Number of Hot-Spots found for pH		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	13	5	9
2023	20	14	11

During the pre-monsoon, in 2022, there were 13 hot spots identified for pH levels, which increased to 20 in 2023. This 53.8% rise indicates a concerning trend toward greater pH variability or imbalance before the monsoon season. During the monsoon season, the number of hot spots during the monsoon period rose from 5 in 2022 to 14 in 2023, representing a substantial increase of 180%. In the post-monsoon phase, hot spots increased from 9 in 2022 to 11 in 2023, which indicates a slight increase of 22.2%.

Ten (10)water quality stations, namely Bamnidhi, Bhind, Jaunpur, Jondhra, Khanpur, Kharkhana, Maighat, Rangeli, Vazhavachanur, and Villupuram, located along eight rivers (Hasdeo, Kunwari, Gomti, Seonath, Mahi, Myntdu, Som, Ponnaiyar), were identified as common hotspot stations during both 2022 and 2023.

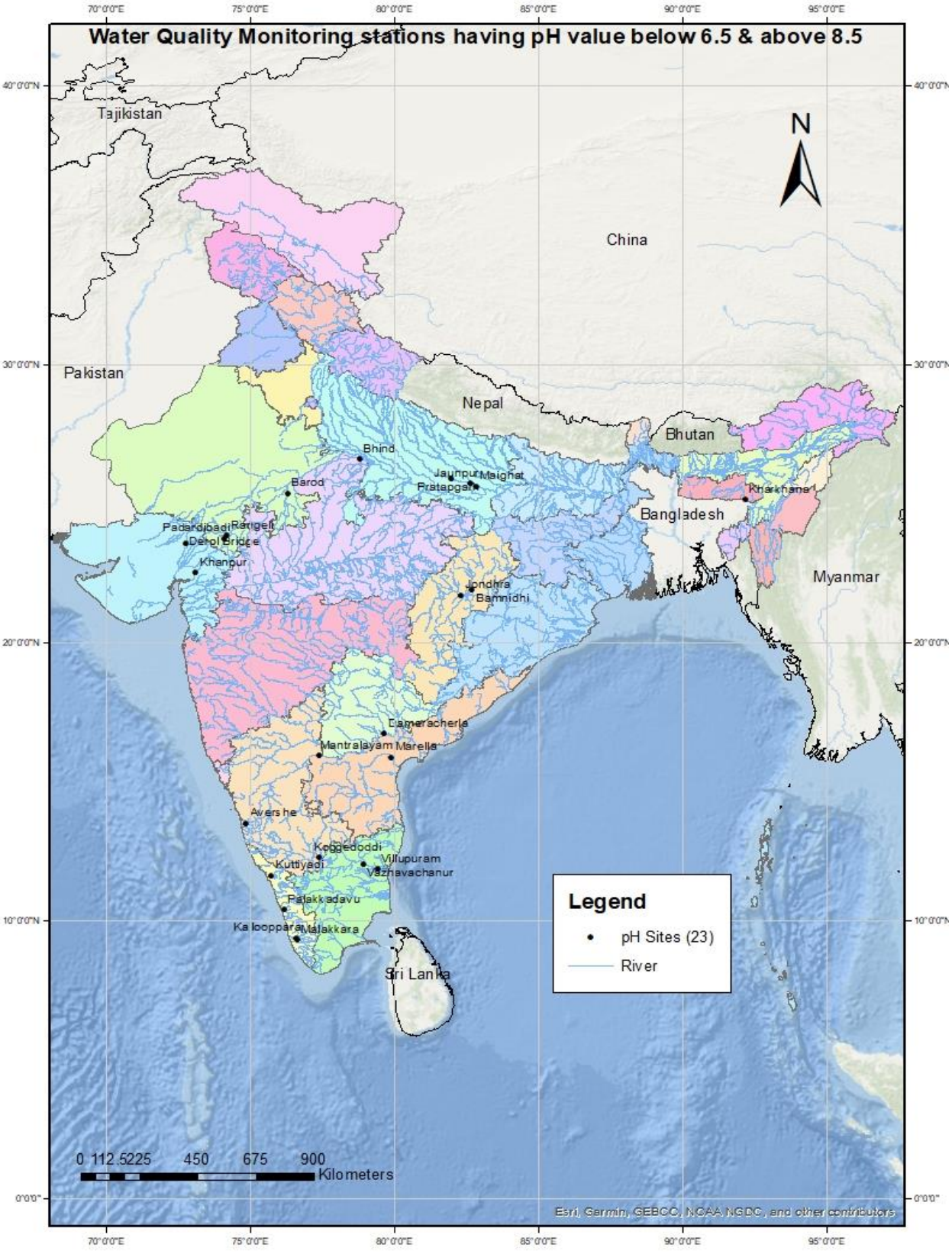
The hot spot study and GIS map for pH parameter are given below in Table 8 and figure 20.

Table 8: Monitoring stations having pH value above 8.5 & below 6.5 in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	Avershe	Seetha	SWR, Kochi	Karnataka	Udupi	-	6.38	6.43
2	Bamnidhi	Hasdeo	MD, Burla	Chhattisgarh	Janjgir-Champa	8.53	-	-
3	Barod	Kalisindh	CD, Jaipur	Rajasthan	Kota	8.60	8.52	8.62
4	Bhind	Kunwari	LYD, Agra	Madhya Pradesh	Bhind	8.92	-	-
5	Dameracherla	Musi	LKD, Hyderabad	Telangana	Nalgonda	8.53	8.54	8.50
6	Derol Bridge	Sabarmati	MD, Gandhinagar	Gujarat	Sabarkantha	8.74	8.57	-
7	Jaunpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	8.59	-	-
8	Jondhra	Seonath	MD, Burla	Chhattisgarh	Bilaspur	8.82	-	-
9	Kallooppara	Manimala	SWR, Kochi	Kerala	Pathanamthitta	6.44	6.42	6.28
10	Khanpur	Mahi	MD, Gandhinagar	Gujarat	Anand	8.79	8.56	8.53
11	Kharkhana	Myntdu	MID, Shillong	Meghalaya	West Jaintia Hills	4.15	5.95	4.27
12	Koggedoddi	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	8.76	8.81	8.61
13	Kuttiyadi	Kuttyadi	SWR, Kochi	Kerala	Kozhikode	6.46	6.45	-
14	Maighat	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	8.63	-	-
15	Malakkara	Pampa	SWR, Kochi	Kerala	Pathanamthitta	-	6.45	6.46
16	Mantralayam	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	8.65	8.57	-
17	Marella	Gundlakamma	LKD, Hyderabad	Andhra Pradesh	Prakasam	8.61	-	-
18	Padardibadi	Mahi	MD, Gandhinagar	Rajasthan	Dungarpur	8.60	8.66	-
19	Palakkadavu	Karuvannur	SWR, Kochi	Kerala	Thrissur	-	6.47	6.43
20	Pratapgarh	Sai	MGD-3, Varanasi	Uttar Pradesh	Pratapgarh	8.61	-	8.58
21	Rangeli	Som	MD, Gandhinagar	Rajasthan	Dungarpur	8.57	8.69	8.65
22	Vazhavachanur	Ponnaiyar	HD, Chennai	Tamil Nadu	Thiruvannamalai	8.59	-	-
23	Villupuram	Ponnaiyar	HD, Chennai	Tamil Nadu	Villupuram	8.62	-	-

(-) means No Hotspot.

Figure 20: Water Quality Monitoring stations having pH value below 6.5 & above 8.5 (2023)



7.1.2 Electrical Conductivity (EC)

Conductivity is a measure of water's ability to conduct an electrical flow, and it is directly related to the concentration of ions present in the water (Wetzel, 2001). The conductivity measurement is directly affected by the number of dissolved ions in the solution. These ions come from dissolved salts and inorganic materials like alkalis, chlorides, sulfides, and carbonate compounds. The more ions present in the water, the higher its conductivity (Langland & Cronin, 2003). Conversely, the fewer the ions in the water, the lower its conductivity.

Bureau of Indian Standards (BIS) has set a recommended drinking water standard for total dissolved solids (TDS) at 500 mg/l (equivalent to about 750 µS/cm at 25°C). This limit can be increased to a TDS of 2000 mg/l (about 3000 µS/cm at 25°C) if no alternative source is available. Additionally, the Central Pollution Control Board (CPCB) has specified a maximum of 2250 µS/cm at 25°C for class-E irrigation, industrial cooling, and controlled waste disposal.

During the pre-monsoon, monsoon, and post-monsoon seasons, six (06) water quality monitoring stations—B.P.M. (Bamni) on the Wardha river, Durvesh on the Vaitarna river, Elunuthi Mangalam on the Noyyal river, Lakshmanapatti on the Kodaganar river, Luwara on the Shetrunji river, and Thevur on the Sarabenga river—exceeded the conductivity limit of 2250 µS/cm. Only the Durvesh and Thevur water quality stations exceeded the acceptable limit in one season. Specifically, at the Durvesh station on the Vaitarna River, the conductivity during the pre-monsoon period was recorded at 4520 µS/cm, while during the monsoon and post-monsoon periods, the electrical conductivity was observed below 2250 µS/cm. At Thevur water quality station on the Sarabenga river, the electrical conductivity observed during the monsoon season was 2346 µS/cm, exceeding the acceptable limit.

Out of Six (06) water quality monitoring stations, water quality at four (04) stations namely- B.P.M. (Bamni) on the Wardha river, Elunuthi Mangalam on the Noyyal river, Lakshmanapatti on the Kodaganar river and Luwara on the Shetrunji river exceeded the acceptable electrical conductivity limit during all seasons. The Wardha River at the B.P.M. station showed a decrease in water quality from the pre-monsoon to the monsoon period, with a decrease in electrical conductivity from 3978 µS/cm to 3455 µS/cm. However, there was a subsequent increase in conductivity during the post-monsoon period to 4519 µS/cm, indicating a potential influx of pollutants or dissolved solids after the monsoon season. Noyyal River at the Elunuthi Mangalam station showed varying conductivity levels across different seasons.

During the pre-monsoon period, conductivity was moderate at 2574 µS/cm, but it increased significantly during the monsoon period to 3292 µS/cm before decreasing again to 2290 µS/cm in the post-monsoon period. The Kodaganar River at the Lakshmanapatti station exhibited relatively stable conductivity levels across seasons, with an increase during the monsoon period. During the pre-monsoon period, conductivity was recorded at 3647 µS/cm, which increased to 5288 µS/cm during the monsoon, and then decreased slightly to 4909 µS/cm in the post-monsoon period. The

Shetrunji River at the Luwara station showed a significant decrease in conductivity from the pre-monsoon to the monsoon period, followed by a slight decrease in the post-monsoon period. During the pre-monsoon period, conductivity was exceptionally high at 7897 µS/cm, but it decreased during the monsoon to 3976 µS/cm before further decreasing to 3420 µS/cm in the post-monsoon period.

Comparision between 2022 & 2023:

The comparison of hotspots at various monitoring stations along rivers during the years 2022 and 2023 reveals significant changes in river water quality. Specifically, the comparison of water quality hotspots at monitoring stations along the Wardha River in Maharashtra, the Noyyal River in Tamil Nadu, and the Shetrunji River in Gujarat during the years 2022 and 2023 shows significant variations in electrical conductivity. The Central Pollution Control Board (CPCB) has set the limit for class-E irrigation, industrial cooling, and controlled waste disposal at less than 2250 µS/cm at 25°C.

The comparison of electrical conductivity hot spots between 2022 and 2023 reveals significant trends across the different seasons: Pre-Monsoon, Monsoon, and Post-Monsoon.

YEAR	Number of Hot-Spots found for Electrical Conductivity		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	5	4	3
2023	5	5	4

In 2022, seven (07) water quality stations observed values above the acceptable limit: A.P. Puram (Chittar river), B.P.M. (Bamni) (Wardha river), Dhansa (Sahibi river), Elunuthi Mangalam (Noyyal river), Kopergaon (Godavari River), Luwara (Shetrunji river), and Varanavasi (Maruthaiyar river). In 2023, six (06) water quality monitoring stations - B.P.M. (Bamni) (Wardha river), Durvesh (Vaitarna river), Elunuthi Mangalam (Noyyal river), Lakshmanapatti (Kodaganar river), Luwara (Shetrunji river), and Thevur (Sarabenga river) - exceeded the conductivity of 2250 µS/cm during the pre-monsoon, monsoon, and post-monsoon seasons. To compare the hotspot water quality stations of 2022 and 2023, three water quality stations - B.P.M. (Bamni) (Wardha River), Elunuthi Mangalam (Noyyal River), and Luwara (Shetrunji River) - were identified as common hotspot stations during both years.

The hot spot study and GIS map for EC parameter are given below in Table 9 and figure 21.

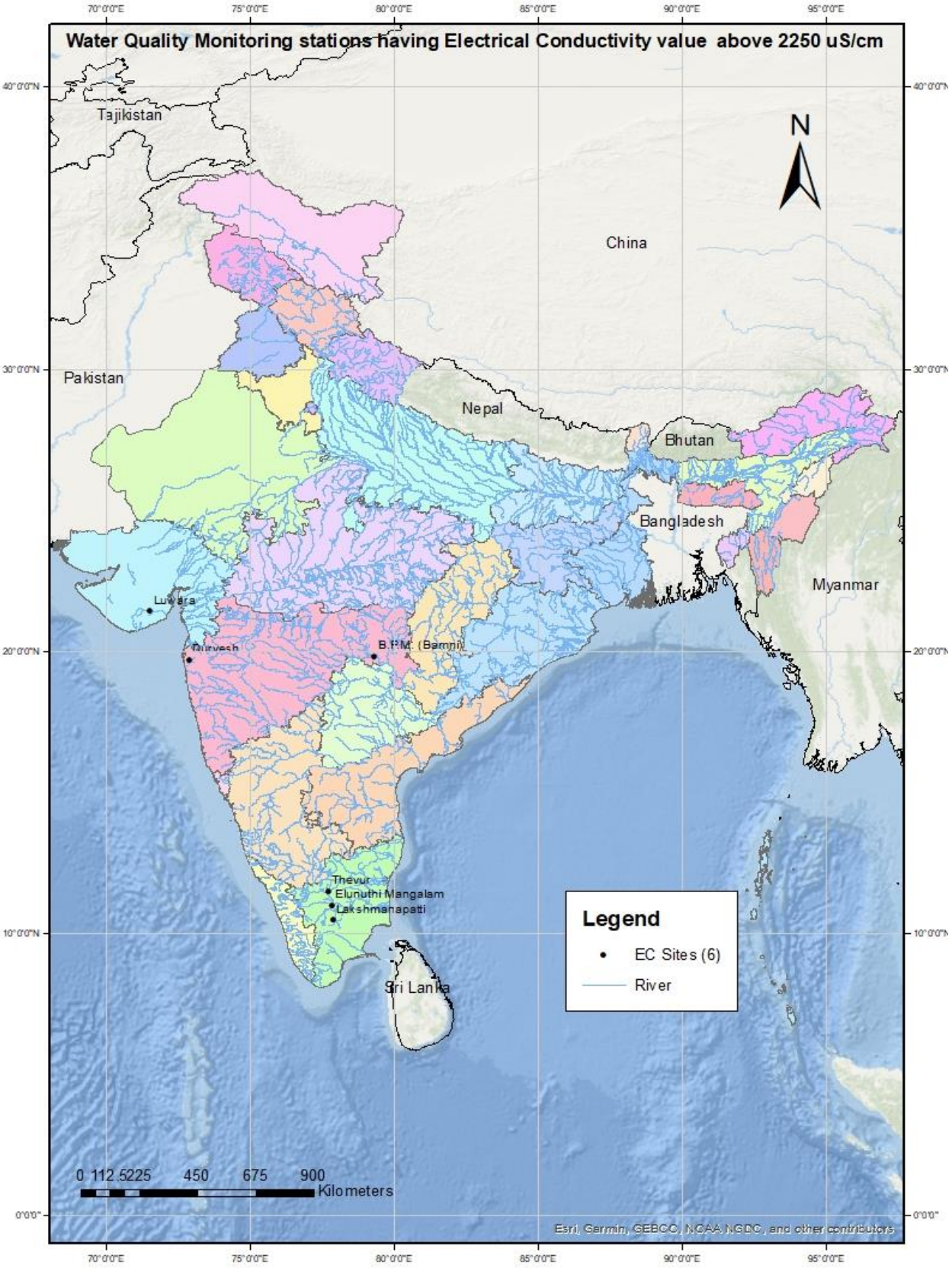
Table 9: Monitoring stations having Electrical Conductivity (EC) >2250 µS/cm in River Water 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	3978	3455	4519
2	Durvesh	Vaitarna	TD, Surat	Maharashtra	Palghar	4520	-	*
3	Elunuthi Mangalam	Noyyal	SRD, Coimbatore	Tamil Nadu	Erode	2574	3292	2290
4	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	3647	5288	4909
5	Luwara	Shetrunji	MD Gandhinagar	Gujarat	Bhavnagar	7897	3976	3420
6	Thevur	Sarabenga	SRD, Coimbatore	Tamil Nadu	Salem	-	2346	-

(-) means No Hotspot ;

(*) means Data not available/ river dry.

Figure 21: Water Quality Monitoring stations having electrical Conductivity value greater than 2250 µmhos/cm (2023)



7.1.3 Ammonia as N (NH_3-N)

The primary agricultural sources include leaching of ammonia-rich fertilizer and transport to surface water and livestock waste. The limit prescribed by CPCB for Ammonia (as N) in class-D: Propagation of Wild life and Fisheries is 1.2 mg/l or less.

Ammonia levels as N during the pre-monsoon, monsoon, and post-monsoon seasons show significant variability across the monitored sites. In 2023, the lowest recorded ammonia level as N among hotspots was 1.28 mg/L (Gatora-2, Arpa River, Chattisgarh), while the highest recorded level was 33.53 mg/L (KT(Satrapur), Kanhan River, Maharashtra). Throughout the study period, 42 water quality stations at 20 rivers (Agra Canal, Arpa, Bearma, Bhima, Brahmani, Dhadar, Hindon, Hindon Cut, Kanhan, Kharkai, Kodaganar, Koel, Mula-Mutha, Ponnaiyar, Sabarmati, Sahibi, Sina, Wardha, Watrak, and Yamuna) exceeded the acceptable limit of ammonia as N.

During the pre-monsoon season, the levels of ammonia as N range from 1.51 mg/L at Gatora-2 (Arpa River, Chattisgarh) to 24.47 mg/L at Singasadanapalli (Ponnaiyar River, Tamil Nadu). This wide range reflects the diverse nature of rivers, with 33 sites exceeding the acceptable limit. In the monsoon season, the levels of ammonia as N range from 1.28 mg/L at Gatora-2 (Arpa River, Chattisgarh) to 24.81 mg/L at Singasadanapalli (Ponnaiyar River, Tamil Nadu). Despite the narrower range compared to the pre-monsoon season, 32 sites still exceed the acceptable limit. Similarly, during the post-monsoon season, the levels of ammonia as N range from 1.40 mg/L at RSP (Brahmani River, Odisha) to 33.53 mg/L at KT(Satrapur) (Kanhan River, Maharashtra), with 21 sites exceeding the acceptable limit.

Comparision between 2022 & 2023:

In both 2022 and 2023, concerning water quality, alarming trends of ammonia were observed across various rivers. In 2022, 28 water quality monitoring stations along 11 rivers, such as Brahmani, Hindon, Hindon Cut, Kanhan, Kharkhai, Mula Mutha, Ponnaiyar, Sabari, Sabarmati, Wardha, and Yamuna, exceed the established threshold for Ammonia concentration at 1.2 mg/L.The following year, in 2023, the issue persisted and intensified, with 42 water quality monitoring stations along 20 rivers, such as Agra Canal, Arpa, Bearma, Bhima, Brahmani, Dhadhar, Hindon, Hindon Cut, Kanhan, Kharkai, Kodaganar, Koel, Mula-Mutha, Ponnaiyar, Sabarmati, Sahibi, Sina, Wardha, Watrak and Yamuna, exceeding the established threshold for Ammonia concentration at 1.2 mg/L.

The comparison of ammonia hot spots between 2022 and 2023 reveals significant trends across the different seasons: Pre-Monsoon, Monsoon, and Post-Monsoon.

YEAR	Number of Hot-Spots found for Ammonia-N		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	23	26	25
2023	33	32	21

25 water quality monitoring stations were identified as common hotspots in the years 2022 and 2023. These monitoring stations are located on 10 rivers, namely Brahmani, Hindon, Hindon Cut, Kanhan, Kharkai, Ponnaiyar, Sabarmati, Sahibi, Wardha, and Yamuna. They consistently showed elevated ammonia levels beyond the acceptable limit of 1.2 mg/L. The primary contributors to this issue were identified as industrial discharges, agricultural runoff, and urban wastewater. Untreated or inadequately treated effluents released from industrial activities, along with urban areas contributing to increased ammonia levels, were found to be significant factors impacting the water quality of these rivers.

The hot spot study and GIS map for ammonia (NH_3-N) parameter are given below in Table 10 and figure 22.

Table 10: Monitoring stations having Ammonia as N (NH_3-N) > 1.2 mg/l in River Water in 2023

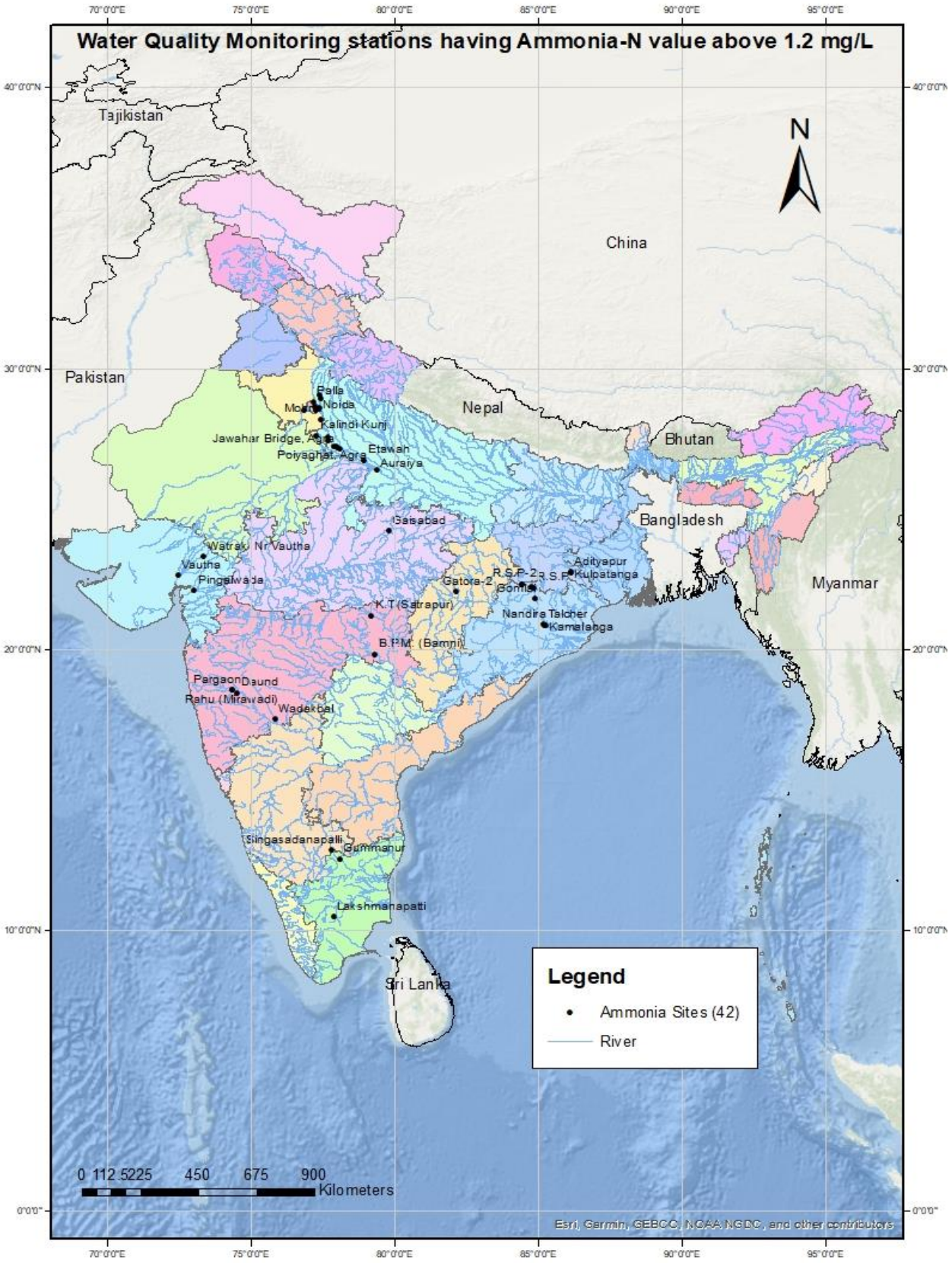
S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	Adityapur	Kharkai	ERD, Bhubaneswar	Jharkhand	Saraikela Kharsawan	-	1.40	-
2	Auraiya	Yamuna	LYD, Agra	Uttar Pradesh	Auraiya	1.69	-	-
3	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	3.56	2.34	7.73
4	Baleni	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	2.92	1.63	3.70
5	Chilla Gaon	Hindon Cut	UYD, New Delhi	Delhi	East Delhi	12.37	3.19	5.05
6	Daund	Bhima	UKD, Pune	Maharashtra	Pune	*	1.81	*
7	Delhi Railway Bridge	Yamuna	UYD, New Delhi	Delhi	North Delhi	18.44	7.16	10.20
8	Dhansa	Sahibi	UYD, New Delhi	Delhi	South West Delhi	*	3.72	*
9	Etawah	Yamuna	LYD, Agra	Uttar Pradesh	Etawah	10.02	-	3.98
10	Gaisabad	Bearma	LYD, Agra	Madhya Pradesh	Damoh	2.09	-	-
11	Galeta	Hindon	UYD, New Delhi	Uttar Pradesh	Meerut	12.35	5.03	4.13
12	Gatora-2	Arpa	MD, Burla	Chhattisgarh	Bilaspur	1.51	1.28	-
13	Gokul Barrage II Mathura D/S	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	10.84	4.51	10.48
14	Gomlai	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	3.69	-	-
15	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	5.60	3.63	3.75
16	Jawahar Bridge, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	15.26	4.74	10.15
17	K.T.(Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	2.33	3.37	33.53
18	Kailash Mandir, Near Benpur Village	Yamuna	LYD, Agra	Uttar Pradesh	Agra	15.49	5.09	11.87
19	Kalindi Kunj	Agra Canal	UYD, New Delhi	Delhi	East Delhi	10.55	3.25	6.75
20	Kamalanga	Brahmani	ERD, Bhubaneswar	Odisha	Angul	2.18	-	-
21	Kulpatanga	Kharkai	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	1.63	-
22	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	-	1.48	-
23	Mohna	Yamuna	UYD, New Delhi	Haryana	Faridabad	19.19	6.44	8.33
24	Nandira	Brahmani	ERD, Bhubaneswar	Odisha	Angul	2.39	-	-
25	Noida	Yamuna	UYD, New Delhi	Uttar Pradesh	Gautam Budh Nagar	21.28	9.17	10.20
26	Okhla Barrage	Yamuna	UYD, New Delhi	Delhi	South Delhi	13.40	4.47	6.36
27	Palla	Yamuna	UYD, New Delhi	Delhi	North West Delhi	2.17	-	-
28	Panposh-2	Koel	ERD, Bhubaneswar	Odisha	Sundergarh	-	5.84	-
29	Pargaon	Bhima	UKD, Pune	Maharashtra	Pune	*	2.91	*
30	Pingalwada	Dhadhar	TD, Surat	Gujarat	Vadodara	4.06	-	*
31	Poiyaghat, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	14.98	4.65	10.73

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
32	R.S. P	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	17.02	14.62	1.40
33	R.S.P-1	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	10.92	9.52	-
34	R.S.P-2	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	2.79	3.58	-
35	Rahu (Mirawadi)	Mula-Mutha	UKD, Pune	Maharashtra	Pune	*	3.37	*
36	Singasadanapalli	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	24.47	24.81	25.67
37	Talcher	Brahmani	ERD, Bhubaneswar	Odisha	Angual	2.72	-	-
38	Vautha	Sabarmati	MD, Gandhinagar	Gujarat	Ahmedabad	3.27	4.23	5.12
39	Vrindawan Bridge (Mathura U/S)	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	15.49	4.69	11.46
40	Wadakbal	Sina	UKD, Pune	Maharashtra	Solapur	*	3.85	*
41	Watrak Nr Vautha	Watrak	MD, Gandhinagar	Gujarat	Kheda	4.35	-	-
42	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	LYD, Agra	Uttar Pradesh	Agra	17.51	5.21	11.03

(-) means No Hotspot

(*) means Data not available/ river dry.

Figure 22: Water Quality monitoring stations having ammonia as N value above 1.2 mg/L (2023)



7.1.4 Fluoride (F^-)

BIS has recommended 1.0 mg/l of F as desirable concentration of fluoride in drinking water, which can be extended to 1.5 mg/l of fluoride in case no alternative source of water is available. During the pre-moonsson, monsoon and post monsoon seasons, the fluoride concentrations observed at the six (06) water quality monitoring stations exceeded the acceptable limit.

Lingdem Hot Spring (Talang Chu River) has a significant variation in fluoride concentration from pre-monsoon (7.57 mg/L) to monsoon (6.31 mg/L) to post-monsoon (7.30 mg/L). Only station with data available during the monsoon season is Lingdem Hot Spring, which recorded fluoride concentrations of 6.31 mg/L. During the post-monsoon season, two (02) water quality stations, Lakshmanapatti and Lingdem Hot Spring, showed fluoride concentrations of 1.60 mg/L and 7.30 mg/L, respectively. During the pre-monsoon season, five (05) water quality stations—Kamalapuram (1.80 mg/L), Lingdem Hot Spring (7.57 mg/L), R.S.P (1.67 mg/L), R.S.P-1 (1.86 mg/L) and Tadipatri (1.72 mg/L)—exceeded the acceptable fluoride concentration.

Comparision between 2022 & 2023:

In the years 2022 and 2023, an investigation into fluoride concentrations at various water quality monitoring stations revealed notable findings. During 2022, seven (07) monitoring stations namely Avarankuppam (Palar), Kamalapuram (Papagani), Lingdem (HS) (Talangchu), R.S.P (Brahmani), R.S.P-1 (Brahmani), Singavaram (Chitravathi) and Thoppur (Thoppaiyar) surpassed the acceptable limits for fluoride concentrations. Similarly, in 2023, six (06) stations, specifically Kamalapuram (Papagani), Lakshmanapatti (Kodaganar), Lingdem (HS) (Talangchu), R.S.P (Brahmani), R.S.P-1 (Brahmani) and Tadipatri (Pennar) recorded fluoride levels above the permissible thresholds.

The comparison of fluoride hot spots between 2022 and 2023 reveals significant trends across the different seasons: Pre-Monsoon, Monsoon and Post-Monsoon.

YEAR	Number of Hot-Spots Found for fluoride		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	3	4	5
2023	5	1	2

In both 2022 and 2023, four water quality monitoring stations were consistently identified: Kamalapuram in Andhra Pradesh, Lingdem (HS) in Sikkim, and R.S.P & R.S.P-1 in Odisha. The presence of fluoride in these locations, especially at Papagani, Talangchu (hot spring) and the Brahmani River, is likely due to the weathering and leaching of fluoride-bearing minerals from rocks.

The hot spot study and GIS map for F^- parameter are given below in Table 11 and figure 23.

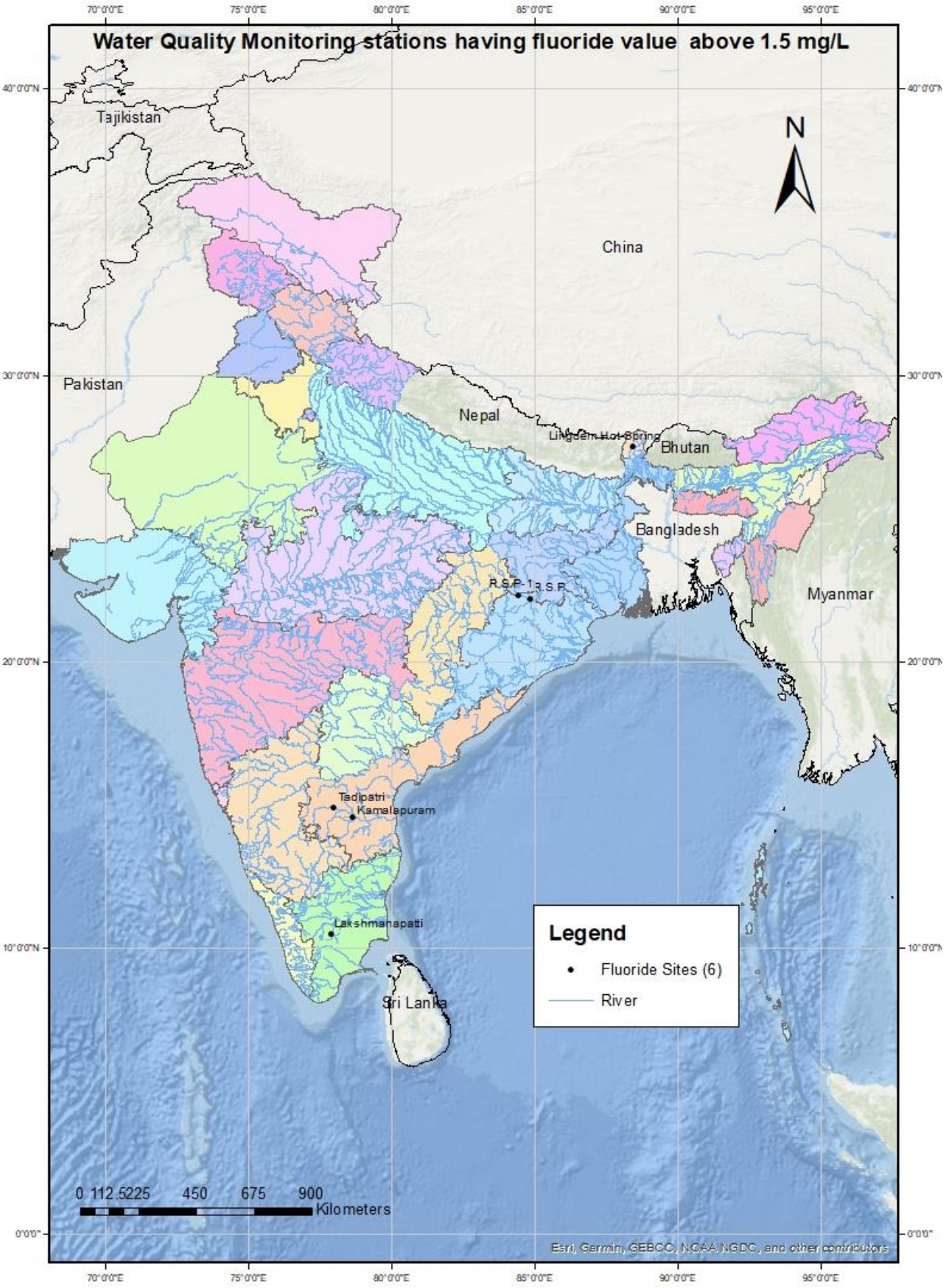
Table 11: Monitoring stations having Fluoride (F^-) concentration above 1.5 mg/l in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	Kamalapuram	Papagani	H D, Chennai	Andhra Pradesh	Kadapa	1.80	-	*
2	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	-	-	1.60
3	Lingdem Hot Spring	Talang Chu	SID, Gangtok	Sikkim	Mangan	7.57	6.31	7.30
4	R.S. P	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	1.67	-	-
5	R.S.P-1	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	1.86	-	-
6	Tadipatri	Pennar	HD, Chennai	Andhra Pradesh	Anantapur	1.72	-	*

(-) means No Hotspot

(*) means Data not available/ river dry.

Figure 23: Water Quality Monitoring stations having fluoride value above 1.5 mg/L (2023)



7.1.5 Total Hardness

The acceptable limit according to Indian Standard Drinking Water-Specification, IS 10500: 2012 is 200 mg/l and the permissible limit in the absence of alternate source is 600 mg/l. The water quality at three (03) stations, B.P.M. (Bamni) on the Wardha River, Lakshmanapatti on Kodaganar River, and Luwara on Shetrunji River, exceeded the acceptable hardness limit during the pre-monsoon, monsoon, and post-monsoon seasons. The minimum hardness value of 629 mg/L was recorded during the post-monsoon season at B.P.M. (Bamni) on the Wardha River, while the maximum value of 1046 mg/L was recorded during the pre-monsoon season at Luwara on Shetrunji River. The persistent exceedance of acceptable hardness levels, due to the presence of minerals like calcium and magnesium in the water, can have adverse effects on various industrial, agricultural, and domestic activities.

Comparision between 2022 & 2023:

In 2022 and 2023, an investigation into total hardness concentrations at various water quality monitoring stations revealed significant findings. In 2022, three (03) water quality monitoring stations, namely B.P.M. (Bamni) on Wardha, Maharashtra; Kopergaon on Godavari, Maharashtra, and Luwara on Shetrunji, Gujarat, showed total hardness values above the permissible limit of BIS 10500:2012 for the pre-monsoon, monsoon, and post-monsoon seasons. Similarly, in 2023, three (03) stations, specifically B.P.M. (Bamni) on the Wardha river, Lakshmanapatti on the Kodaganar river, and Luwara on the Shetrunji river, recorded total hardness levels above the permissible thresholds.

The data presented summarizes the number of hot-spots identified for total hardness across different seasons for the years 2022 and 2023. The results are detailed in the table below:

YEAR	Number of Hot-Spots found for Total Hardness		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	2	1	0
2023	3	1	2

In 2022, there were 2 hotspots for total hardness during the pre-monsoon season. In 2023, this number increased to 3. Throughout the monsoon season, one hotspot was consistently recorded in both 2022 and 2023. Notably, there were no identified hotspots during the post-monsoon season in 2022, but this increased to two in 2023. Two water quality monitoring stations were commonly identified in both 2022 and 2023: B.P.M. (Bamni) (Wardha river) in Maharashtra and Luwara (Shetrunji river) in Gujarat.

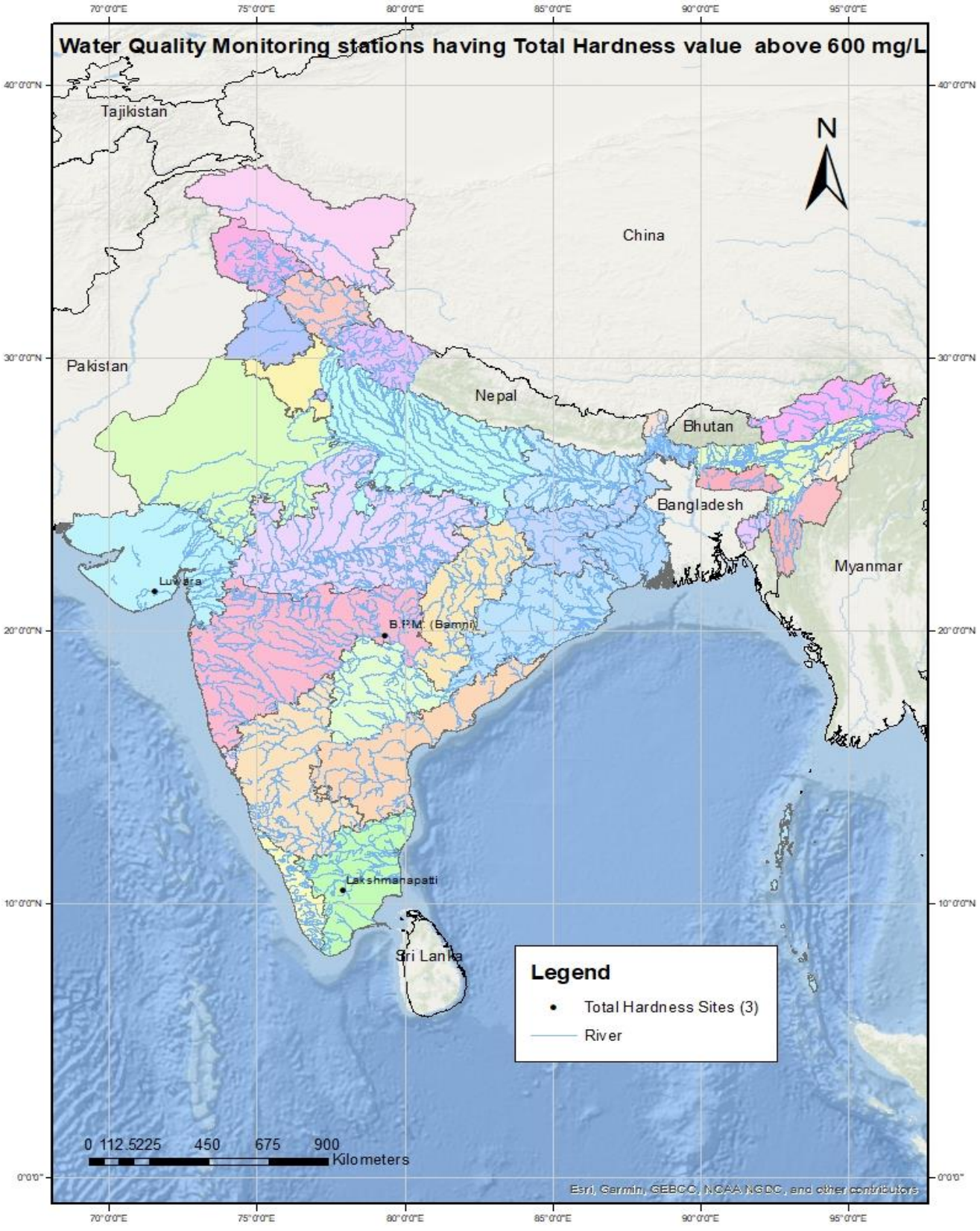
The hot spot study and GIS map for total hardness (TH) parameter are given below in Table 12 and figure 24.

Table 12: Monitoring stations having Total hardness (TH) concentration above 600 mg/l in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	675	-	629
2	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	717	961	910
3	Luwara	Shetrunji	MD, Gandhinagar	Gujarat	Bhavnagar	1046	-	-

(-) means No Hotspot.

Figure 24: Water Quality Monitoring stations having total hardness value above 600 mg/L (2023)



7.1.6 Chloride (Cl^-)

Chloride is a major inorganic anion found in water and wastewater. It occurs naturally in all types of water and the salty taste it produces varies depending on the water's chemical composition. According to the Indian Standard Drinking Water-Specification, IS 10500: 2012, the acceptable limit for chloride is 250 mg/l, and the permissible limit in the absence of an alternate source is 1000 mg/l. Some waters containing 250 mg Cl^-/L may have a detectable salty taste, especially if the cation is sodium. Conversely, water containing as much as 1000 mg/l may not have a typical salty taste if another element is predominant.

In 2023, three (03) water quality stations - Durvesh (Vaitarna river), Lakshmanapatti (Kodaganar river), and Luwara (Shetrunji river) - exceeded the permissible limit of 1000 mg/L for chloride. The Durvesh station, located along the Vaitarna river in Maharashtra, consistently showed high chloride levels with an average concentration of 1374 mg/L during the pre-monsoon season. However, during the monsoon and post-monsoon periods, chloride concentration remained within the permissible limit. The Lakshmanapatti station on the Kodaganar River in Tamil Nadu exhibited varying chloride concentrations across the monsoon and post-monsoon seasons. Chloride levels were recorded at 1368 mg/L during the monsoon season, slightly increasing to 1429 mg/L in the post-monsoon period. These fluctuations may be attributed to changes in precipitation patterns, water flow dynamics, and anthropogenic activities influencing chloride inputs into the river. At the Luwara station along the Shetrunji river in Gujarat, the highest chloride concentrations were observed across the pre-monsoon and monsoon seasons. Particularly alarming was the exceptionally high average concentration of 2306 mg/L during the pre-monsoon period, indicating severe contamination levels. However, the data indicated a significant decrease in water quality from 2306 mg/L during the pre-monsoon season to 1397 mg/L during the monsoon season, which may be attributed to a dilution effect.

Comparision between 2022 & 2023:

The comparison of chloride hot spots between 2022 and 2023 reveals significant trends across the different seasons: Pre-Monsoon, Monsoon, and Post-Monsoon.

YEAR	Number of Hot-Spots found for Chloride		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	1	0	1
2023	2	2	1

During the 2022, only one water quality monitoring station, Luwara, exceeded the acceptable limit. In 2023, three stations – Durvesh (Vaitarna river), Lakshmanapatti (Kodaganar river), and Luwara (Shetrunji river) – exceeded the permissible limit of 1000 mg/L for chloride. Luwara (Shetrunji river) in Gujarat was the only station identified as a hotspot in both 2022 and 2023. High chloride levels often indicate the presence of industrial effluents, agricultural runoff, or urban waste, which pose risks to aquatic ecosystems and public health.

The hot spot study and GIS map for chloride (Cl^-) are given below in Table 13 and figure 25.

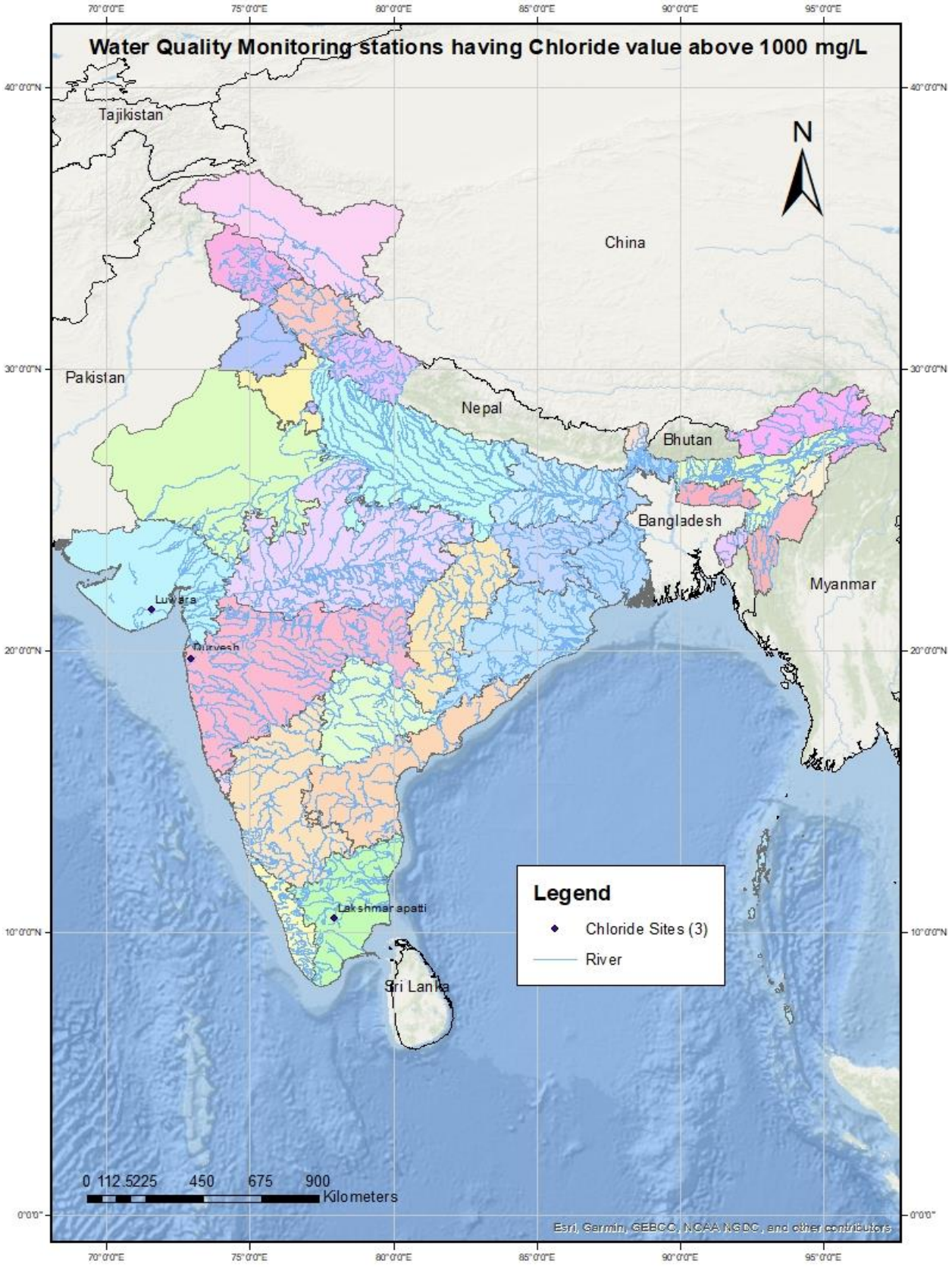
Table 13: Monitoring stations having Chloride (Cl^-) > 1000 mg/l in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	Durvesh	Vaitarna	TD, Surat	Maharashtra	Palghar	1374.24	-	*
2	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	955.66	1368.25	1429.17
3	Luwara	Shetrunji	MD, Gandhinagar	Gujarat	Bhavnagar	2305.56	1396.76	864.75

(-) means No Hotspot

(*) means Data not available/ river dry.

Figure 25: Water Quality Monitoring stations having chloride value above 1000 mg/L (2023)



7.1.7 Boron (B)

Boron is a chemical element that is found in the earth's crust and is crucial for various natural and industrial processes. It is naturally present in fruits, vegetables, and water sources, often forming compounds known as borates. These compounds, including borax and boric acid, are widely used in the manufacturing of glass, ceramics, soaps, detergents, cosmetics, medications, and pesticides. Boron is typically a minor component of river water. It is considered an essential micronutrient for plants and also shows indications of being vital for animals and humans. Boron enters the environment through natural processes such as weathering of soils and rocks, as well as human activities like glass manufacturing and coal-burning power plants.

The Central Pollution Control Board (CPCB) sets a limit of 2 mg/l for boron in specific classes, including irrigation and industrial cooling. The limit prescribed by CPCB for Boron (B) in class-E: Irrigation, Industrial Cooling, Controlled Waste disposals is not greater than 2 mg/l. Monitoring stations during pre-monsoon, monsoon and post-monsoon seasons consistently report average boron values within the permissible limit, highlighting efforts to manage and control boron levels in various water sources.

7.1.8 Nitrate as N (NO_3^--N)

Nitrate as N concentration showed significant variation across different seasons at the monitored sites. In 2023, the lowest nitrate concentration (among hotspots values) of 10.30 mg/L was observed at the Jamtara WQ station on River Ajoy, while the highest concentration of 23.04 mg/L was recorded at the Hanskhali WQ station on River Churni/Bhagirathi. A total of 42 water quality stations at 27 rivers exceeded the nitrate concentration in 2023. These rivers included Ajoy, Arkavathy, Badanadi, Bhagirathi, Bhima, Brahmani, Churni/Bhagirathi, Edduvagu, Feeder Canal, Ganga, Garga, Gomti, Hoogly/Bhagirathi, Jalangi/Bhagirathi, Kharkai, Krishna, Mathabhanga/Bhagirathi, Munneru, Musi, Ponnaiyar, Purna, Ramganga, Rushikulya, Sarada, Subarnarekha, Sukheta, and Wyra.

During the pre-monsoon season, only one (01) WQ station, Gummanur on the Ponnaiyar river, recorded an average nitrate concentration exceeding 10.16 mg/L (45 mg/L as NO_3^-). This concentration increased from the pre-monsoon to the monsoon and post-monsoon seasons, ranging from 10.79 to 11.32 mg/L at Gummanur. In the monsoon season, 35 WQ stations on 20 rivers recorded average nitrate concentrations exceeding 10.16 mg/L (45 mg/L as NO_3^-). Similarly, in the post-monsoon season, 18 WQ stations on 14 rivers recorded average nitrate concentrations exceeding 10.16 mg/L (45 mg/L as NO_3^-).

Comparision between 2022 & 2023:

In 2022, 93 water quality monitoring stations were identified as hotspots during the pre-monsoon, monsoon and post-monsoon periods. In 2023, 42 water quality stations were observed as hotspots. The comparison of nitrate-nitrogen (N) hot-spots between 2022 and 2023 highlights significant trends across different seasons, summarized in the table below:

YEAR	Number of Hot-Spots found for Nitrate-N		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	25	79	17
2023	1	35	18

The comparison of the number of hotspots in all seasons between 2022 and 2023 indicates an improving trend in water quality. Seventeen (17) water quality stations, namely Adityapur, Anakapali, Bonaigarh, Domuhani, Ghatshila, Gomti Nagar (Lko D/S), Gummanur, Jamshedpur, Lupungdih, Madhabarida, Munugodu, R.S.P, R.S.P-1, Sorada, Tihar Khera, Tondarpur, and Veligonda, are located along twelve (12) rivers (Kharkai, Sarada, Brahmani, Subarnarekha, Gomti, Ponnaiyar, Badanadi, Edduvagu, Rushikulya, Ramganga, Sukheta, Musi) and were identified as common hotspot stations between 2022 and 2023.

The hot spot study and GIS map for nitrate as N (NO_3^-N) are given below in Table 14 and figure 26.

Table 14: Monitoring stations having Nitrate as N (NO_3^--N) > 10.16 mg/l (45mg/l as Nitrate) in River Water in 2023

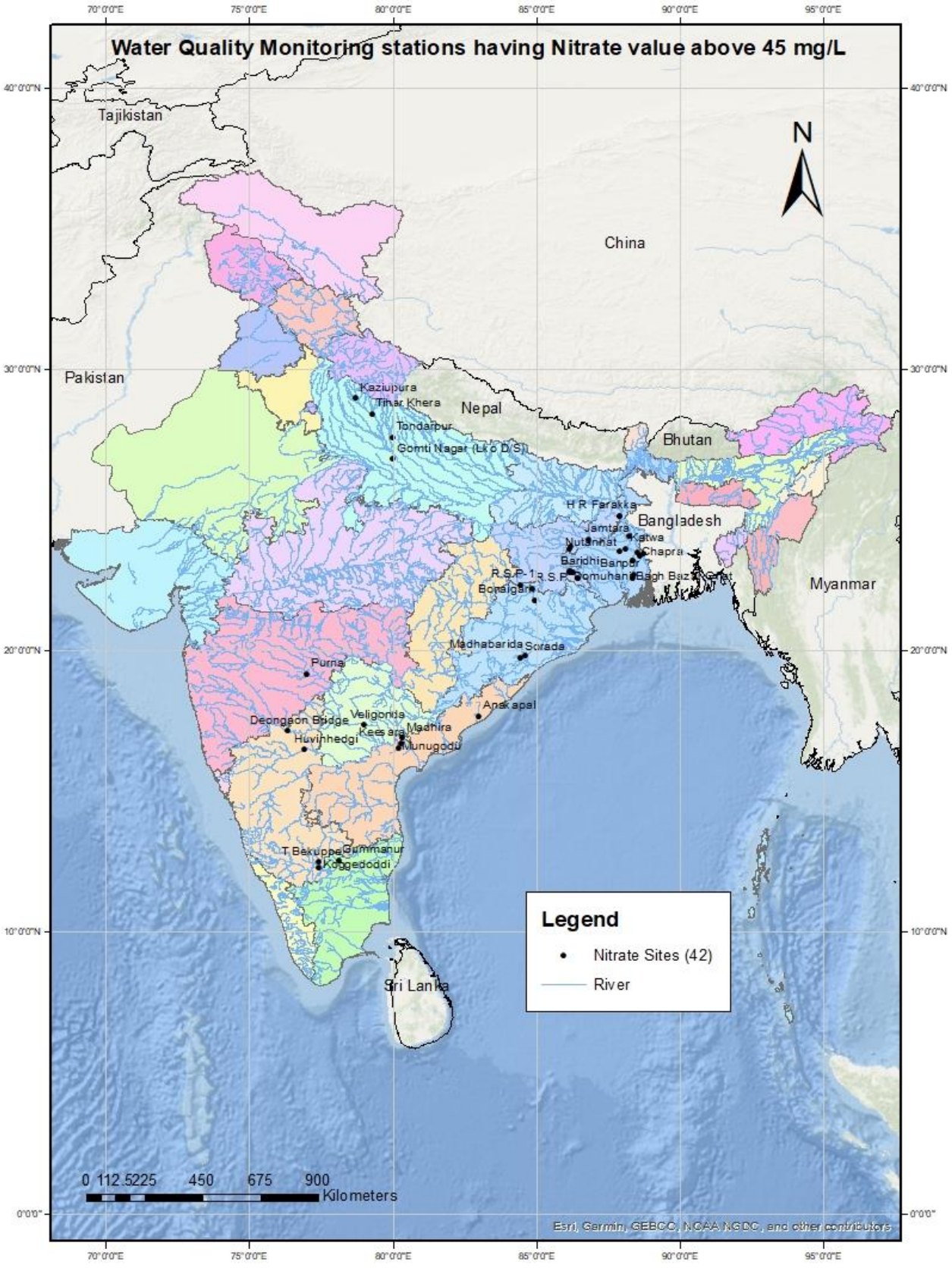
S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	Adityapur	Kharkai	ERD, Bhubaneswar	Jharkhand	Saraikela Kharsawan	-	12.81	-
2	Anakapali	Sarada	ERD, Bhubaneswar	Andhra Pradesh	Visakhapatnam	-	11.32	-
3	Bagh Bazar Ghat	Hoogly/ Bhagirathi	LGD-3, Berhampore	West Bengal	Kolkata	*	12.53	13.03
4	Banpur	Mathabhanga/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	*	18.87	-
5	Baridhi	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	10.49	-
6	Berhampore	Bhagirathi	LGD-3, Berhampore	West Bengal	Murshidabad	*	13.60	-
7	Bokaro Down	Garga	DD, Asansol	Jharkhand	Bokaro	*	15.10	-
8	Bokaro Up	Garga	DD, Asansol	Jharkhand	Bokaro	*	14.25	-
9	Bonaigarh	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	-	22.19	-
10	Chapra	Jalangi/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	*	15.41	17.44
11	Deongaon Bridge	Bhima	LKD, Hyderabad	Karnataka	Bijapur	-	12.54	*
12	Domuhani	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	12.27	-
13	Farakka Cs 97 A	Ganga	LGD-3, Berhampore	West Bengal	Murshidabad	*	12.57	-
14	GH.Rd. Bridge	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	12.79	-
15	Ghatshila	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	10.36	-
16	Gomti Nagar (Lko D/S)	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	-	11.90	-
17	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	10.79	11.14	11.32
18	H R Farakka	Feeder Canal	LGD-3, Berhampore	West Bengal	Murshidabad	*	12.99	-
19	Hanskhali	Churni/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	*	18.25	23.04
20	Huvinhedgi	Krishna	LKD, Hyderabad	Karnataka	Raichur	-	-	10.89
21	Jamshedpur	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	-	10.43	-
22	Jamtara	Ajoy	DD, Asansol	Jharkhand	Jamtara	*	10.30	-
23	Kalna Ebb	Bhagirathi	LGD-3, Berhampore	West Bengal	Burdwan	*	11.12	13.15
24	Kalna Flow	Bhagirathi	LGD-3, Berhampore	West Bengal	Burdwan	*	11.33	16.78
25	Katwa	Bhagirathi	LGD-3, Berhampore	West Bengal	Burdwan	*	13.31	15.41
26	Kaziupura	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Moradabad	-	10.73	10.18
27	Keesara	Munneru	LKD, Hyderabad	Andhra Pradesh	Krishna	-	-	10.53
28	Koggedoddi	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	-	-	13.46
29	Lupungdih	Subarnarekha	ERD, Bhubaneswar	Jharkhand	Saraikela Kharsawan	-	10.88	-
30	Madhabarida	Badanadi	ERD, Bhubaneswar	Odisha	Ganjam	-	11.14	-

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
31	Madhira	Wyra	LKD, Hyderabad	Telangana	Khammam	-	-	10.26
32	Munugodu	Edduvagu	LKD, Hyderabad	Andhra Pradesh	Guntur	-	13.15	12.20
33	Nutanhat	Ajoy	DD, Asansol	West Bengal	Burdwan	*	11.61	-
34	Panihati Ferry Ghat	Hoogly/ Bhagirathi	LGD-3, Berhampore	West Bengal	North 24 Parganas	*	13.15	12.58
35	Purna	Purna	UGD, Hyderabad	Maharashtra	Parbhani	*	-	10.70
36	R.S. P	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	-	12.21	-
37	R.S.P-1	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	-	10.39	-
38	Sorada	Rushikulya	ERD, Bhubaneswar	Odisha	Ganjam	-	11.67	-
39	T Bekuppe	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	-	-	15.14
40	Tihar Khera	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bareilly	-	10.59	-
41	Tondarpur	Sukheta	MGD-2, Lucknow	Uttar Pradesh	Hardoi	-	-	12.98
42	Veligonda	Musi	LKD, Hyderabad	Telangana	Nalgonda	-	17.43	20.26

(-) means No Hotspot

(*) means Data not available/ river dry.

Figure 26: Water Quality Monitoring stations having nitrate value above 45 mg/L (10.16 mg/L as Nitrate-N) (2023)



7.1.9 Dissolved Oxygen (DO)

Dissolved oxygen (DO) is a critical factor in maintaining the health of aquatic ecosystems, serving as a primary indicator when assessing the suitability of river water to support aquatic life. CPCB has recommended 5.0 mg/l or more concentration of dissolved oxygen for outdoor bathing in Class B. Water having DO below 5.0 mg/l concentration is not suitable for out-door bathing.

Dissolved oxygen level at one hundred fifteen (115) water quality stations at sixty one (61) rivers Agra Canal, Amaravathi, Aradei, Arkavathy, Arpa, Badanadi, Baitarani, Brahmani, Burhabalang, Cauvery, Churni/ Bhagirathi, Dhadhar, Edduvagu, Ganga, Godavari, Gomti, Hindon, Hindon Cut, Kali, Kanhan, Kanijhari, Katakhal, Khannaut, Kharkai, Kitcha/Bahgul, Kodaganar, Koel, Krishna, Kwano, Maruthaiyar, Mathabhanga/ Bhagirathi, Musi, Paleru, Parwati, Ponnaiyar, Puravidlyanar,Purna, Ramganga, Ramial, Rushikulya, Sabarmati, Sahibi, Sai, Sankh, Sarabenga, Sarayan, Shimsha, Shipra, Sina, Solani, Subarnarekha, Sukheta, Tambraparani, Thoppaiyar, Tunga, Tungabhadra, Vaippar, Vamsadhara, Wardha, Watrak, Yamuna found below 5 mg/L.

In the pre - monsoon season, 86 water quality monitoring stations on 41 rivers in 14 states Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Haryana, Jharkhand, Karnataka, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand and West Bengal recorded average DO values below 5.0 mg/l. The monsoon season recorded 99 water quality monitoring stations on 53 rivers across 14 states Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand reporting average DO values below 5.0 mg/l. Finally, in the post-monsoon season, 62 water quality monitoring stations on 35 rivers across 14 states Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand recorded average DO values below 5.0 mg/l.

Comparision between 2022 & 2023:

The comparison of dissolved oxygen (DO) hot-spots between 2022 and 2023 highlights significant trends across different seasons, summarized in the table below:

YEAR	Number of Hot-Spots found for Dissolved Oxygen		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	79	96	41
2023	86	99	62

Overall, this comparative analysis highlights the fact that although there is an increase in the number of water quality monitoring stations reporting low DO levels during all seasons of 2023, the situation appears to be deteriorating the water quality of rivers throughout the year.

The hot spot study and GIS map for dissolved oxygen (DO) parameter are given below in Table 15 and figure 27.

Table 15: Monitoring stations having Dissolved Oxygen (DO) < 5.0 mg/l in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	A.B. Road Crossing	Parwati	CD, Jaipur	Madhya Pradesh	Guna	*	4.33	*
2	Adityapur	Kharkai	ERD, Bhubaneswar	Jharkhand	Saraikela Kharsawan	4.03	4.20	4.93
3	Altuma	Ramial	ERD, Bhubaneswar	Odisha	Dhenkanal	4.51	4.48	-
4	Anandapur	Baitarani	ERD, Bhubaneswar	Odisha	Keonjhar	4.46	4.80	4.57
5	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	2.64	3.12	3.93
6	Baghpat	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	4.33	4.63	-
7	Baleni	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	0.43	3.14	1.48
8	Balighat	Burhabalang	ERD, Bhubaneswar	Odisha	Balasore	4.74	4.72	-
9	Banpur	Mathabhanga/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	1.76	*	*
10	Bareilly	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bareilly	4.87	4.18	-
11	Baridhi	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	4.48	4.92	4.79
12	Baripada	Burhabalang	ERD, Bhubaneswar	Odisha	Mayurbhanj	4.83	4.90	4.86
13	Basti	Kwano	MGD-1, Lucknow	Uttar Pradesh	Basti	-	4.00	-
14	Basti D/S	Kwano	MGD-1, Lucknow	Uttar Pradesh	Basti	4.47	4.41	-
15	Bido	Brahmani	ERD, Bhubaneswar	Odisha	Dhenkanal	4.93	4.23	4.62
16	Bolani	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	4.81	4.74	4.87
17	Chilla Gaon	Hindon Cut	UYD, New Delhi	Delhi	East Delhi	0.98	1.99	1.17
18	Dabri	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Shahjahanpur	-	3.75	-
19	Dameracherla	Musi	LKD, Hyderabad	Telangana	Nalgonda	4.69	4.12	4.61
20	Delhi Railway Bridge	Yamuna	UYD, New Delhi	Delhi	North Delhi	0.18	1.19	0.41
21	Dhaneta	Kitcha/Bahgul	MGD-2, Lucknow	Uttar Pradesh	Bareilly	-	3.29	4.78
22	Dhansa	Sahibi	UYD, New Delhi	Delhi	South West Delhi	*	3.07	*
23	Domuhani	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	4.71	4.61	-
24	Etawah	Yamuna	LYD, Agra	Uttar Pradesh	Etawah	4.41	3.65	4.19
25	Fatehgarh	Ganga	MGD-2, Lucknow	Uttar Pradesh	Farrukhabad	4.61	3.04	-
26	Galeta	Hindon	UYD, New Delhi	Uttar Pradesh	Meerut	0.04	1.90	0.17
27	Gatora	Arpa	MD, Burla	Chhattisgarh	Bilaspur	4.62	-	-
28	Gatora-1	Arpa	MD, Burla	Chhattisgarh	Bilaspur	4.62	4.42	-
29	Gatora-2	Arpa	MD, Burla	Chhattisgarh	Bilaspur	4.05	2.03	-
30	GH.Rd. Bridge	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	4.80	4.88	-
31	Gokul Barrage II Mathura D/S	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	1.87	2.39	1.59
32	Gomlai	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	4.81	4.89	-
33	Gomti Nagar (Lko D/S)	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	2.99	2.36	2.55
34	Gopiballavpur	Subarnarekha	ERD, Bhubaneswar	West Bengal	Paschim Midnapur/ West Bengal	4.46	-	-
35	Gopurajapuram	Puravidlyanar	HD, Chennai	Tamil Nadu	Nagapattinam	-	4.62	-
36	Govindpur (NH-5)	Burhabalang	ERD, Bhubaneswar	Odisha	Balasore	4.57	4.75	4.47
37	GR Bridge	Godavari	UGD, Hyderabad	Maharashtra	Parbhani	-	-	4.49
38	Gudari	Vamsadhara	ERD, Bhubaneswar	Odisha	Rayagada	4.85	-	4.70
39	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	3.36	2.42	2.24
40	Gunupur	Vamsadhara	ERD, Bhubaneswar	Odisha	Rayagada	4.86	4.58	4.85
41	Hanskhali	Churni/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	2.36	*	*
42	Hathi Khana	Ganga	MGD-2, Lucknow	Uttar Pradesh	Fatehgarh	3.95	3.83	-
43	Indupur	Brahmani	ERD, Bhubaneswar	Odisha	Kendrapara	4.70	4.65	4.28
44	Irrukkankudi	Vaippar	SRD, Coimbatore	Tamil Nadu	Virudhunagar	*	1.59	1.86
45	Jamshedpur	Subarnarekha	ERD, Bhubaneswar	Jharkhand	East Singhbhum	3.88	4.30	-
46	Jaraikela	Koel	ERD, Bhubaneswar	Odisha	Sundergarh	4.96	4.77	-
47	Jawahar Bridge, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	2.78	3.21	3.83
48	Jenapur	Brahmani	ERD, Bhubaneswar	Odisha	Jajpur	-	4.51	-

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
49	K.T.(Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	0.73	0.65	0.20
50	Kailash Mandir, Near Benpur Village	Yamuna	LYD, Agra	Uttar Pradesh	Agra	2.83	3.41	4.19
51	Kalindi Kunj	Agra Canal	UYD, New Delhi	Delhi	East Delhi	0.84	2.88	1.72
52	Kamalanga	Brahmani	ERD, Bhubaneswar	Odisha	Angul	-	4.65	-
53	Kasganj	Kali	MGD-2, Lucknow	Uttar Pradesh	Etah	4.20	4.41	3.85
54	Kashinagar	Vamsadhara	ERD, Bhubaneswar	Odisha	Gajapati	4.70	4.46	4.46
55	Kenduapada	Kanijhari	ERD, Bhubaneswar	Odisha	Keonjhar	4.21	-	-
56	Keonjhar	Aradei	ERD, Bhubaneswar	Odisha	Keonjhar	4.84	4.07	4.66
57	Kopergaon	Godavari	UGD, Hyderabad	Maharashtra	Ahmednagar	*	4.59	*
58	Kulpatanga	Kharkai	ERD, Bhubaneswar	Jharkhand	East Singhbhum	4.59	4.01	4.63
59	Kusei	Baitarani	ERD, Bhubaneswar	Odisha	Keonjhar	-	4.79	-
60	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	-	-	4.74
61	Lala	Katakhal	MD, Silchar	Assam	Hailakandi	*	*	4.10
62	Lucknow	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	0.90	2.93	1.58
63	Lupungdih	Subarnarekha	ERD, Bhubaneswar	Jharkhand	Saraikela Kharsawan	4.33	4.58	-
64	Madhabarida	Badanadi	ERD, Bhubaneswar	Odisha	Ganjam	-	4.85	3.81
65	Mantralayam	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	-	4.80	-
66	Mohna	Yamuna	UYD, New Delhi	Haryana	Faridabad	0.20	1.75	0.32
67	Moradabad	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Moradabad	2.53	3.81	-
68	Munugodu	Edduvagu	LKD, Hyderabad	Andhra Pradesh	Guntur	-	4.58	-
69	Murappanadu	Tambraparani	SRD, Coimbatore	Tamil Nadu	Tuticorin	-	3.71	3.65
70	Muri	Subarnarekha	ERD, Bhubaneswar	Jharkhand	Ranchi	4.33	-	-
71	Musala	Baitarani	ERD, Bhubaneswar	Odisha	Keonjhar	-	4.65	-
72	Nallamaranpatty	Amaravathi	SRD, Coimbatore	Tamil Nadu	Karur	-	4.60	-
73	Nanded	Godavari	UGD, Hyderabad	Maharashtra	Nanded	0.37	2.78	1.87
74	Nandira	Brahmani	ERD, Bhubaneswar	Odisha	Angul	4.88	4.83	-
75	Nashik	Godavari	UGD, Hyderabad	Maharashtra	Nasik	4.06	-	4.20
76	Noida	Yamuna	UYD, New Delhi	Uttar Pradesh	Gautam Budh Nagar	0.11	1.26	0.93
77	Okhla Barrage	Yamuna	UYD, New Delhi	Delhi	South Delhi	1.07	2.94	1.72
78	Paleru Bridge	Paleru	LKD, Hyderabad	Andhra Pradesh	Krishna	4.85	4.30	4.48
79	Panposh	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	4.47	4.31	-
80	Panposh-2	Koel	ERD, Bhubaneswar	Odisha	Sundergarh	4.80	-	-
81	Pingalwada	Dhadhar	TD, Surat	Gujarat	Vadodara	0.34	0.79	*
82	Poiyaghat, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	2.50	2.97	3.86
83	Purna	Purna	UGD, Hyderabad	Maharashtra	Parbhani	*	-	4.84
84	Purunagarh	Brahmani	ERD, Bhubaneswar	Odisha	Deogarh	4.47	4.29	4.92
85	Purushottampur	Rushikulya	ERD, Bhubaneswar	Odisha	Ganjam	4.77	4.74	4.66
86	R.S.P	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	3.50	3.93	3.46
87	R.S.P-1	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	4.22	4.20	-
88	R.S.P-2	Brahmani	ERD, Bhubaneswar	Odisha	Sundergarh	4.48	4.01	-
89	Raebareli	Sai	MGD-2, Lucknow	Uttar Pradesh	Raebareli	3.67	4.01	-
90	Rajghat	Subarnarekha	ERD, Bhubaneswar	Odisha	Mayurbhanj	4.87	4.53	-
91	Roorkee D/S	Solani	HGD, Haridwar	Uttarakhand	Haridwar	0.35	1.60	0.52
92	Roorkee U/S	Solani	HGD, Haridwar	Uttarakhand	Haridwar	0.44	1.83	0.62
93	Shahjahanpur	Khannaut	MGD-2, Lucknow	Uttar Pradesh	Shahjahanpur	3.79	4.44	-
94	Shimoga	Tunga	CD, Bangaluru	Karnataka	Shimoga	-	4.89	-
95	Singasadanapalli	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	0.00	0.00	0.00
96	Sitapur	Sarayan	MGD-2, Lucknow	Uttar Pradesh	Sitapur	-	2.45	-
97	Sorada	Rushikulya	ERD, Bhubaneswar	Odisha	Ganjam	4.85	4.50	4.87
98	Swampatana	Baitarani	ERD, Bhubaneswar	Odisha	Keonjhar	4.70	-	4.57
99	T Bekuppe	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	3.86	2.80	2.59
100	T K Halli	Shimsha	CD, Bangaluru	Karnataka	Mandya	-	4.21	4.42
101	Thevur	Sarabenga	SRD, Coimbatore	Tamil Nadu	Salem	3.38	0.92	3.32
102	Thoppur	Thoppaiyar	SRD, Coimbatore	Tamil Nadu	Salem	4.32	*	*
103	Tihar Khera	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bareilly	-	4.21	-
104	Tilga	Sankh	ERD, Bhubaneswar	Jharkhand	Simdega	-	4.15	-
105	Tondarpur	Sukheta	MGD-2, Lucknow	Uttar Pradesh	Hardoi	4.34	3.07	3.82
106	Ujjain	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	3.60	0.00

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
107	Urachikottai	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	-	2.93	*
108	Varanavasi	Maruthaiyar	SRD, Coimbatore	Tamil Nadu	Perambalur	4.98	3.96	-
109	Vautha	Sabarmati	MD, Gandhinagar	Gujarat	Ahmedabad	0.12	0.95	0.17
110	Veligonda	Musi	LKD, Hyderabad	Telangana	Nalgonda	2.58	1.40	1.50
111	Vrindawan Bridge (Mathura U/S)	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	1.31	2.16	1.16
112	Wadakbal	Sina	UKD, Pune	Maharashtra	Solapur	*	2.73	*
113	Wadenapally	Krishna	LKD, Hyderabad	Telangana	Nalgonda	2.56	4.27	4.08
114	Watrak Nr Vautha	Watrak	MD, Gandhinagar	Gujarat	Kheda	3.72	-	-
115	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	LYD, Agra	Uttar Pradesh	Agra	3.19	3.28	4.87

(-) means No Hotspot

(*) means Data not available/ river dry.

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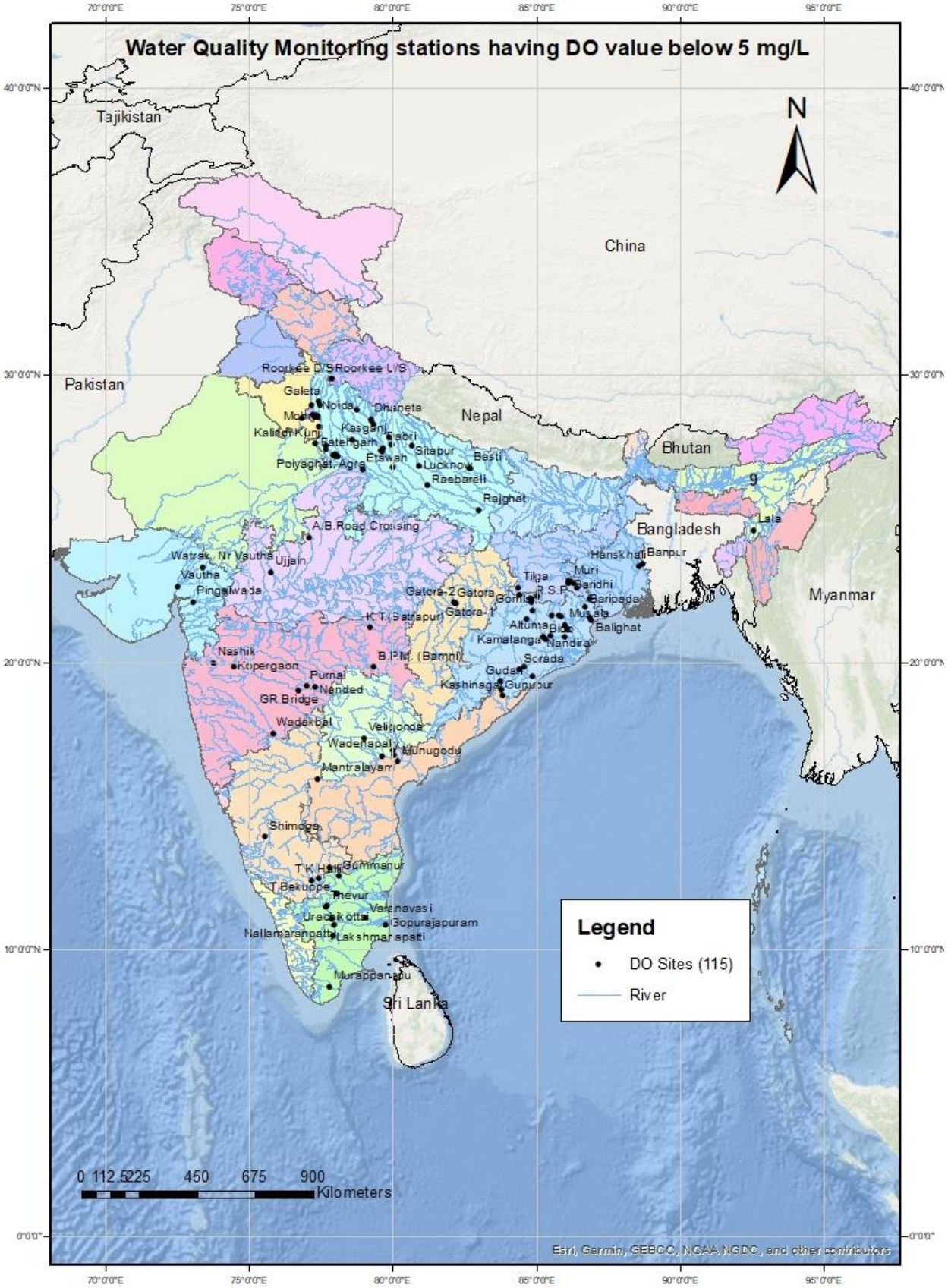
Figure 27: Water Quality Monitoring stations having Dissolved Oxygen (DO) below 5.0 mg/L (2023)



7.1.10 Biochemical Oxygen Demand (BOD)

Biochemical oxygen demand is the amount of dissolved oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period (Kaiser, 1998). Biochemical oxygen demand (BOD) holds unique significance in assessing the pollution of river water caused by wastewater discharge from sources such as sewage, industries, and agricultural fields. This parameter is important for river pollution control management and assessing the self-purifying capacity of the river. BOD serves as a comprehensive indicator of river water quality, reflecting the impact of various human activities on the ecosystem and providing essential information for pollution control and environmental management.

Biochemical oxygen demand at 152 water quality stations on 71 rivers across 15 states found above 3 mg/L. The pre-monsoon season witnessed 108 water quality monitoring stations on 46 rivers across 15 states- Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand and West Bengal reporting average BOD values exceeding 3.0 mg/l. Minimum BOD value 3.07 mg/L was recorded at Jaunpur station on the Gomti River in Uttar Pradesh and maximum BOD value 70.09 mg/L was recorded at Satrapur station on the Kanhan River in Maharashtra. The lowest BOD values observed at stations like Jaunpur, Gomti Nagar, and V.S. Bridge indicate lower levels of organic pollution. Conversely, the highest BOD values recorded at stations like Satrapur, Yamuna Expressway Road Bridge, and Gokul Barrage II highlight severely polluted rivers with significant organic contamination.

In the monsoon season, 132 water quality monitoring stations on 60 rivers in 14 states of India- Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand exceeded the acceptable limit of BOD. Minimum BOD Value 3.10 mg/L recorded at Satna station on Tons River in Madhya Pradesh and maximum BOD Value was recorded 79.46 mg/L at Singasadanapalli station on the Ponnaiyar River in Tamil Nadu. Stations with low BOD values, such as Jaunpur, V.S. Bridge, and Pargaon, indicate lower levels of organic pollution even during the monsoon season. Conversely, stations with high BOD values, like Singasadanapalli, Dhansa, and Gummanur, signify severe organic contamination, likely due to untreated sewage and agricultural runoff.

Finally, in the post-monsoon season, 102 water quality monitoring stations on 45 rivers in 12 states of India- Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand recorded average BOD values exceeding 3.0 mg/l. Minimum BOD Value 3.07 mg/L was recorded at Turtipar station on Ghaghra River in Uttar Pradesh and maximum BOD Value was recorded 75.80 mg/L at Singasadanapalli station on the Ponnaiyar River in Tamil Nadu.

Comparing the seasonal trends, it's evident that the monsoon season generally witnesses higher BOD levels compared to the pre-monsoon and post-monsoon

seasons. This is attributed to increased surface runoff and the influx of pollutants washed out from urban and agricultural areas during heavy rainfall.

Comparision between 2022 & 2023:

The comparison of Biochemical Oxygen Demand (BOD) hot-spots between 2022 and 2023 illustrates significant trends in water quality across different seasonal periods. The data is summarized in the following table:

YEAR	Number of Hot-Spots found for Biochemical Oxygen Demand		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	93	123	85
2023	108	132	102

In 2023, the number of water quality monitoring stations increased for all seasons compared to 2022, indicating deterioration in the water quality of the rivers. During the pre-monsoon, monsoon, and post-monsoon seasons in 2022 and 2023, 111 water quality stations across 48 rivers were identified as common hotspot stations.

The hot spot study and GIS map for biochemical oxygen demand (BOD) are given below in Table 16 and figure 28.

Table 16: Monitoring stations having biochemical oxygen Demand (BOD) > 3.0 mg/l in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	A.B. Road Crossing	Parwati	CD, Jaipur	Madhya Pradesh	Guna	*	13.15	*
2	A.P.M.(Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	7.53	-	-
3	Akbarpur	Chhoti sarju	MGD-3, Varanasi	Uttar Pradesh	Ambedkar Nagar	4.89	3.52	3.68
4	Aklera	Parwan	CD, Jaipur	Rajasthan	Jhalawar	-	4.14	*
5	Alanthurai	Noyyal	SRD, Coimbatore	Tamil Nadu	Coimbatore	4.30	-	*
6	Allahabad	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	3.13	3.43	3.58
7	Ankinghat	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kanpur Nagar	4.33	4.25	4.25
8	Auraiya	Yamuna	LYD, Agra	Uttar Pradesh	Auraiya	9.51	6.54	9.25
9	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	42.00	26.69	33.33
10	Baghpat	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	21.44	22.16	4.25
11	Baleni	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	26.14	21.27	38.17
12	Bamni (Nagpur)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	4.00	-	-
13	Bangapani	Gauri Ganga	MGD-1, Lucknow	Uttarakhand	Pithoragarh	3.63	3.55	3.72
14	Banka	Chandan	LGD-2, Patna	Bihar	Banka	-	-	4.56
15	Banpur	Mathabhanga/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	6.55	*	*
16	Bansi	Rapti	MGD-1, Lucknow	Uttar Pradesh	Siddarthnagar	-	4.70	6.61
17	Baranwada	Banas	CD, Jaipur	Rajasthan	Sawai-madhopur	*	13.12	*
18	Bareilly	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bareilly	18.23	16.23	7.13
19	Barod	Kalisindh	CD, Jaipur	Rajasthan	Kota	7.02	4.18	-
20	Basantpur (Ganga)	Ganga	MGD-2, Lucknow	Uttar Pradesh	Bijnaur	3.44	15.05	4.00
21	Basti	Kwano	MGD-1, Lucknow	Uttar Pradesh	Basti	5.95	16.05	7.33
22	Basti D/S	Kwano	MGD-1, Lucknow	Uttar Pradesh	Basti	8.51	11.53	7.51
23	Basti U/S	Kwano	MGD-1, Lucknow	Uttar Pradesh	Basti	6.14	8.07	5.74
24	Bhadana Village D/s of Kota City	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	8.12	*
25	Bhind	Kunwari	LYD, Agra	Madhya Pradesh	Bhind	3.42	3.98	3.41
26	Bhitaura	Ganga	MGD-2, Lucknow	Uttar Pradesh	Fatehpur	8.81	12.49	6.85
27	Bigod	Banas	CD, Jaipur	Rajasthan	Bhilwara	12.28	7.81	*
28	Birdghat	Rapti	MGD-1, Lucknow	Uttar Pradesh	Gorakhpur	3.29	4.57	3.54
29	Bithoor	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kanpur	4.22	8.74	4.10
30	Chandrika Devi (Lko U/S)	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	3.91	4.78	6.37
31	Chilla Gaon	Hindon Cut	UYD, New Delhi	Delhi	East Delhi	28.34	23.37	27.58
32	D/S (Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	3.51	5.13	-
33	Dabri	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Shahjahanpur	8.73	12.83	7.82
34	Daund	Bhima	UKD, Pune	Maharashtra	Pune	*	6.69	*
35	Delhi Railway Bridge	Yamuna	UYD, New Delhi	Delhi	North Delhi	28.61	25.83	26.28
36	Dhaneta	Kitcha/Bahgul	MGD-2, Lucknow	Uttar Pradesh	Bareilly	8.53	17.60	14.03
37	Dhansa	Sahibi	UYD, New Delhi	Delhi	South West Delhi	*	32.03	*
38	Dhareri	Chambal	CD, Jaipur	Madhya Pradesh	Ujjain	*	12.49	*

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
39	Elunuthi Mangalam	Noyyal	SRD, Coimbatore	Tamil Nadu	Erode	-	4.36	-
40	Etawah	Yamuna	LYD, Agra	Uttar Pradesh	Etawah	29.85	15.83	56.33
41	Fatehgarh	Ganga	MGD-2, Lucknow	Uttar Pradesh	Farrukhabad	4.79	18.95	5.77
42	Galeta	Hindon	UYD, New Delhi	Uttar Pradesh	Meerut	27.26	34.78	67.68
43	Gandhighat	Ganga	LGD-2, Patna	Bihar	Patna	4.38	3.47	4.12
44	Ganguwala	Yamuna	UYD, New Delhi	Himachal Pradesh	Sirmaur	-	7.30	-
45	Gatora-2	Arpa	MD, Burla	Chhattisgarh	Bilaspur	3.69	5.18	-
46	Ghazipur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	3.46	3.63	3.63
47	Gokul Barrage II Mathura D/S	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	35.27	30.31	28.59
48	Gomti Nagar (Lko D/S)	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	20.23	25.53	20.77
49	Gorakhpur D/S	Rapti	MGD-1, Lucknow	Uttar Pradesh	Gorakhpur	-	4.45	4.26
50	Gorakhpur U/S	Rapti	MGD-1, Lucknow	Uttar Pradesh	Gorakhpur	-	5.03	3.33
51	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	21.63	32.75	43.56
52	Hamirpur	Yamuna	LYD, Agra	Uttar Pradesh	Hamirpur	4.85	-	3.41
53	Hanging Bridge	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	5.69	*
54	Hanskhali	Churni/ Bhagirathi	LGD-3, Berhampore	West Bengal	Nadia	4.27	*	*
55	Hathi Khana	Ganga	MGD-2, Lucknow	Uttar Pradesh	Fatehgarh	13.21	12.91	11.08
56	Hayaghat	Bagmati	LGD-1, Patna	Bihar	Darbhanga	-	-	4.45
57	Hogenakkal	Chinnar	SRD, Coimbatore	Tamil Nadu	Dharmapuri	-	*	4.15
58	Huvinhedgi	Krishna	LKD, Hyderabad	Karnataka	Raichur	-	4.57	-
59	Irrukkankudi	Vaippar	SRD, Coimbatore	Tamil Nadu	Virudhunagar	*	18.41	6.91
60	Jajmau	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kanpur	4.57	7.91	5.98
61	Jaunpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	3.07	3.53	3.76
62	Jawahar Bridge, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	20.00	12.75	32.35
63	Jhalawad	Kalisindh	CD, Jaipur	Rajasthan	Jhalawar	*	13.89	*
64	Jhanjharpur	Kamlabalan	LGD-1, Patna	Bihar	Madhubani	-	-	4.08
65	K.T.(Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	70.09	55.41	66.67
66	Kabirganj	Sharda	MGD-1, Lucknow	Uttar Pradesh	Pilibhit	-	3.89	4.41
67	Kachlabridge	Ganga	MGD-2, Lucknow	Uttar Pradesh	Badaun	3.12	4.26	4.62
68	Kailash Mandir, Near Benpur Village	Yamuna	LYD, Agra	Uttar Pradesh	Agra	25.68	15.51	29.82
69	Kalanaur	Yamuna	UYD, New Delhi	Uttar Pradesh	Saharanpur	5.89	9.63	-
70	Kalindi Kunj	Agra Canal	UYD, New Delhi	Delhi	East Delhi	29.19	29.03	28.19
71	Kalpi	Yamuna	LYD, Agra	Uttar Pradesh	Jalaun	4.81	-	3.29
72	Kannauj	Kali	MGD-2, Lucknow	Uttar Pradesh	Kannauj	9.55	6.33	6.68
73	Kanpur	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kanpur Nagar	3.53	5.56	3.73
74	Karnal	Yamuna	UYD, New Delhi	Haryana	Karnal	3.25	9.91	-
75	Kasganj	Kali	MGD-2, Lucknow	Uttar Pradesh	Etah	15.09	14.76	15.07
76	Katri Umrauli	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kannauj	3.65	4.81	5.22
77	Kaziupura	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Moradabad	3.73	10.84	4.38
78	Khatoli	Parwati	CD, Jaipur	Rajasthan	Kota	5.18	4.89	-

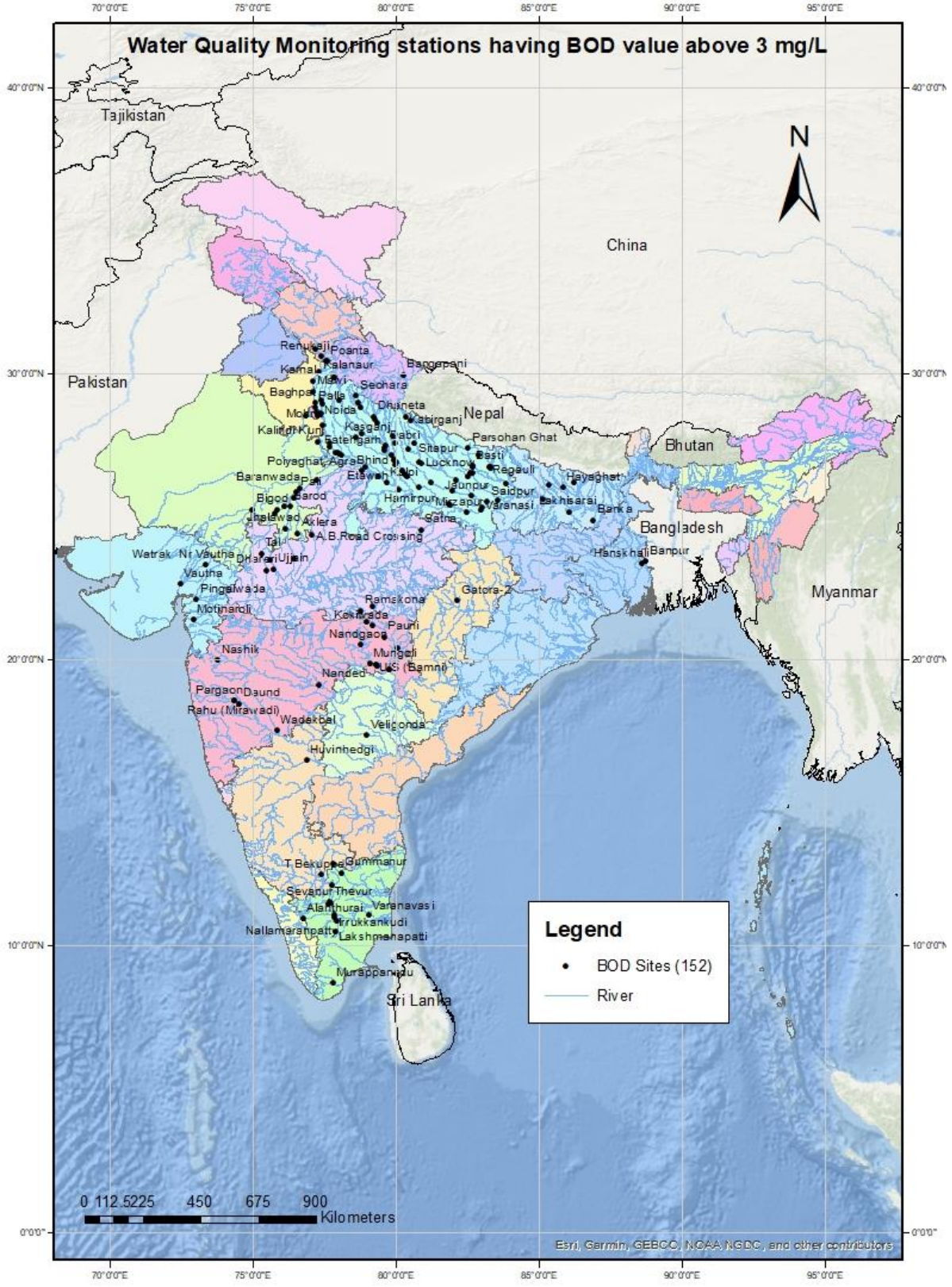
S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
79	Kokiwada	Pench	WD, Nagpur	Madhya Pradesh	Chhindwara	-	4.08	3.27
80	Lakhisarai	Kiul	LGD-2, Patna	Bihar	Lakhisarai	4.97	-	3.27
81	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	-	5.36	-
82	Lucknow	Gomti	MGD-2, Lucknow	Uttar Pradesh	Lucknow	27.24	15.06	19.18
83	Mahidpur	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	15.93	*
84	Mandawara	Chambal	CD, Jaipur	Rajasthan	Kota	13.50	8.70	-
85	Manderial	Chambal	CD, Jaipur	Rajasthan	Karauli	12.42	10.04	-
86	Mawi	Yamuna	UYD, New Delhi	Uttar Pradesh	Shamli	11.71	14.31	-
87	Mehandipur	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kannauj	6.53	7.05	7.40
88	Mirzapur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Mirzapur	3.08	3.41	3.49
89	Mohna	Yamuna	UYD, New Delhi	Haryana	Faridabad	27.48	30.49	34.71
90	Moradabad	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Moradabad	23.93	16.29	11.15
91	Motinaroli	Kim	TD, Surat	Gujarat	Surat	-	5.29	*
92	Mungoli	Penganga	WD, Nagpur	Maharashtra	Yavatmal	6.32	-	-
93	Murappanadu	Tambraparani	SRD, Coimbatore	Tamil Nadu	Tuticorin	-	6.53	3.19
94	Nallamaranpatty	Amaravathi	SRD, Coimbatore	Tamil Nadu	Karur	-	10.54	-
95	Nanded	Godavari	UGD, Hyderabad	Maharashtra	Nanded	18.04	10.20	3.99
96	Nandgaon	Wunna	WD, Nagpur	Maharashtra	Wardha	7.52	5.44	-
97	Nashik	Godavari	UGD, Hyderabad	Maharashtra	Nasik	3.25	3.91	-
98	Neemsar	Gomti	MGD-2, Lucknow	Uttar Pradesh	Sitapur	5.87	8.28	4.28
99	Noida	Yamuna	UYD, New Delhi	Uttar Pradesh	Gautam Budh Nagar	25.85	28.26	53.87
100	Okhla Barrage	Yamuna	UYD, New Delhi	Delhi	South Delhi	29.21	29.81	37.14
101	Pali	Chambal	CD, Jaipur	Rajasthan	Sawai-madhopur	6.54	9.43	-
102	Paliakalan	Sharda	MGD-1, Lucknow	Uttar Pradesh	Lakhimpur Khiri	-	3.19	3.63
103	Palla	Yamuna	UYD, New Delhi	Delhi	North West Delhi	18.46	12.43	9.00
104	Pargaon	Bhima	UKD, Pune	Maharashtra	Pune	*	9.25	*
105	Parmat Ghat	Ganga	MGD-2, Lucknow	Uttar Pradesh	Kanpur	3.77	8.33	5.85
106	Parsohan Ghat	Budhi Rapti	MGD-1, Lucknow	Uttar Pradesh	Siddarthnagar	-	6.76	12.62
107	Patansaongi	Chandrabhaga	WD, Nagpur	Maharashtra	Nagpur	-	4.90	-
108	Pauni	Wainganga	WD, Nagpur	Maharashtra	Bhandara	5.72	-	-
109	Pingalwada	Dhadhar	TD, Surat	Gujarat	Vadodara	11.36	14.75	*
110	Poanta	Yamuna	UYD, New Delhi	Himachal Pradesh	Simaur	-	5.53	-
111	Poiyaghat, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	23.43	14.63	23.14
112	Pratapgarh	Sai	MGD-3, Varanasi	Uttar Pradesh	Pratapgarh	3.64	3.38	3.75
113	Raebareli	Sai	MGD-2, Lucknow	Uttar Pradesh	Raebareli	13.81	9.37	7.55
114	Rahu (Mirawadi)	Mula-Mutha	UKD, Pune	Maharashtra	Pune	*	7.72	*
115	Ramakona	Kanhan	WD, Nagpur	Madhya Pradesh	Chhindwara	4.11	3.20	-
116	Regauli	Rapti	MGD-1, Lucknow	Uttar Pradesh	Gorakhpur	-	4.30	3.33
117	Renukaji	Giri	UYD, New Delhi	Himachal Pradesh	Sirmaur	-	7.74	-
118	Roorkee D/S	Solani	HGD, Haridwar	Uttarakhand	Haridwar	25.09	26.85	21.00
119	Roorkee U/S	Solani	HGD, Haridwar	Uttarakhand	Haridwar	23.81	24.88	19.99
120	Saidpur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	3.86	-	3.09

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
121	Sarangpur	Kalisindh	CD, Jaipur	Madhya Pradesh	Rajgarh	*	15.28	*
122	Satna	Tons	MGD-3, Varanasi	Madhya Pradesh	Satna	3.34	3.10	3.29
123	Seohara	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bijnaur	4.12	8.47	4.40
124	Sevanur	Chittar	SRD, Coimbatore	Tamil Nadu	Erode	8.22	*	9.67
125	Shahjahanpur	Khannaut	MGD-2, Lucknow	Uttar Pradesh	Shahjahanpur	15.47	11.54	7.05
126	Shastri Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	3.15	3.34	3.57
127	Sikandarpur	Burhi Gandak	LGD-1, Patna	Bihar	Muzaffarpur	3.32	-	3.86
128	Singasadanapalli	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	50.86	79.46	75.80
129	Sitapur	Sarayan	MGD-2, Lucknow	Uttar Pradesh	Sitapur	14.85	15.14	6.53
130	Sultanpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Sultanpur	3.78	-	3.20
131	T Bekuppe	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	9.17	11.38	6.72
132	Tal	Chambal	CD, Jaipur	Madhya Pradesh	Ratlam	*	3.98	*
133	Tanda D/S	Ghaghra	MGD-1, Lucknow	Uttar Pradesh	Ambedkar Nagar	-	3.83	3.44
134	Tanda U/S	Ghaghra	MGD-1, Lucknow	Uttar Pradesh	Ambedkar Nagar	-	3.68	3.90
135	Thevur	Sarabenga	SRD, Coimbatore	Tamil Nadu	Salem	3.61	6.92	6.05
136	Tihar Khera	Ramganga	MGD-2, Lucknow	Uttar Pradesh	Bareilly	7.49	14.21	5.18
137	Tondarpur	Sukheta	MGD-2, Lucknow	Uttar Pradesh	Hardoi	7.44	13.36	10.33
138	Turtipar	Ghaghra	MGD-1, Lucknow	Uttar Pradesh	Ballia	-	3.33	3.07
139	U/S (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	3.91	3.27	-
140	Ujjain	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	20.09	16.04
141	Urachikottai	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	-	4.90	*
142	V S Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	3.33	3.70	3.76
143	Varanasi	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	3.65	-	3.20
144	Varanavasi	Maruthaiyar	SRD, Coimbatore	Tamil Nadu	Perambalur	3.52	6.70	-
145	Vautha	Sabarmati	MD, Gandhinagar	Gujarat	Ahmedabad	30.14	15.02	26.09
146	Veligonda	Musi	LKD, Hyderabad	Telangana	Nalgonda	16.53	16.67	11.53
147	Vrindawan Bridge (Mathura U/S)	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	36.03	32.07	35.10
148	Wadakbal	Sina	UKD, Pune	Maharashtra	Solapur	*	5.72	*
149	Wairagarh	Khobragadi	WD, Nagpur	Maharashtra	Gadchiroli	-	4.08	-
150	Watrak Nr Vautha	Watrak	MD, Gandhinagar	Gujarat	Kheda	10.02	-	5.46
151	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	LYD, Agra	Uttar Pradesh	Agra	27.20	17.48	33.55
152	Yashwant Nagar	Giri	UYD, New Delhi	Himachal Pradesh	Simaur	7.08	9.89	7.08

(-) means No Hotspot

(*) means Data not available/ river dry.

Figure 28: Water Quality Monitoring stations having Biochemical Oxygen Demand (BOD) above 3.0 mg/L (2023)



7.1.11 Total Coliform (TC)

The coliform group primarily consists of species from genera such as Citrobacter, Enterobacter, Escherichia, Klebsiella, including fecal coliforms. Although coliform organisms may not be directly linked to the presence of viruses in drinking water, the coliform test remains essential for monitoring the microbial quality of public water supplies. This bacterial group is present in large numbers throughout all seasons, possibly attributed to the addition of sewage and various forms of waste, higher concentrations of suspended particles, and the dark coloration of receiving water.

Total Coliforms at 277 water quality stations on 138 rivers in 18 states found above 500 MPN/100mL. During the pre-monsoon season, 199 water quality monitoring stations across 16 states of India- Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand reported average TC values exceeding 500 MPN/100 ml. In the monsoon season, 258 water quality monitoring stations in 17 states of India- Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, and Uttarakhand displayed similar findings. Finally, in the post-monsoon season, 215 water quality monitoring stations in 18 states of India- Andhra Pradesh, Assam Chhattisgarh, Gujarat, Delhi, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, and Uttarakhand recorded average TC values exceeding 500 MPN/100 ml.

Comparision between 2022 & 2023:

The comparison of total coliform hot-spots between 2022 and 2023 illustrates significant trends in water quality across different seasonal periods. The data is summarized in the following table:

YEAR	Number of Hot-Spots found for Total Coliforms		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	235	247	171
2023	199	258	215

The hot spot study and GIS map for total coliform (TC) parameter are given below in Table 17 and figure 29.

Table 17: Monitoring stations having Total Coliform (TC) > 500 MPN/100 mL in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	A.B. Road Crossing	Parwati	CD, Jaipur	Madhya Pradesh	Guna	*	113990	*
2	A.P. Puram	Chittar	SRD, Coimbatore	Tamil Nadu	Tirunelveli	*	*	7450
3	A.P.M.(Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	*	10933	11300
4	Abu Road	Banas	MD, Gandhinagar	Rajasthan	Sirohi	*	18600	18200
5	Aie NH Xing	Aie	MBD, Guwahati	Assam	Barpeta	*	1911	1567
6	Akbarpur	Chhoti sarju	MGD-3, Varanasi	Uttar Pradesh	Ambedkar Nagar	7873	7920	5367
7	Akkihebbal	Hemavati	CD, Bangaluru	Karnataka	Mandya	92245	248267	136800
8	Aklera	Parwan	CD, Jaipur	Rajasthan	Jhalawar	79000	63889	*
9	Alanthurai	Noyyal	SRD, Coimbatore	Tamil Nadu	Coimbatore	4900	26000	*
10	Alladupalli	Kunderu	HD, Chennai	Andhra Pradesh	Kadapa	2431	1545	-
11	Allahabad	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	7227	8067	6883
12	Ambarampalayam	Bharathapuzha	SRD, Coimbatore	Tamil Nadu	Coimbatore	11547	11613	12150
13	Ambasamudram	Vaigai	SRD, Coimbatore	Tamil Nadu	Theni	37633	*	3050
14	Arcot	Palar	HD, Chennai	Tamil Nadu	Ranipet	16000	1810	6150
15	Arjunwad	Krishna	UKD, Pune	Maharashtra	Kolhapur	*	42071	*
16	Asthi	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	1642	4187	3430
17	Auraiya	Yamuna	LYD, Agra	Uttar Pradesh	Auraiya	110360	62980	58140
18	Avarankuppam	Palar	SRD, Coimbatore	Tamil Nadu	Vellore	9633	3300	*
19	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	*	11767	13733
20	Badalapur	Ulhas	UKD, Pune	Maharashtra	Thane	72067	104000	63333
21	Baghpat	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	477867	105000	136667
22	Bakhari	Wainganga	WD, Nagpur	Madhya Pradesh	Seoni	3771	1511	1405
23	Baleni	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	1766000	996000	833333
24	Baluaghat	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	7027	7393	7117
25	Bamni(Nagpur)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	3709	3552	2750
26	Banda	Ken	LYD, Agra	Uttar Pradesh	Banda	1780	6742	1830
27	Baranwada	Banas	CD, Jaipur	Rajasthan	Sawai-madhopur	*	127583	*
28	Barod	Kalisindh	CD, Jaipur	Rajasthan	Kota	111917	43455	45000
29	Basoda	Betwa	LYD, Agra	Madhya Pradesh	Vidisha	3800	3913	*
30	Bawapuram	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	2981	1800	1900
31	Beki	Beki	MBD, Guwahati	Assam	Barpeta	*	-	627
32	Belne Bridge	Gad	CD, Bangaluru	Maharashtra	Sindhudurg	20217	381333	26040
33	Bendrahalli	Suvarnavathi	CD, Bangaluru	Karnataka	Chamarajanagar	450067	469933	334000
34	Bhadana Village D/s of Kota City	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	119750	*
35	Bhadrachelam	Godavari	LGD, Hyderabad	Telangana	Khammam	1559	2367	2900
36	Bhatpalli	Peddavagu	WD, Nagpur	Telangana	Asifabad	2876	3417	2900
37	Bhind	Kunwari	LYD, Agra	Madhya Pradesh	Bhind	16144	24867	3900
38	Bigod	Banas	CD, Jaipur	Rajasthan	Bhilwara	89333	119667	*
39	Biligundulu	Cauvery	SRD, Coimbatore	Tamil Nadu	Krishnagiri	14919	9220	5933
40	Byladahalli	Haridra	CD, Bangaluru	Karnataka	Davanagere	*	277625	21750
41	Chaklagaon	Manas	MBD, Guwahati	Assam	Bongaigaon	*	886	1267
42	Changsari	Kurijali	MBD,	Assam	Kamrup (M)	*	1050	1167

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
			Guwahati					
43	Chengalpet	Palar	HD, Chennai	Tamil Nadu	Chengalpet	1190	5563	3000
44	Chennur	Pennar	HD, Chennai	Andhra Pradesh	Kadapa	617	967	-
45	Chindnar	Indravathi	LGD, Hyderabad	Chhattisgarh	Dantewada	1836	3173	2928
46	Chitrasani	Balaram	MD, Gandhinagar	Gujarat	Banaskantha	*	22000	17000
47	Cholachagudda	Malaprabha	CD, Bangaluru	Karnataka	Bagalkot	59314	496556	*
48	Chopan	Sone	MGD-3, Varanasi	Uttar Pradesh	Sonbhadra	4753	4693	3600
49	Chunchunkatte	Cauvery	CD, Bangaluru	Karnataka	Mysore	160000	411900	*
50	D/S (Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	*	7913	11467
51	Dameracherla	Musi	LKD, Hyderabad	Telangana	Nalgonda	2253	2372	2700
52	Daund	Bhima	UKD, Pune	Maharashtra	Pune	*	60500	*
53	Delhi Railway Bridge	Yamuna	UYD, New Delhi	Delhi	North Delhi	74533333	22333333	10500000
54	Deongaon Bridge	Bhima	LKD, Hyderabad	Karnataka	Bijapur	*	4733	*
55	Deosugar	Krishna	LKD, Hyderabad	Karnataka	Raichur	3253	2207	2100
56	Derol Bridge	Sabarmati	MD, Gandhinagar	Gujarat	Sabarkantha	8460	34364	20167
57	Dhalegaon	Godavari	UGD, Hyderabad	Maharashtra	Parbhani	*	1960	1717
58	Dhansa	Sahibi	UYD, New Delhi	Delhi	South West Delhi	*	611667	*
59	Dhareri	Chambal	CD, Jaipur	Madhya Pradesh	Ujjain	*	762000	*
60	Dholpur	Chambal	LYD, Agra	Rajasthan	Dholpur	16033	14618	8260
61	Duddhi	Kanhar	MGD-3, Varanasi	Uttar Pradesh	Sonbhadra	4673	3333	3233
62	Dudhnoi	Dhudnoi	MBD, Guwahati	Assam	Goalpara	*	-	933
63	Elunuthi Mangalam	Noyyal	SRD, Coimbatore	Tamil Nadu	Erode	20320	16240	29000
64	Etawah	Yamuna	LYD, Agra	Uttar Pradesh	Etawah	715467	206267	980000
65	Gaisabad	Bearma	LYD, Agra	Madhya Pradesh	Damoh	3050	2957	3167
66	Galeta	Hindon	UYD, New Delhi	Uttar Pradesh	Meerut	50960000	7173333	14800000
67	Gandhavayal	Gandhayar	SRD, Coimbatore	Tamil Nadu	Coimbatore	49658	15667	4867
68	Gandlapet	Peddavagu	UGD, Hyderabad	Telangana	Nizamabad	3335	1810	2433
69	Ganguwala	Yamuna	UYD, New Delhi	Himachal Pradesh	Sirmaur	16653	35400	24500
70	Ganod	Bhadar	MD, Gandhinagar	Gujarat	Rajkot	*	27190	*
71	Garhakota	Sonar	LYD, Agra	Madhya Pradesh	Sagar	*	6150	*
72	Garrauli	Dhasan	LYD, Agra	Madhya Pradesh	Chhatarpur	1651	11267	5016
73	Ghazipur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	6733	7393	5833
74	Goalpara	Brahmaputra	MBD, Guwahati	Assam	Goalpara	*	1100	*
75	Gokak	Ghataprabha	CD, Bangaluru	Karnataka	Belgaum	*	447300	17000
76	Gokul Barrage II Mathura D/S	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	5004667	9133333	9700000
77	Gopurajapuram	Puravidlyanar	HD, Chennai	Tamil Nadu	Nagapattinam	*	5400	-
78	GR Bridge	Godavari	UGD, Hyderabad	Maharashtra	Parbhani	2353	2440	2450
79	Gudam Bridge	Pranhita	WD, Nagpur	Maharashtra	Gadchiroli	739	1342	-
80	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	79533	26947	17133
81	Guwahati D.C.Court	Brahmaputra	MBD, Guwahati	Assam	Kamrup (M)	-	562	3103
82	Halia	Halia	LKD, Hyderabad	Telangana	Nalgonda	1992	3425	*
83	Hamirpur	Yamuna	LYD, Agra	Uttar Pradesh	Hamirpur	38887	17203	9020

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
84	Hanging Bridge	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	20250	*
85	Haralahalli	Tungabhadra	CD, Bangaluru	Karnataka	Haveri	40086	295727	24250
86	Hariharapura	Tunga	CD, Bangaluru	Karnataka	Chikamagalur	101800	181667	90800
87	Haripur	Tons	UYD, New Delhi	Uttarakhand	Dehradun	14927	40200	25167
88	Hivra	Wardha	WD, Nagpur	Maharashtra	Wardha	1571	2634	933
89	Hogenakkal	Chinnar	SRD, Coimbatore	Tamil Nadu	Dharmapuri	28000	*	54000
90	Holehonnur	Bhadra	CD, Bangaluru	Karnataka	Shimoga	112400	411533	56560
91	Honnali	Tungabhadra	CD, Bangaluru	Karnataka	Davanagere	190427	565400	20240
92	Hoovinahole	Swarnamukhi	CD, Bangaluru	Karnataka	Chitradurga	30800	*	*
93	Huvinhedgi	Krishna	LKD, Hyderabad	Karnataka	Raichur	2293	2383	3033
94	Irrukkankudi	Vaippar	SRD, Coimbatore	Tamil Nadu	Virudhunagar	*	56667	23200
95	Jagdalpur	Indravathi	LGD, Hyderabad	Chhattisgarh	Bastar	1973	2940	1440
96	Jaunpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	6927	6813	6617
97	Jawahar Bridge, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	414000	147867	338000
98	Jhalawad	Kalisindh	CD, Jaipur	Rajasthan	Jhalawar	*	60700	*
99	Jhansi Mirjapur Highway Road Bridge	Betwa	LYD, Agra	Uttar Pradesh	Hamirpur	4493	6213	3780
100	K M Vadi	Cauvery/ Lakshmanthirth	CD, Bangaluru	Karnataka	Mysore	84667	319000	169750
101	K.T.(Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	*	13917	16000
102	Kailash Mandir, Near Benpur Village	Yamuna	LYD, Agra	Uttar Pradesh	Agra	606000	196733	310000
103	Kalanaur	Yamuna	UYD, New Delhi	Uttar Pradesh	Saharanpur	63653	90933	36667
104	Kalpi	Yamuna	LYD, Agra	Uttar Pradesh	Jalaun	40427	15800	23800
105	Kamalapuram	Papagani	HD, Chennai	Andhra Pradesh	Kadapa	*	3150	*
106	Kamalpur	Banas	MD, Gandhinagar	Gujarat	Patan	*	18767	*
107	Karad	Krishna	UKD, Pune	Maharashtra	Satara	*	31750	*
108	Karnal	Yamuna	UYD, New Delhi	Haryana	Karnal	114933	32867	135000
109	Keesara	Munneru	LKD, Hyderabad	Andhra Pradesh	Krishna	2000	2015	4025
110	Keolari	Wainganga	WD, Nagpur	Madhya Pradesh	Seoni	1035	3483	1972
111	Khanpur	Mahi	MD, Gandhinagar	Gujarat	Anand	7077	25753	13767
112	Khatoli	Parwati	CD, Jaipur	Rajasthan	Kota	77000	101545	73500
113	Kodumudi	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	7121	14893	6067
114	Koggedoddi	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	202480	440067	32160
115	Kokiwada	Pench	WD, Nagpur	Madhya Pradesh	Chhindwara	3424	5222	6417
116	Kollegal	Cauvery	CD, Bangaluru	Karnataka	Chamarajanagar	225071	322533	14500
117	Konta	Sabari	LGD, Hyderabad	Chhattisgarh	Bastar	2167	2526	1427
118	Kopergaon	Godavari	UGD, Hyderabad	Maharashtra	Ahmednagar	*	2750	*
119	Kora	Rind	LYD, Agra	Uttar Pradesh	Fatehpur	3332	3159	2500
120	Kudalaiyathur	Vellar	HD, Chennai	Tamil Nadu	Cuddalore	1950	*	-
121	Kudige	Cauvery	CD, Bangaluru	Karnataka	Kodagu	75640	254667	62200
122	Kuldahbridge	Sone	MGD-3, Varanasi	Madhya Pradesh	Sidhi	5660	6053	3750
123	Kulsi	Kulsi	MBD, Guwahati	Assam	Kamrup (R)	-	681	1077
124	Kumarapalayam	Varahanadhi	HD, Chennai	Puducherry	Puducherry	*	*	805
125	Kumhari	Wainganga	WD, Nagpur	Madhya Pradesh	Balaghat	-	3041	538
126	Kuppelur	Kumudavathi	CD, Bangaluru	Karnataka	Haveri	*	249000	*
127	Kurundwad	Krishna	UKD, Pune	Maharashtra	Kolhapur	*	15417	*

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
128	Lakkavalli	Bhadra	CD, Bangaluru	Karnataka	Chikamagalur	95680	218667	20440
129	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	26583	24433	18733
130	Lalpur	Sengar	LYD, Agra	Uttar Pradesh	Kanpur Dehat	4689	13720	3035
131	Lodhikheda	Jam	WD, Nagpur	Madhya Pradesh	Chhindwara	8564	3335	11967
132	Luwara	Shetrunji	MD, Gandhinagar	Gujarat	Bhavnagar	22377	23133	16400
133	M H Halli	Hemavati	CD, Bangaluru	Karnataka	Hassan	103667	170500	45160
134	Madhira	Wyra	LKD, Hyderabad	Telangana	Khammam	2152	1792	1820
135	Madla	Ken	LYD, Agra	Madhya Pradesh	Panna	*	2362	2850
136	Magaral	Cheyyar	HD, Chennai	Tamil Nadu	Kancheepuram	2800	-	1298
137	Magardhara	Wainganga	WD, Nagpur	Madhya Pradesh	Balaghat	2135	4647	-
138	Mahalgaon	Wainganga	WD, Nagpur	Maharashtra	Gondia	2619	2343	2818
139	Mahidpur	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	168250	*
140	Maighat	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	6047	7173	5417
141	Malkhed	Kangna	LKD, Hyderabad	Karnataka	Gulbarga	3055	2193	1427
142	Mancherial	Godavari	UGD, Hyderabad	Telangana	Mancherial	2006	1961	2910
143	Mandawara	Chambal	CD, Jaipur	Rajasthan	Kota	118467	85800	100333
144	Manderial	Chambal	CD, Jaipur	Rajasthan	Karauli	56067	87267	70833
145	Mangaon	Kal	UKD, Pune	Maharashtra	Raigad	*	20417	*
146	Mantralayam	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	1791	1820	1058
147	Marella	Gundlakamma	LKD, Hyderabad	Andhra Pradesh	Prakasam	1958	2800	1320
148	Marol	Varada	CD, Bangaluru	Karnataka	Haveri	*	172200	*
149	Mataji	Mahi	MD, Gandhinagar	Madhya Pradesh	Ratlam	27636	20567	18500
150	Mawi	Yamuna	UYD, New Delhi	Uttar Pradesh	Shamli	907267	784667	775000
151	Mejaroad	Tons	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	4107	4107	3800
152	Menangudi	Noolar	HD, Chennai	Tamil Nadu	Thiruvarur	*	2083	502
153	Mirzapur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Mirzapur	7093	8013	7067
154	Mohana	Betwa	LYD, Agra	Uttar Pradesh	Jalaun	15596	16407	7440
155	Mohna	Yamuna	UYD, New Delhi	Haryana	Faridabad	5313333	2258667	10550000
156	Mungoli	Penganga	WD, Nagpur	Maharashtra	Yavatmal	2115	965	1633
157	Munugodu	Edduvagu	LKD, Hyderabad	Andhra Pradesh	Guntur	1906	1821	2250
158	Muradpur	Vashishti	UKD, Pune	Maharashtra	Ratnagiri	*	46182	*
159	Murappanadu	Tambraparani	SRD, Coimbatore	Tamil Nadu	Tuticorin	8486	7050	6483
160	Musiri	Cauvery	SRD, Coimbatore	Tamil Nadu	Thiruchirapalli	10269	16440	7167
161	Muthankera	Kabini	CD, Bangaluru	Kerala	Wayanad	99953	528733	55400
162	Nagothane	Amba	UKD, Pune	Maharashtra	Raigad	*	19383	*
163	Naidupet	Swarnamukhi	HD, Chennai	Andhra Pradesh	Nellore	10900	5324	-
164	Nallamaranpatty	Amaravathi	SRD, Coimbatore	Tamil Nadu	Karur	7933	4850	4900
165	Nallathur	Nandalar	HD, Chennai	Puducherry	Karaikal	*	*	1140
166	Nanded	Godavari	UGD, Hyderabad	Maharashtra	Nanded	2100	4213	1407
167	Nandgaon	Wunna	WD, Nagpur	Maharashtra	Wardha	5257	3950	7183
168	Nandipalli	Sagileru	HD, Chennai	Andhra Pradesh	Kadapa	-	1766	1765
169	Nashik	Godavari	UGD, Hyderabad	Maharashtra	Nasik	2800	1967	3517
170	Naugaon	Yamuna	UYD, New Delhi	Uttarakhand	Uttarakashi	11213	61733	21833
171	Nellithurai	Bhavani	SRD, Coimbatore	Tamil Nadu	Coimbatore	3800	*	*
172	Nellore	Pennar	HD, Chennai	Andhra Pradesh	Nellore	700	1947	5650

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
173	Noida	Yamuna	UYD, New Delhi	Uttar Pradesh	Gautam Budh Nagar	60533333	15466667	10366667
174	Nona	Nona	MBD, Guwahati	Assam	Nalbari	*	1286	1810
175	Nowrangpur	Indravathi	LGD, Hyderabad	Odisha	Nowrangpur	2322	2060	1960
176	Odenthurai	Kallar	SRD, Coimbatore	Tamil Nadu	Coimbatore	53073	16164	15733
177	Orai Rath marg Road Bridge, Chikasi	Betwa	LYD, Agra	Uttar Pradesh	Jalaun	15207	14627	7760
178	P.G. Bridge	Penganga	WD, Nagpur	Maharashtra	Yavatmal	996	2970	1072
179	Pachawali	Sindh	LYD, Agra	Madhya Pradesh	Shivpuri	*	3214	*
180	Pachegaon	Pravara	UGD, Hyderabad	Maharashtra	Ahmednagar	2433	1963	2567
181	Padardibadi	Mahi	MD, Gandhinagar	Rajasthan	Dungarpur	33038	13400	24833
182	Pagladiya	Pagladiya	MBD, Guwahati	Assam	Lakhimpur	*	-	1870
183	Paleru Bridge	Paleru	LKD, Hyderabad	Andhra Pradesh	Krishna	1764	2245	1176
184	Pali	Chambal	CD, Jaipur	Rajasthan	Sawai-madhopur	82600	62533	57667
185	Palla	Yamuna	UYD, New Delhi	Delhi	North West Delhi	1813333	672000	2068000
186	Pancharatna	Brahmaputra	MBD, Guwahati	Assam	Goalpara	*	-	600
187	Paramkudi	Vaigai	SRD, Coimbatore	Tamil Nadu	Ramanathapuram	12971	*	41333
188	Pargaon	Bhima	UKD, Pune	Maharashtra	Pune	*	46083	*
189	Patala	Wardha	WD, Nagpur	Maharashtra	Chandrapur	2375	4221	5877
190	Patansaongi	Chandrabhaga	WD, Nagpur	Maharashtra	Nagpur	6908	5169	1967
191	Pathagudem	Indravathi	LGD, Hyderabad	Chhattisgarh	Bijapur	2321	2469	2960
192	Pauni	Wainganga	WD, Nagpur	Maharashtra	Bhandara	5107	3887	2700
193	Peralam	Vanjiyar	HD, Chennai	Tamil Nadu	Thiruvarur	*	11445	3580
194	Perur	Godavari	UGD, Hyderabad	Telangana	Mulugu	2193	2140	3117
195	Phulgaon	Bhima	UKD, Pune	Maharashtra	Pune	*	55333	*
196	Poanta	Yamuna	UYD, New Delhi	Himachal Pradesh	Simaur	209720	139933	24667
197	Poiyaghat, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	555333	173067	262000
198	Polavaram	Godavari	LGD, Hyderabad	Andhra Pradesh	West Godavari	2145	3300	2257
199	Porakudi	Arasalar	HD, Chennai	Tamil Nadu	Nagapattinam	*	2526	-
200	Pratap pur	Yamuna	LYD, Agra	Uttar Pradesh	Prayagraj	6446	5773	3572
201	Pratapgarh	Sai	MGD-3, Varanasi	Uttar Pradesh	Pratapgarh	7267	6347	3683
202	Pratappur	Pravara	UGD, Hyderabad	Maharashtra	Ahmednagar	2250	3891	1400
203	Purna	Purna	UGD, Hyderabad	Maharashtra	Parbhani	*	2264	1833
204	Puthimari	Puthimari	MBD, Guwahati	Assam	Kamrup	*	-	3507
205	Rahu (Mirawadi)	Mula-Mutha	UKD, Pune	Maharashtra	Pune	*	75250	*
206	Rajapur	Yamuna	LYD, Agra	Uttar Pradesh	Chitrakoot	9973	8333	7080
207	Rajegaon	Pranhita	WD, Nagpur	Madhya Pradesh	Balaghat	945	3092	672
208	Rajghat (Agra)	Betwa	LYD, Agra	Uttar Pradesh	Lalitpur	2683	2123	2560
209	Ramakona	Kanhan	WD, Nagpur	Madhya Pradesh	Chhindwara	5391	7927	5700
210	Rangeli	Som	MD, Gandhinagar	Rajasthan	Dungarpur	15992	26393	16267
211	Renukaji	Giri	UYD, New Delhi	Himachal Pradesh	Sirmaur	9680	31000	16167
212	Sahijana	Betwa	LYD, Agra	Uttar Pradesh	Hamirpur	4747	3703	3020
213	Saidpur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	6913	7353	4583
214	Saigaon	Manjira	UGD, Hyderabad	Karnataka	Bidar	*	2625	*

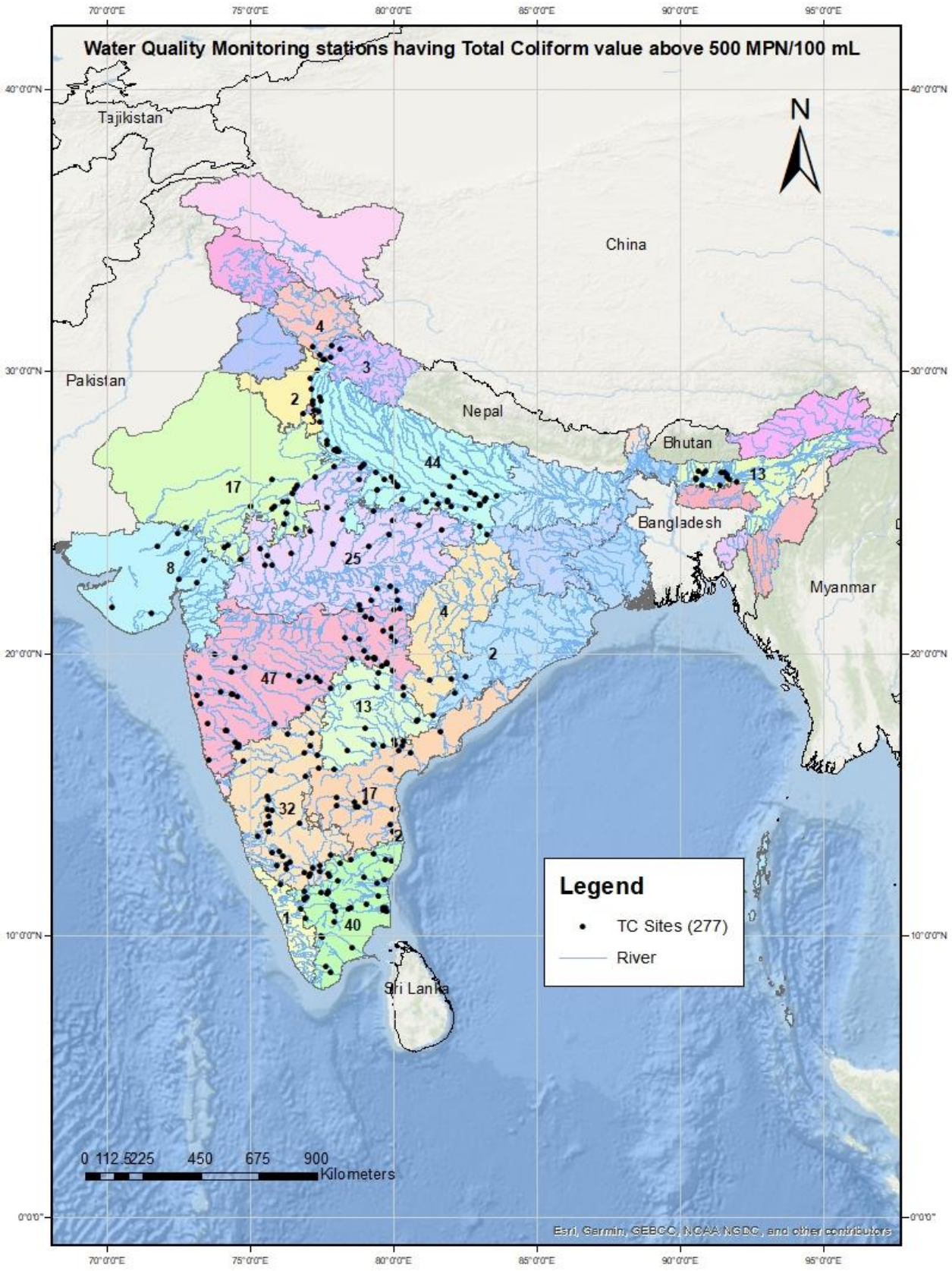
S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
215	Sakhara	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	3661	3772	2567
216	Sakleshpura	Hemavati	CD, Bangaluru	Karnataka	Hassan	51127	362800	362600
217	Sakmur	Wardha	WD, Nagpur	Maharashtra	Chandrapur	2519	4388	2222
218	Salebardi	Wainganga	WD, Nagpur	Maharashtra	Bhandara	*	4302	668
219	Saloora	Manjira	UGD, Hyderabad	Telangana	Nizamabad	2053	2113	1900
220	Samdoli	Warna	UKD, Pune	Maharashtra	Sangli	*	32143	*
221	Sangam(LGD)	Kinnerasani	LGD, Hyderabad	Telangana	Bhadradri Kothagudem	1893	1727	2167
222	Sangod	Parwan	CD, Jaipur	Rajasthan	Kota	*	76500	*
223	Saradaput	Sabari	LGD, Hyderabad	Odisha	Malkangiri	1985	1926	1780
224	Sarangpur	Kalisindh	CD, Jaipur	Madhya Pradesh	Rajgarh	*	103800	*
225	Satna	Tons	MGD-3, Varanasi	Madhya Pradesh	Satna	6213	4627	5050
226	Satrapur	Kanhan	WD, Nagpur	Maharashtra	Nagpur	7480	5353	2433
227	Savandapur	Bhavani	SRD, Coimbatore	Tamil Nadu	Erode	17893	14260	4283
228	Seondha	Sindh	LYD, Agra	Madhya Pradesh	Datia	2032	2693	3060
229	Sevanur	Chittar	SRD, Coimbatore	Tamil Nadu	Erode	31467	*	7900
230	Shahzadpur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Kaushambi	7027	8280	5950
231	Shastri Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	7567	7933	6033
232	Shimoga	Tunga	CD, Bangaluru	Karnataka	Shimoga	68667	535909	780000
233	Singasadanapalli	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	1959867	2038667	4583333
234	Singavaram	Chitravathi	HD, Chennai	Andhra Pradesh	Anantapur	*	2567	-
235	Sonapur	Digaru	MBD, Guwahati	Assam	Kamrup (R)	-	970	2713
236	Suddakallu	Dindi	LKD, Hyderabad	Telangana	Mahaboob Nagar	1759	2820	1567
237	Sultanpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Sultanpur	6607	6227	7300
238	Sulurpet	Kalingi	HD, Chennai	Andhra Pradesh	Nellore	8563	*	-
239	T Bekuppe	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	489667	661200	358000
240	T K Halli	Shimsha	CD, Bangaluru	Karnataka	Mandya	329700	584091	132500
241	T Narsipura	Kabini	CD, Bangaluru	Karnataka	Mysore	64827	374400	74200
242	T.Ramapuram	Hagari	LKD, Hyderabad	Karnataka	Bellary	2485	3625	1657
243	Tadipatri	Pennar	HD, Chennai	Andhra Pradesh	Anantapur	7880	6220	*
244	Tal	Chambal	CD, Jaipur	Madhya Pradesh	Ratlam	*	113333	*
245	Tandalaiputhur	Ayyar	SRD, Coimbatore	Tamil Nadu	Thiruchirapalli	63667	*	*
246	Terwad	Panchganga	UKD, Pune	Maharashtra	Kolhapur	*	18525	*
247	Thengudi	Thirumalairajanar	HD, Chennai	Tamil Nadu	Thiruvarur	5647	2768	2998
248	Thengumarahada	Bhavani / Moyar	SRD, Coimbatore	Tamil Nadu	Nilgiris	16813	6012	3233
249	Theni	Vagai/Suruliar	SRD, Coimbatore	Tamil Nadu	Theni	20747	14173	8683
250	Thevur	Sarabenga	SRD, Coimbatore	Tamil Nadu	Salem	10843	6400	39333
251	Thimmanahalli	Yagachi	CD, Bangaluru	Karnataka	Hassan	140000	414000	237400
252	Thoppur	Thoppaiyar	SRD, Coimbatore	Tamil Nadu	Salem	31000	*	*
253	Tonk	Banas	CD, Jaipur	Rajasthan	Tonk	*	154000	*
254	Tuini	Tons	UYD, New Delhi	Uttarakhand	Dehradun	32420	27733	13617
255	U/S (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	*	9852	4183
256	U/S (Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	*	10833	8683
257	Udi	Chambal	LYD, Agra	Uttar Pradesh	Etawah	7100	8300	9180
258	Ujjain	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	931083	1700000
259	Urachikottai	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	4025	9592	*

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
260	V S Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	7320	7860	5533
261	Varanasi	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	7427	8067	6267
262	Varanavasi	Maruthaiyar	SRD, Coimbatore	Tamil Nadu	Perambalur	7950	4700	7900
263	Vautha	Sabarmati	MD, Gandhinagar	Gujarat	Ahmedabad	995385	852000	280000
264	Vazhavachanur	Ponnaiyar	HD, Chennai	Tamil Nadu	Thiruvannamalai	-	1213	-
265	Veligonda	Musi	LKD, Hyderabad	Telangana	Nalgonda	5815	4023	2875
266	Vijayawada	Krishna	LKD, Hyderabad	Andhra Pradesh	Krishna	2096	1801	1833
267	Villupuram	Ponnaiyar	HD, Chennai	Tamil Nadu	Villupuram	*	6315	2175
268	Vrindawan Bridge (Mathura U/S)	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	2402857	1143333	1058333
269	Wadakbal	Sina	UKD, Pune	Maharashtra	Solapur	*	125000	*
270	Wadenapally	Krishna	LKD, Hyderabad	Telangana	Nalgonda	1866	2433	1640
271	Wairagarh	Khobragadi	WD, Nagpur	Maharashtra	Gadchiroli	800	5650	957
272	Warunji	Koyna	UKD, Pune	Maharashtra	Satara	*	50000	*
273	Watrak Nr Vautha	Watrak	MD, Gandhinagar	Gujarat	Kheda	140000	27750	17667
274	Yadgir	Bhima	LKD, Hyderabad	Karnataka	Yadgir	*	1950	1400
275	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	LYD, Agra	Uttar Pradesh	Agra	652667	225533	364000
276	Yashwant Nagar	Giri	UYD, New Delhi	Himachal Pradesh	Simaur	12967	54786	19500
277	Yelli	Godavari	UGD, Hyderabad	Maharashtra	Nanded	2421	3380	2400

(-) means No Hotspot.

(*) means river dry/data not available.

Figure 29: Water Quality Monitoring stations having Total Coliform (TC) above 500 MPN/100ml (2023)



7.1.12 Faecal Coliform (FC)

Various indicators of faecal contamination are commonly employed to identify faecal coliform in river water. The abundance of these indicators is assumed to correlate with the density of pathogenic microorganisms originating from faecal sources. Consequently, it serves as an indication of the sanitary risk associated with various water utilizations.

Faecal Coliforms at 257 water quality stations on 125 rivers in 17 states found above 500 MPN/100mL. During pre-monsoon season, 184 water quality monitoring stations across 16 states-Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand reported average FC values exceeding 500 MPN/100 ml. In the monsoon season, 238 water quality monitoring stations across 17 states- Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Odisha, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand displayed similar findings. Finally, in the post-monsoon season, 181 water quality monitoring stations in 17 states- Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Odisha, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand recorded average FC values exceeding 500 MPN/100 ml.

Comparision between 2022 & 2023:

The comparison of faecal coliform hot-spots between 2022 and 2023 highlights significant trends in water quality across different seasonal periods. The data is summarized in the following table:

YEAR	Number of Hot-Spots found for Faecal Coliforms		
	Pre-Monoon	Monsoon	Post-Monsoon
2022	199	241	158
2023	184	238	181

The comparison between 2022 and 2023 suggests some variations in the trends of faecal coliforms across different seasons. While the pre-monsoon and monsoon seasons of 2023 showed slight decrease in the number of monitoring stations with elevated FC levels, post-monsoon season displayed increase compared to the corresponding season in 2022.

The hot spot study and GIS map for faecal coliform (FC) are given below in Table 18 and figure 30.

Table 18: Monitoring stations having Faecal Coliforms (FC) > 500 MPN in River Water in 2023

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
1	A.B. Road Crossing	Parwati	CD, Jaipur	Madhya Pradesh	Guna	*	18000	*
2	A.P. Puram	Chittar	SRD, Coimbatore	Tamil Nadu	Tirunelveli	*	*	1100
3	A.P.M.(Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	*	5056	3583
4	Abu Road	Banas	MD, Gandhinagar	Rajasthan	Sirohi	*	6262	5300
5	Aie NH Xing	Aie	MBD, Guwahati	Assam	Barpeta	*	732	700
6	Akbarpur	Chhoti sarju	MGD-3, Varanasi	Uttar Pradesh	Ambedkar Nagar	4060	4100	2633
7	Akkihebbal	Hemavati	CD, Bangaluru	Karnataka	Mandya	24560	39953	11760
8	Aklera	Parwan	CD, Jaipur	Rajasthan	Jhalawar	9300	17789	*
9	Alanthurai	Noyyal	SRD, Coimbatore	Tamil Nadu	Coimbatore	1100	2500	*
10	Allahabad	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	3987	4220	3400
11	Ambarampalayam	Bharathapuzha	SRD, Coimbatore	Tamil Nadu	Coimbatore	827	853	932
12	Ambasamudram	Vaigai	SRD, Coimbatore	Tamil Nadu	Theni	1693	*	518
13	Arjunwad	Krishna	UKD, Pune	Maharashtra	Kolhapur	*	7414	*
14	Asthi	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	989	1682	843
15	Auraiya	Yamuna	LYD, Agra	Uttar Pradesh	Auraiya	61193	39953	39420
16	Avarankuppam	Palar	SRD, Coimbatore	Tamil Nadu	Vellore	1300	780	*
17	B.P.M. (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	*	4231	6517
18	Badalapur	Ulhas	UKD, Pune	Maharashtra	Thane	14707	33133	5283
19	Baghpat	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	81320	22373	23833
20	Bakhari	Wainganga	WD, Nagpur	Madhya Pradesh	Seoni	1840	783	-
21	Baleni	Yamuna	UYD, New Delhi	Uttar Pradesh	Baghpat	216000	165733	193333
22	Baluaghat	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	3840	3973	3333
23	Bamni (Nagpur)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	1797	1448	912
24	Banda	Ken	LYD, Agra	Uttar Pradesh	Banda	994	4157	1222
25	Baranwada	Banas	CD, Jaipur	Rajasthan	Sawai-madhopur	*	13733	*
26	Barod	Kalisindh	CD, Jaipur	Rajasthan	Kota	38242	8255	22383
27	Basoda	Betwa	LYD, Agra	Madhya Pradesh	Vidisha	2373	2435	*
28	Bawapuram	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	1651	985	570
29	Belne Bridge	Gad	CD, Bangaluru	Maharashtra	Sindhudurg	4392	65800	6120
30	Bendrahalli	Suvarnavathi	CD, Bangaluru	Karnataka	Chamarajanagar	75860	100453	50200
31	Bhadana Village D/s of Kota City	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	15950	*
32	Bhadrachelam	Godavari	LGD, Hyderabad	Telangana	Khammam	1213	915	762
33	Bhatpalli	Peddavagu	WD, Nagpur	Telangana	Asifabad	1053	1275	1090
34	Bhind	Kunwari	LYD, Agra	Madhya Pradesh	Bhind	9144	16417	2700
35	Bigod	Banas	CD, Jaipur	Rajasthan	Bhilwara	8467	35067	*
36	Biligundulu	Cauvery	SRD,	Tamil Nadu	Krishnagiri	-	707	668

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
			Coimbatore					
37	Byladahalli	Haridra	CD, Bangaluru	Karnataka	Davanagere	*	43288	5525
38	Chaklagaon	Manas	MBD, Guwahati	Assam	Bongaigaon	*	-	613
39	Changsari	Kurijali	MBD, Guwahati	Assam	Kamrup (M)	*	543	647
40	Chengalpet	Palar	HD, Chennai	Tamil Nadu	Chengalpet	-	808	-
41	Chindnar	Indravathi	LGD, Hyderabad	Chhattisgarh	Dantewada	1176	1360	548
42	Chitrasani	Balaram	MD, Gandhinagar	Gujarat	Banaskantha	*	7015	2700
43	Cholachagudda	Malaprabha	CD, Bangaluru	Karnataka	Bagalkot	6686	35556	*
44	Chopan	Sone	MGD-3, Varanasi	Uttar Pradesh	Sonbhadra	2653	2287	1700
45	Chunchunkatte	Cauvery	CD, Bangaluru	Karnataka	Mysore	2600	49330	*
46	D/S (Ashti)	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	*	2894	2350
47	Dameracherla	Musi	LKD, Hyderabad	Telangana	Nalgonda	1317	1378	705
48	Daund	Bhima	UKD, Pune	Maharashtra	Pune	*	15333	*
49	Delhi Railway Bridge	Yamuna	UYD, New Delhi	Delhi	North Delhi	21038000	11869333	4100000
50	Deongaon Bridge	Bhima	LKD, Hyderabad	Karnataka	Bijapur	*	1733	*
51	Deosugar	Krishna	LKD, Hyderabad	Karnataka	Raichur	2001	1199	580
52	Derol Bridge	Sabarmati	MD, Gandhinagar	Gujarat	Sabarkantha	5100	3718	4900
53	Dhalegaon	Godavari	UGD, Hyderabad	Maharashtra	Parbhani	*	997	652
54	Dhansa	Sahibi	UYD, New Delhi	Delhi	South West Delhi	*	123000	*
55	Dhareri	Chambal	CD, Jaipur	Madhya Pradesh	Ujjain	*	292000	*
56	Dholpur	Chambal	LYD, Agra	Rajasthan	Dholpur	8746	9955	5860
57	Duddhi	Kanhar	MGD-3, Varanasi	Uttar Pradesh	Sonbhadra	2873	1480	1400
58	Elunuthi Mangalam	Noyyal	SRD, Coimbatore	Tamil Nadu	Erode	2091	733	1433
59	Etawah	Yamuna	LYD, Agra	Uttar Pradesh	Etawah	426667	137267	556000
60	Gaisabad	Bearma	LYD, Agra	Madhya Pradesh	Damoh	2000	1859	1960
61	Galeta	Hindon	UYD, New Delhi	Uttar Pradesh	Meerut	6992667	1274667	9900000
62	Gandhavayal	Gandhayar	SRD, Coimbatore	Tamil Nadu	Coimbatore	2579	1402	572
63	Gandlapet	Peddavagu	UGD, Hyderabad	Telangana	Nizamabad	1804	1009	607
64	Ganguwala	Yamuna	UYD, New Delhi	Himachal Pradesh	Sirmaur	6560	5907	9017
65	Ganod	Bhadar	MD, Gandhinagar	Gujarat	Rajkot	*	5880	*
66	Garhakota	Sonar	LYD, Agra	Madhya Pradesh	Sagar	*	3685	*
67	Garrauli	Dhasan	LYD, Agra	Madhya Pradesh	Chhatarpur	1008	6944	3212
68	Ghazipur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	3887	3973	2967
69	Gokak	Ghataprabha	CD, Bangaluru	Karnataka	Belgaum	*	41900	6800

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
70	Gokul Barrage II Mathura D/S	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	874667	2006667	2730000
71	GR Bridge	Godavari	UGD, Hyderabad	Maharashtra	Parbhani	1583	1403	700
72	Gudam Bridge	Pranhita	WD, Nagpur	Maharashtra	Gadchiroli	-	575	-
73	Gummanur	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	1713	1339	1780
74	Guwahati D.C. Court	Brahmaputra	MBD, Guwahati	Assam	Kamrup (M)	-	-	1037
75	Halia	Halia	LKD, Hyderabad	Telangana	Nalgonda	1289	1385	*
76	Hamirpur	Yamuna	LYD, Agra	Uttar Pradesh	Hamirpur	23513	10520	6740
77	Hanging Bridge	Chambal/Parwati	CD, Jaipur	Rajasthan	Kota	*	9325	*
78	Haralahalli	Tungabhadra	CD, Bangaluru	Karnataka	Haveri	11971	41218	21950
79	Hariharapura	Tunga	CD, Bangaluru	Karnataka	Chikamagalur	42740	33880	33460
80	Haripur	Tons	UYD, New Delhi	Uttarakhand	Dehradun	6773	9193	13967
81	Hivra	Wardha	WD, Nagpur	Maharashtra	Wardha	700	1487	-
82	Hogenakkal	Chinnar	SRD, Coimbatore	Tamil Nadu	Dharmapuri	4900	*	3300
83	Holehonnur	Bhadra	CD, Bangaluru	Karnataka	Shimoga	29967	37653	12760
84	Honnali	Tungabhadra	CD, Bangaluru	Karnataka	Davanagere	46484	107587	6220
85	Hoovinahole	Swarnamukhi	CD, Bangaluru	Karnataka	Chitradurga	5140	*	*
86	Huvinhedgi	Krishna	LKD, Hyderabad	Karnataka	Raichur	1399	1318	647
87	Irrukkankudi	Vaippar	SRD, Coimbatore	Tamil Nadu	Virudhunagar	*	4900	1280
88	Jagdalpur	Indravathi	LGD, Hyderabad	Chhattisgarh	Bastar	1358	1218	-
89	Jaunpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	3887	3440	3167
90	Jawahar Bridge, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	258667	97933	224000
91	Jhalawad	Kalisindh	CD, Jaipur	Rajasthan	Jhalawar	*	14510	*
92	Jhansi Mirjapur Highway Road Bridge	Betwa	LYD, Agra	Uttar Pradesh	Hamirpur	2953	3826	2640
93	K M Vadi	Cauvery/ Lakshmanthirth	CD, Bangaluru	Karnataka	Mysore	7693	50375	19200
94	K.T.(Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	*	7817	6500
95	Kailash Mandir, Near Benpur Village	Yamuna	LYD, Agra	Uttar Pradesh	Agra	377267	126213	208000
96	Kalanaur	Yamuna	UYD, New Delhi	Uttar Pradesh	Saharanpur	10687	11320	8233
97	Kalpi	Yamuna	LYD, Agra	Uttar Pradesh	Jalaun	22880	9779	15640
98	Kamalpur	Banas	MD, Gandhinagar	Gujarat	Patan	*	7050	*
99	Karad	Krishna	UKD, Pune	Maharashtra	Satara	*	11250	*
100	Karnal	Yamuna	UYD, New Delhi	Haryana	Karnal	15107	9600	14133
101	Keesara	Munneru	LKD, Hyderabad	Andhra Pradesh	Krishna	1224	1021	535
102	Keolari	Wainganga	WD, Nagpur	Madhya Pradesh	Seoni	528	1677	682
103	Khanpur	Mahi	MD, Gandhinagar	Gujarat	Anand	3200	5347	3300

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
104	Khatoli	Parwati	CD, Jaipur	Rajasthan	Kota	21800	16000	10600
105	Kodumudi	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	889	1161	933
106	Koggedoddi	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	37217	42613	7380
107	Kokiwada	Pench	WD, Nagpur	Madhya Pradesh	Chhindwara	1813	1833	2548
108	Kollegal	Cauvery	CD, Bangaluru	Karnataka	Chamarajanagar	47700	76920	3920
109	Konta	Sabari	LGD, Hyderabad	Chhattisgarh	Bastar	1304	1255	655
110	Kopergaon	Godavari	UGD, Hyderabad	Maharashtra	Ahmednagar	*	1387	*
111	Kora	Rind	LYD, Agra	Uttar Pradesh	Fatehpur	2131	1885	1720
112	Kudalaiyathur	Vellar	HD, Chennai	Tamil Nadu	Cuddalore	945	*	-
113	Kudige	Cauvery	CD, Bangaluru	Karnataka	Kodagu	17467	57840	10060
114	Kuldahbridge	Sone	MGD-3, Varanasi	Madhya Pradesh	Sidhi	3060	3080	1650
115	Kulsi	Kulsi	MBD, Guwahati	Assam	Kamrup (R)	-	-	550
116	Kumhari	Wainganga	WD, Nagpur	Madhya Pradesh	Balaghat	-	1134	-
117	Kuppelur	Kumudavathi	CD, Bangaluru	Karnataka	Haveri	*	42256	*
118	Kurundwad	Krishna	UKD, Pune	Maharashtra	Kolhapur	*	5967	*
119	Lakkavalli	Bhadra	CD, Bangaluru	Karnataka	Chikamagalur	39320	70993	6820
120	Lakshmanapatti	Kodaganar	SRD, Coimbatore	Tamil Nadu	Dindigul	640	2250	1533
121	Lalpur	Sengar	LYD, Agra	Uttar Pradesh	Kanpur Dehat	2539	8540	2073
122	Lodhikheda	Jam	WD, Nagpur	Madhya Pradesh	Chhindwara	3006	1547	5783
123	Luwara	Shetrunji	MD, Gandhinagar	Gujarat	Bhavnagar	10092	5713	5517
124	M H Halli	Hemavati	CD, Bangaluru	Karnataka	Hassan	39544	23800	7440
125	Madhira	Wyra	LKD, Hyderabad	Telangana	Khammam	1143	962	-
126	Madla	Ken	LYD, Agra	Madhya Pradesh	Panna	*	1418	1900
127	Magardhara	Wainganga	WD, Nagpur	Madhya Pradesh	Balaghat	1357	1873	-
128	Mahalgaon	Wainganga	WD, Nagpur	Maharashtra	Gondia	871	-	650
129	Mahidpur	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	40350	*
130	Maighat	Gomti	MGD-3, Varanasi	Uttar Pradesh	Jaunpur	3173	3513	2600
131	Malkhed	Kangna	LKD, Hyderabad	Karnataka	Gulbarga	1931	1258	528
132	Mancherial	Godavari	UGD, Hyderabad	Telangana	Mancherial	1497	1236	547
133	Mandawara	Chambal	CD, Jaipur	Rajasthan	Kota	11580	13027	10500
134	Manderial	Chambal	CD, Jaipur	Rajasthan	Karauli	6953	12840	17000
135	Mangaon	Kal	UKD, Pune	Maharashtra	Raigad	*	6592	*
136	Mantralayam	Tungabhadra	LKD, Hyderabad	Andhra Pradesh	Kurnool	1146	874	-
137	Marella	Gundlakamma	LKD, Hyderabad	Andhra Pradesh	Prakasam	1071	-	-
138	Marol	Varada	CD, Bangaluru	Karnataka	Haveri	*	58200	*

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
139	Mataji	Mahi	MD, Gandhinagar	Madhya Pradesh	Ratlam	9455	6600	8525
140	Mawi	Yamuna	UYD, New Delhi	Uttar Pradesh	Shamli	143267	137067	156667
141	Mejaroad	Tons	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	2100	1987	1767
142	Mirzapur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Mirzapur	3607	4220	3550
143	Mohana	Betwa	LYD, Agra	Uttar Pradesh	Jalaun	9735	10879	4480
144	Mohna	Yamuna	UYD, New Delhi	Haryana	Faridabad	718000	960667	2433333
145	Mungoli	Penganga	WD, Nagpur	Maharashtra	Yavatmal	-	564	762
146	Munugodu	Edduvagu	LKD, Hyderabad	Andhra Pradesh	Guntur	1378	969	-
147	Muradpur	Vashishti	UKD, Pune	Maharashtra	Ratnagiri	*	8336	*
148	Murappanadu	Tambraparani	SRD, Coimbatore	Tamil Nadu	Tuticorin	-	717	903
149	Musiri	Cauvery	SRD, Coimbatore	Tamil Nadu	Thiruchirapalli	877	2723	1097
150	Muthankera	Kabini	CD, Bangaluru	Kerala	Wayanad	26750	57733	25000
151	Nagothane	Amba	UKD, Pune	Maharashtra	Raigad	*	4900	*
152	Naidupet	Swarnamukhi	HD, Chennai	Andhra Pradesh	Nellore	523	817	-
153	Nallamaranpatty	Amaravathi	SRD, Coimbatore	Tamil Nadu	Karur	-	865	615
154	Nanded	Godavari	UGD, Hyderabad	Maharashtra	Nanded	1118	1543	-
155	Nandgaon	Wunna	WD, Nagpur	Maharashtra	Wardha	2421	1192	1700
156	Nandipalli	Sagileru	HD, Chennai	Andhra Pradesh	Kadapa	-	-	1077
157	Nashik	Godavari	UGD, Hyderabad	Maharashtra	Nasik	1495	1218	630
158	Naugaon	Yamuna	UYD, New Delhi	Uttarakhand	Uttarakashi	4693	6040	7067
159	Nellore	Pennar	HD, Chennai	Andhra Pradesh	Nellore	-	-	1695
160	Noida	Yamuna	UYD, New Delhi	Uttar Pradesh	Gautam Budh Nagar	10793333	2833333	3683333
161	Nona	Nona	MBD, Guwahati	Assam	Nalbari	*	636	1410
162	Nowrangpur	Indravathi	LGD, Hyderabad	Odisha	Nowrangpur	1411	1070	692
163	Odenthurai	Kallar	SRD, Coimbatore	Tamil Nadu	Coimbatore	2691	993	1063
164	Orai Rath marg Road Bridge, Chikasi	Betwa	LYD, Agra	Uttar Pradesh	Jalaun	10113	9865	5340
165	P.G. Bridge	Penganga	WD, Nagpur	Maharashtra	Yavatmal	617	1263	-
166	Pachawali	Sindh	LYD, Agra	Madhya Pradesh	Shivpuri	*	2096	*
167	Pachegaon	Pravara	UGD, Hyderabad	Maharashtra	Ahmednagar	1357	1160	-
168	Padardibadi	Mahi	MD, Gandhinagar	Rajasthan	Dungarpur	14894	5540	7283
169	Paleru Bridge	Paleru	LKD, Hyderabad	Andhra Pradesh	Krishna	1216	920	528
170	Pali	Chambal	CD, Jaipur	Rajasthan	Sawai-madhopur	10573	11427	10633
171	Palla	Yamuna	UYD, New Delhi	Delhi	North West Delhi	199333	146800	155833
172	Paramkudi	Vaigai	SRD, Coimbatore	Tamil Nadu	Ramanathapuram	1080	*	3350

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
173	Pargaon	Bhima	UKD, Pune	Maharashtra	Pune	*	12233	*
174	Patala	Wardha	WD, Nagpur	Maharashtra	Chandrapur	681	3035	1872
175	Patansaongi	Chandrabhaga	WD, Nagpur	Maharashtra	Nagpur	1909	1281	768
176	Pathagudem	Indravathi	LGD, Hyderabad	Chhattisgarh	Bijapur	1527	1010	812
177	Pauni	Wainganga	WD, Nagpur	Maharashtra	Bhandara	1825	1485	1445
178	Perur	Godavari	UGD, Hyderabad	Telangana	Mulugu	1517	994	617
179	Phulgaon	Bhima	UKD, Pune	Maharashtra	Pune	*	20333	*
180	Poanta	Yamuna	UYD, New Delhi	Himachal Pradesh	Simaur	27800	9860	6433
181	Poiyaghat, Agra	Yamuna	LYD, Agra	Uttar Pradesh	Agra	337267	112533	171800
182	Polavaram	Godavari	LGD, Hyderabad	Andhra Pradesh	West Godavari	1516	1549	-
183	Pratap pur	Yamuna	LYD, Agra	Uttar Pradesh	Prayagraj	4016	3511	2143
184	Pratapgarh	Sai	MGD-3, Varanasi	Uttar Pradesh	Pratapgarh	4240	3260	1650
185	Pratappur	Pravara	UGD, Hyderabad	Maharashtra	Ahmednagar	1320	1846	-
186	Purna	Purna	UGD, Hyderabad	Maharashtra	Parbhani	*	1249	550
187	Puthimari	Puthimari	MBD, Guwahati	Assam	Kamrup	*	-	1340
188	Rahu (Mirawadi)	Mula-Mutha	UKD, Pune	Maharashtra	Pune	*	13083	*
189	Rajapur	Yamuna	LYD, Agra	Uttar Pradesh	Chitrakoot	6060	5533	4720
190	Rajegaon	Pranhita	WD, Nagpur	Madhya Pradesh	Balaghat	-	1555	-
191	Rajghat (Agra)	Betwa	LYD, Agra	Uttar Pradesh	Lalitpur	1613	1323	1716
192	Ramakona	Kanhan	WD, Nagpur	Madhya Pradesh	Chhindwara	2307	3313	2053
193	Rangeli	Som	MD, Gandhinagar	Rajasthan	Dungarpur	5277	8027	3833
194	Renukaji	Giri	UYD, New Delhi	Himachal Pradesh	Sirmaur	4527	6620	5900
195	Sahijana	Betwa	LYD, Agra	Uttar Pradesh	Hamirpur	2767	2379	1996
196	Saidpur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Ghazipur	3353	3620	2100
197	Saigaon	Manjira	UGD, Hyderabad	Karnataka	Bidar	*	1335	*
198	Sakhara	Wainganga	WD, Nagpur	Maharashtra	Gadchiroli	1161	1573	823
199	Sakleshpura	Hemavati	CD, Bangaluru	Karnataka	Hassan	28183	105587	16080
200	Sakmur	Wardha	WD, Nagpur	Maharashtra	Chandrapur	1267	1040	1142
201	Salebardi	Wainganga	WD, Nagpur	Maharashtra	Bhandara	*	1575	-
202	Saloora	Manjira	UGD, Hyderabad	Telangana	Nizamabad	1297	1491	-
203	Samdoli	Warna	UKD, Pune	Maharashtra	Sangli	*	9079	*
204	Sangam (LGD)	Kinnerasani	LGD, Hyderabad	Telangana	Bhadradri Kothagudem	1181	1019	-
205	Sangod	Parwan	CD, Jaipur	Rajasthan	Kota	*	10320	*
206	Saradaput	Sabari	LGD, Hyderabad	Odisha	Malkangiri	1292	957	838
207	Sarangpur	Kalisindh	CD, Jaipur	Madhya Pradesh	Rajgarh	*	20280	*
208	Satna	Tons	MGD-3, Varanasi	Madhya Pradesh	Satna	3513	2327	2400
209	Satpokhali	Koa	MBD, Guwahati	Assam	Kamrup	*	705	*
210	Satrapur	Kanhan	WD, Nagpur	Maharashtra	Nagpur	2607	2079	1150
211	Savandapur	Bhavani	SRD, Coimbatore	Tamil Nadu	Erode	681	881	755
212	Seondha	Sindh	LYD, Agra	Madhya	Datia	1233	1681	2088

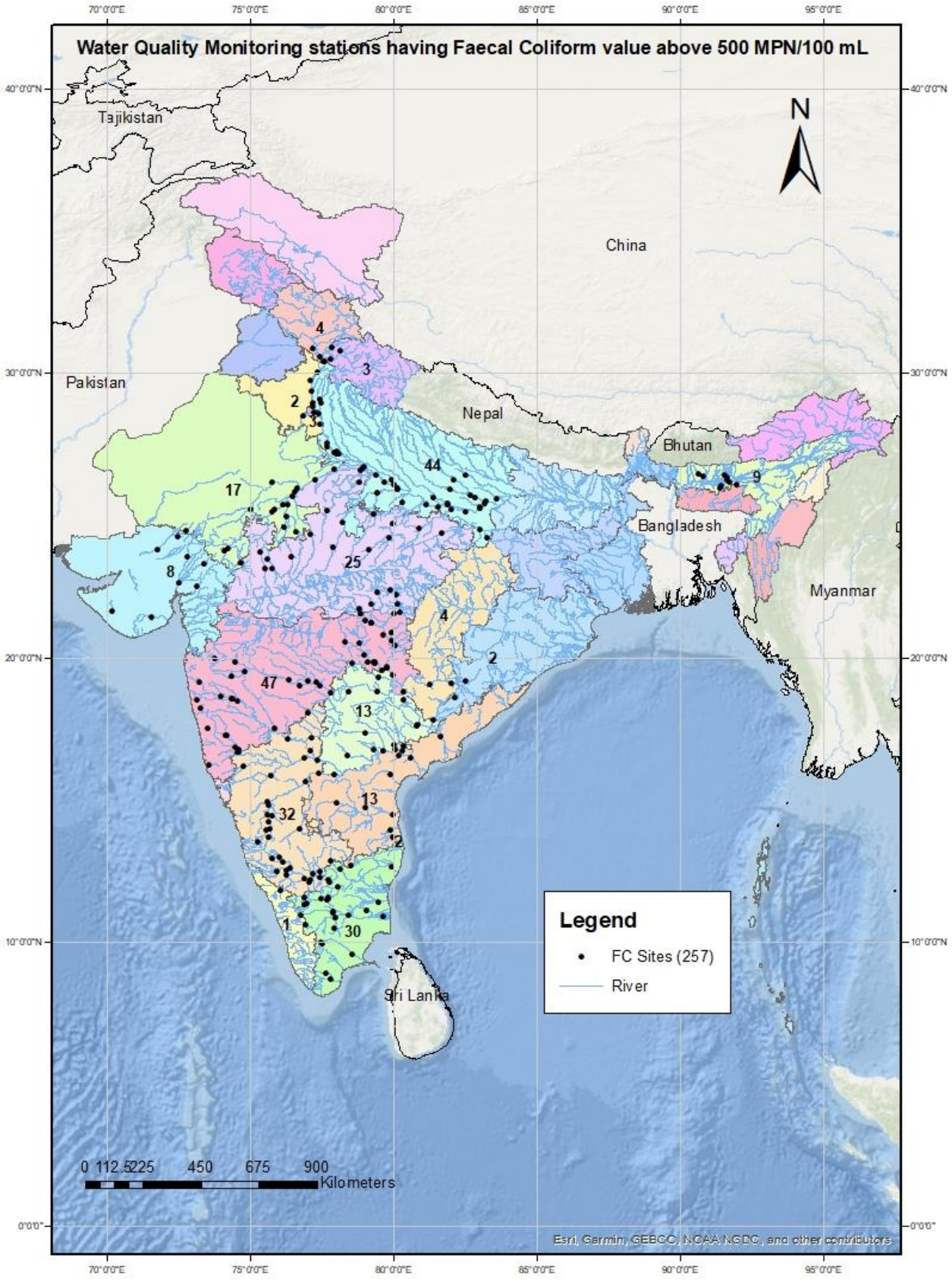
S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
				Pradesh				
213	Sevanur	Chittar	SRD, Coimbatore	Tamil Nadu	Erode	3513	*	1100
214	Shahzadpur	Ganga	MGD-3, Varanasi	Uttar Pradesh	Kaushambi	3447	3980	3000
215	Shastri Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Prayagraj	3900	3953	2867
216	Shimoga	Tunga	CD, Bangaluru	Karnataka	Shimoga	18967	39800	30600
217	Singasadanapalli	Ponnaiyar	SRD, Coimbatore	Tamil Nadu	Krishnagiri	631000	430000	433333
218	Sonapur	Digaru	MBD, Guwahati	Assam	Kamrup (R)	-	581	1570
219	Suddakallu	Dindi	LKD, Hyderabad	Telangana	Mahaboob Nagar	1192	1252	-
220	Sultanpur	Gomti	MGD-3, Varanasi	Uttar Pradesh	Sultanpur	3400	3227	3900
221	Sulurpet	Kalingi	HD, Chennai	Andhra Pradesh	Nellore	3623	*	-
222	T Bekuppe	Arkavathy	CD, Bangaluru	Karnataka	Ramanagara	209691	156067	77600
223	T K Halli	Shimsha	CD, Bangaluru	Karnataka	Mandya	94696	78345	22750
224	T Narsipura	Kabini	CD, Bangaluru	Karnataka	Mysore	16263	56200	14960
225	T. Ramapuram	Hagari	LKD, Hyderabad	Karnataka	Bellary	1415	713	-
226	Tadipatri	Pennar	HD, Chennai	Andhra Pradesh	Anantapur	1993	-	*
227	Tal	Chambal	CD, Jaipur	Madhya Pradesh	Ratlam	*	11433	*
228	Terwad	Panchganga	UKD, Pune	Maharashtra	Kolhapur	*	6358	*
229	Thengudi	Thirumalairajanar	HD, Chennai	Tamil Nadu	Thiruvarur	633	-	-
230	Thengumarahada	Bhavani / Moyar	SRD, Coimbatore	Tamil Nadu	Nilgiris	2301	531	505
231	Theni	Vagai/Suruliar	SRD, Coimbatore	Tamil Nadu	Theni	1181	1130	877
232	Thevur	Sarabenga	SRD, Coimbatore	Tamil Nadu	Salem	2621	775	1467
233	Thimmanahalli	Yagachi	CD, Bangaluru	Karnataka	Hassan	29489	56207	10160
234	Thoppur	Thoppaiyar	SRD, Coimbatore	Tamil Nadu	Salem	3026	*	*
235	Tonk	Banas	CD, Jaipur	Rajasthan	Tonk	*	12600	*
236	Tuini	Tons	UYD, New Delhi	Uttarakhand	Dehradun	5147	4747	5567
237	U/S (Bamni)	Wardha	WD, Nagpur	Maharashtra	Chandrapur	*	4770	1480
238	U/S (Satrapur)	Kanhan	WD, Nagpur	Maharashtra	Nagpur	*	2628	3178
239	Udi	Chambal	LYD, Agra	Uttar Pradesh	Etawah	4159	5511	5920
240	Ujjain	Shipra	CD, Jaipur	Madhya Pradesh	Ujjain	*	186917	330000
241	Urachikottai	Cauvery	SRD, Coimbatore	Tamil Nadu	Erode	1090	555	*
242	V S Bridge	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	3700	4207	2650
243	Varanasi	Ganga	MGD-3, Varanasi	Uttar Pradesh	Varanasi	4173	3920	2817
244	Varanavasi	Maruthaiyar	SRD, Coimbatore	Tamil Nadu	Perambalur	1090	883	780
245	Vautha	Sabarmati	MD, Gandhinagar	Gujarat	Ahmedabad	418615	85933	65833
246	Veligonda	Musi	LKD,	Telangana	Nalgonda	3438	1342	755

S.No.	Water Quality Stations	River/ Reservoir	Division	State	District	Pre-Monsoon	Monsoon	Post-Monsoon
			Hyderabad					
247	Vijayawada	Krishna	LKD, Hyderabad	Andhra Pradesh	Krishna	1383	1022	-
248	Vrindawan Bridge (Mathura U/S)	Yamuna	UYD, New Delhi	Uttar Pradesh	Mathura	432857	208667	333333
249	Wadakbal	Sina	UKD, Pune	Maharashtra	Solapur	*	60000	*
250	Wadenapally	Krishna	LKD, Hyderabad	Telangana	Nalgonda	1246	1109	573
251	Wairagarh	Khobragadi	WD, Nagpur	Maharashtra	Gadchiroli	-	1267	-
252	Warunji	Koyna	UKD, Pune	Maharashtra	Satara	*	15325	*
253	Watrak Nr Vautha	Watrak	MD, Gandhinagar	Gujarat	Kheda	33000	11225	5000
254	Yadgir	Bhima	LKD, Hyderabad	Karnataka	Yadgir	*	1086	700
255	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	LYD, Agra	Uttar Pradesh	Agra	412000	149333	252000
256	Yashwant Nagar	Giri	UYD, New Delhi	Himachal Pradesh	Simaur	5607	11879	8200
257	Yelli	Godavari	UGD, Hyderabad	Maharashtra	Nanded	1341	1244	502

(-) means No Hotspot.

(*) means river dry/data not available.

Figure 30: Water Quality Monitoring stations having Faecal Coliform (FC) above 500 MPN/100ml (2023)



7.1.13 Sodium Adsorption Ratio (SAR)

Sodium adsorption ratio (SAR) is an irrigation water quality parameter used in the management of sodium-affected soils. It is an indicator of the suitability of water for use in agricultural irrigation, as determined from the concentrations of the main alkaline and earth alkaline cations present in the water. It is also a standard diagnostic parameter for the sodicity hazard of a soil as determined from analysis of pore water extracted from the soil. SAR is a measure of the amount of sodium (Na^{+}) relative to calcium (Ca^{2+}) and magnesium (Mg^{2+}) in the water extracted from a saturated soil paste.

Soils that have values for sodium adsorption ratio of 13 or more may have an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

SAR allows assessment of the state of flocculation or of dispersion of clay aggregates in a soil. Sodium and potassium ions facilitate the dispersion of clay particles while calcium and magnesium promote their flocculation. The behaviour of clay aggregates influences the soil structure and affects the permeability of the soil whose directly depends on the water infiltration rate. It is important to accurately know the nature and the concentrations of cations at which the flocculation occurs: critical flocculation concentration (CFC). The SAR parameter is also used to determine the stability of colloids in suspension in water.

Although SAR is only one factor in determining the suitability of water for irrigation, in general, the higher the sodium adsorption ratio, the less suitable the water is for irrigation. Irrigation using water with high sodium adsorption ratio may require soil amendments to prevent long-term damage to the soil.

In 2023, the pre-monsoon, monsoon, and post-monsoon seasons consistently demonstrated that the average values of SAR (Sodium Adsorption Ratio) at all water quality monitoring stations remained within the permissible limit of Class E, as designated by the Central Pollution Control Board (CPCB) for the best uses of water. This observation indicates that the levels of sodium relative to other ions in the water were within the acceptable range, suggesting no significant deterioration in water quality with respect to SAR during these periods.

CHAPTER – 8

COMPARISON STUDY (PARAMETER VALUES) - HOT SPOTS IN (JANUARY-DECEMBER, 2022) WITH (JANUARY-DECEMBER, 2023)

Comparison has been done among the water quality hotspots observed for the period January-December, 2022 with the average values of pre-monsoon, monsoon and post monsoon from January-December, 2023 of 11 parameters (pH, EC, DO, BOD, TC, FC, Fluoride, Nitrate as N, Chloride, Total Hardness and Ammonia as N). The summary is as under:

8.1 pH

The comparison of hotspots at various monitoring stations along rivers during the years 2022 and 2023 reveals significant changes in water quality and environmental conditions. The assessment considered pre-monsoon (Pre-M), monsoon (M) and post-monsoon (Post-M) periods to capture seasonal variations and their impact on the identified hotspots. In 2022, 19 water quality monitoring stations were identified as hotspots during the pre-monsoon, monsoon, and post-monsoon periods, while in 2023, 23 water quality stations were observed as hotspots. These hotspots were compared with the average values of the pre-monsoon, monsoon, and post-monsoon periods of January to December 2023. Ten (10) water quality stations, namely Bamnidhi, Bhind, Jaunpur, Jondhra, Khanpur, Kharkhana, Maighat, Rangeli, Vazhavachanur, and Villupuram, located along eight rivers (Hasdeo, Kunwari, Gomti, Seonath, Mahi, Myntdu, Som, Ponnaiyar), were identified as common hotspot stations during both 2022 and 2023.

Several monitoring stations showed an improvement in water quality from 2022 to 2023. For instance, areas such as Kharkhana (Myntdu River) demonstrated improvement throughout all seasons, Khanpur (Mahi River) during the post-monsoon and Villupuram (Ponnaiyar River) showed signs of improvement during the pre-monsoon, with either no hotspots detected or a decrease in hotspot intensity. Conversely, several monitoring stations experienced deterioration in water quality over the same period. Locations like Bhind (Kunwari River), Jaunpur (Gomti River), Jondhra (Seonath river) and Maighat (Gomti River) during the pre-monsoon season and Rangeli (Som River) showed consistent or worsening hotspot conditions during the post-monsoon season, indicating persistent environmental challenges and potential anthropogenic influences exacerbating water pollution. Some areas displayed mixed trends, with both improvements and ongoing challenges. For example, Khanpur (Mahi River) and Bamnidhi (Hasdeo River) saw fluctuations in hotspot presence and improvement in different seasons.

Table 19: Comparison of pH Hot Spots during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	Bamnidhi	Hasdeo	Chhattisgarh	-	-	8.68	8.53	-	8.39	NHS	-	NoHS
2	Bhind	Kunwari	Madhya Pradesh	8.64	-	-	8.92	-	-	D	-	-
3	Chitrasani	Balaram	Gujarat	*	-	8.57	*	-	8.36	*	-	NoHS
4	Elunuthi Mangalam	Noyyal	Tamil Nadu	8.54	8.51	-	8.47	8.45	-	NoHS	NoHS	-
5	Hivra	Wardha	Maharashtra	8.55	-	-	8.36	-	-	NoHS	-	-
6	Jaunpur	Gomti	Uttar Pradesh	8.57	-	-	8.59	-	-	D	-	-
7	Jondhra	Seonath	Chhattisgarh	8.80	-	-	8.82	-	-	D	-	-
8	Kamalapuram	Papagani	Andhra Pradesh	8.66	8.75	8.68	8.48	8.35	*	NoHS	NoHS	*
9	Khanpur	Mahi	Gujarat	-	-	8.70	8.79	8.56	8.53	D	D	IBHS
10	Kharkhana	Myntdu	Meghalaya	4.12	5.03	4.24	4.15	5.95	4.27	IBHS	IBHS	IBHS
11	Khatoli	Parwati	Rajasthan	8.55	-	-	8.44	-	-	NoHS	-	-
12	Maharo	Mayurakshi	Jharkhand	-	-	8.82	-	-	7.88	-	-	NoHS
13	Maighat	Gomti	Uttar Pradesh	8.62	-	-	8.63	-	-		-	-
14	P.G. Bridge	Penganga	Maharashtra	8.57	-	-	8.31	-	-	NoHS	-	-
15	Pali	Chambal	Rajasthan	8.69	-	8.53	8.44	-	8.49	NoHS	-	NoHS
16	Rangeli	Som	Rajasthan	-	-	8.62	8.57	8.69	8.65	NHS	NHS	D
17	Ranikor	Kynshi	Meghalaya	5.77	*	*	*	*	*	*	*	*
18	Vazhavachanur	Ponnaiyar	Tamil Nadu	-	8.60	-	8.59	8.07	-	NHS	NoHS	-
19	Villupuram	Ponnaiyar	Tamil Nadu	8.70	8.70	8.66	8.62	8.35	8.34	IBHS	NoHS	NoHS

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.2 Electrical Conductivity (EC)

The comparison of hotspots at various monitoring stations along rivers during the years 2022 and 2023 reveals significant changes in river water quality. Specifically, the comparison of water quality hotspots at monitoring stations along the Wardha River in Maharashtra, the Noyyal River in Tamil Nadu, and the Shetrunji River in Gujarat during the years 2022 and 2023 shows significant variations in electrical conductivity. In 2022, 7 water quality monitoring stations were identified as hotspots during the pre-monsoon, monsoon, and post-monsoon periods, while in 2023, 6 water quality stations were observed as hotspots. Three (03) water quality stations, namely B.P.M. (Bamni) (Wardha River), Elunuthi Mangalam (Noyyal River) and Luwara (Shetrunji River), were identified as common hotspots stations between 2022 and 2023.

The average electrical conductivity at the Elunuthimangalam and Luwara (Shetrunji

River) monitoring stations experienced a significant increase during the pre-monsoon and monsoon seasons, indicating a potential deterioration in water quality during the 2023 period. For Elunuthimangalam station, even during the post-monsoon season, the conductivity observed was 2290 µmhos/cm during 2023, exceeding the acceptable limit, while in 2022, the conductivity value was below the threshold, indicating non-hotspot status. For Luwara station, despite fluctuations, there is an overall deterioration in water quality hotspots at the Luwara station on the Shetrunji River from 2022 to 2023. However, there is a slight improvement in post-monsoon 2023. The water quality hotspot on the B.P.M.(Bamni) station along the Wardha River have shown a consistent increasing trend of deterioration from the monsoon to the post-monsoon period of both 2022 and 2023.

Table 20: Comparison of EC Hot Spots during year 2022 with 2023

S. No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	A.P. Puram	Chittar	Tamil Nadu	2546	*	*	*	*	743	*	*	*
2	B.P.M. (Bamni)	Wardha	Maharashtra	*	3381	3898	3978	3455	4519	*	D	D
3	Dhansa	Sahibi	Delhi	*	2582	*	*	2117	*	*	NoHS	*
4	Elunuthi Mangalam	Noyyal	Tamil Nadu	2408	2251	-	2574	3292	2290	D	D	D
5	Kopergaon	Godavari	Maharashtra	3585	-	-	*	-	*	*	-	*
6	Luwara	Shetrunji	Gujarat	5076	2289	4415	7897	3976	3420	D	D	IBHS
7	Varanavasi	Maruthaiyar	Tamil Nadu	2354	-	2318	1795	-	2012	NoHS	-	NoHS

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.3 Ammonia (NH_3-N)

The comparison of hotspots at various monitoring stations along rivers during the years 2022 and 2023 reveals significant changes in water quality and environmental conditions. In 2022, 28 water quality monitoring stations were identified as hotspots during the pre-monsoon, monsoon, and post-monsoon periods, while in 2023, 42 water quality stations were observed as hotspots.

Twenty-five (25) water quality monitoring stations were identified as common hotspots during pre-monsoon, monsoon and post-monsoon seasons in the years 2022 and 2023. These monitoring stations were located on 11 rivers Brahmani, Hindon, Hindon Cut, Kanhan, Kharkai, Ponnaiyar, Sabarmati, Sahibi, Wardha, and Yamuna. The data reveals that 8, 18, 12 monitoring stations show improvement but hot spot in ammonia levels during the pre-monsoon, monsoon and post monsoon seasons respectively. Ammonia levels deteriorate at all seasons in four water quality stations along the

Yamuna River: Jawahar Bridge in Agra, Kailash Mandir near Benpur Village, Poiyaghat in Agra, and the Expressway Road Bridge in Etamadpur. No hot spots were observed at the Kulpatanga (Kharkai river) and Baghpat (Yamuna River) during the pre-monsoon season. However, during the monsoon, two stations, Etawah (Yamuna River) and Gomlai (Brahmani River), exhibited no hot spots. Additionally, during the post-monsoon period, three stations - Gomlai, R.S.P-1, and R.S.P-2 (Brahmani River) showed improvement in ammonia levels.

Table 21: Comparison of Ammonia (NH_3-N) Hot Spots during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	Agra Canal	Yamuna	Delhi	10.19	7.43	7.98	10.55	3.25	6.75	D	IBHS	IBHS
2	B.P.M. (Bamni)	Wardha	Maharashtra	*	30.75	51.87	3.56	2.34	7.73	*	IBHS	IBHS
3	Baghpat	Yamuna	Uttar Pradesh	1.84	-	-	0.08	-	-	NoHS	-	-
4	Baleni	Yamuna	Uttar Pradesh	4.64	1.38	1.82	2.92	1.63	3.70	IBHS	D	D
5	Chilla Gaon	Hindon Cut	Delhi	34.48	11.31	10.46	12.37	3.19	5.05	IBHS	IBHS	IBHS
6	Delhi Railway Bridge	Yamuna	Delhi	21.16	9.95	14.09	18.44	7.16	10.20	D	IBHS	IBHS
7	Dhansa	Sahibi	Delhi	-	18.49	-	*	3.72	*	*	IBHS	*
8	Etawah	Yamuna	Uttar Pradesh	7.60	1.30	3.87	10.02	0.92	3.98	D	NoHS	D
9	Galeta	Hindon	Uttar Pradesh	10.17	7.69	8.44	12.35	5.03	4.13	D	IBHS	IBHS
10	Gokul Barrage II Mathura D/S	Yamuna	Uttar Pradesh	10.60	7.52	7.49	10.84	4.51	10.48	D	IBHS	D
11	Gomlai	Brahmani	Odisha	6.78	1.93	3.63	3.69	0.82	0.58	IBHS	NoHS	NoHS
12	Gummanur	Ponnaiyar	Tamil Nadu	1.60	4.96	8.10	5.60	3.63	3.75	D	IBHS	IBHS
13	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	9.74	3.03	8.03	15.26	4.74	10.15	D	D	D
14	K.T.(Satrapur)	Kanhan	Maharashtra	-	23.22	55.91	2.33	3.37	33.53	NHS	IBHS	IBHS
15	Kailash Mandir, Near Benpur Village	Yamuna	Uttar Pradesh	8.04	3.33	7.57	15.49	5.09	11.87	D	D	D
16	Kulpatanga	Kharkai	Jharkhand	2.39	3.27	-	0.49	1.63	0.39	NoHS	IBHS	NoHS
17	Mirawadi	Mula Mutha	Maharashtra	*	-	5.48	*	3.37	*	*	NHS	*
18	Mohna	Yamuna	Haryana	16.51	17.42	14.31	19.19	6.44	8.33	D	IBHS	IBHS
19	Noida	Yamuna	Uttar Pradesh	20.25	19.65	16.34	21.28	9.17	10.20	D	IBHS	IBHS
20	Okhla Barrage	Yamuna	Delhi	12.55	10.46	10.15	13.40	4.47	6.36	D	IBHS	IBHS
21	Poiyaghat, Agra	Yamuna	Uttar Pradesh	9.96	3.09	7.79	14.98	4.65	10.73	D	D	D
22	R.S.P	Brahmani	Odisha	27.10	38.71	25.53	17.02	14.62	1.40	IBHS	IBHS	IBHS
23	R.S.P-1	Brahmani	Odisha	20.60	18.85	18.45	10.92	9.52	0.76	IBHS	IBHS	NoHS
24	R.S.P-2	Brahmani	Odisha	6.90	14.18	5.52	2.79	3.58	1.15	IBHS	IBHS	NoHS

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
25	Singasadanapalli	Ponnaiyar	Tamil Nadu	32.39	17.62	23.74	24.47	24.81	25.67	IBHS	D	D
26	Vautha	Sabarmati	Gujarat	13.36	7.78	2.71	3.27	4.23	5.12	IBHS	IBHS	D
27	Vrindawan Bridge (Mathura U/S)	Yamuna	Uttar Pradesh	*	11.91	12.07	15.49	4.69	11.46	*	IBHS	IBHS
28	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	9.33	3.68	8.55	17.51	5.21	11.03	D	D	D

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.4 Total Hardness (TH)

The comparison of hotspots at various monitoring stations along rivers during the years 2022 and 2023 reveals significant changes in river water quality. In 2022, total hardness values were obtained for the pre-monsoon, monsoon, and post-monsoon seasons at three water quality monitoring stations: B.P.M. (Bamni) on the Wardha River in Maharashtra, Kopergaon on the Godavari River in Maharashtra, and Luwara on the Shetrunji River in Gujarat. However, in 2023, three water quality stations, namely B.P.M. (Bamni) on the Wardha River, Lakshmanapatti on the Kodaganar River, and Luwara on the Shetrunji River, were observed as hotspots. Two (2) water quality stations, namely B.P.M. (Bamni) on the Wardha River and Luwara on the Shetrunji River, were identified as common hotspots stations during both years.

Total hardness levels at the B.P.M. station along the Wardha River in Maharashtra showed fluctuations from 2022 to 2023. While no pre- and post-monsoon hotspots were identified in 2022, a hotspot emerged in the monsoon season. However, in 2023, total hardness values exceeded the acceptable limit in pre-monsoon and post-monsoon seasons. At the Luwara water quality station on the Shetrunji River, a decreasing trend in total hardness levels was observed from the pre-monsoon season to the post-monsoon season.

Table 22 Comparison of Hot Spots Total Hardness (TH) during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M(2022)	M(2022)	Post-M(2022)	Pre-M(2023)	M(2023)	Post-M(2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
1	B.P.M. (Bamni)	Wardha	Maharashtra	*	654	-	675	518	629	*	NoHS	NHS
2	Kopergaon	Godavari	Maharashtra	776	-	-	*	-	*	*	-	*
3	Luwara	Shetrunji	Gujarat	741	-	-	1046	-	-	D	-	-

(-) means No Hotspot; (*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.5 Chloride (Cl^-)

In 2022, only one (01) water quality monitoring station, Luwara, exceeded the acceptable limit, with chloride levels measured at 1507.43 mg/L before the monsoon season (pre-monsoon) and 1204.59 mg/L after the monsoon season (post-monsoon), indicating a significant decrease in chloride concentration. In 2023, three (03) water quality stations - Durvesh (Vaitarna River), Lakshmanapatti (Kodaganar River) and Luwara (Shetrunji River) - exceeded the acceptable limit set by the Bureau of Indian Standards (BIS).

During the pre-monsoon and monsoon seasons of 2023, water quality deteriorated with respect to chloride concentration, evidenced by an increase in chloride levels at Luwara (Shetrunji River). In the post-monsoon season of 2023, the chloride level decreased to 865 mg/L, indicating a considerable improvement compared to both the pre-monsoon phase of 2023 and the post-monsoon phase of 2022.

Table 23: Comparison of Chloride (Cl^-) Hot Spots during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	Luwara	Shetrunji	Gujarat	1507	-	1205	2306	1397	865	D	NHS	NoHS

(-) means No Hotspot.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.6 Fluoride (F^-)

During 2022, seven (07) water quality monitoring stations recorded fluoride concentrations exceeding acceptable limits, while in 2023, six (06) stations recorded fluoride concentrations exceeding acceptable limits. A comparison of hot spots in 2022 and 2023 reveals that four (04) stations—Kamalapuram (Papagani), Lingdem (HS) (Talangchu), R.S.P (Brahmani) and R.S.P-1 (Brahmani)—were common in both years. Lingdem Hot Spring station consistently showed fluoride concentrations above 5.0 mg/L across all seasons, surpassing the acceptable limit of 1.0 mg/L. No hot spots were observed at R.S.P and R.S.P-1 stations during the post-monsoon season and Kamalapuram, Singavaram and R.S.P. water quality monitoring stations during the monsoon season.

Table 24: Comparison of Fluoride (F^-) Hot Spots during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M(2022)	M(2022)	Post-M(2022)	Pre-M(2023)	M(2023)	Post-M(2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	Avarankuppam	Palar	Tamil Nadu	1.52	-	-	1.02	-	*	NoHS	-	*
2	Kamalapuram	Papagani	Andhra Pradesh	-	1.60	-	1.80	0.80	*	NHS	NoHS	*
3	Lingdem (HS)	Talangchu	Sikkim	5.37	6.37	5.70	7.57	6.31	7.30	D	IBHS	D
4	R.S.P	Brahmani	Odisha	1.86	2.09	1.83	1.67	1.14	1.30	IBHS	NoHS	NoHS
5	R.S.P-1	Brahmani	Odisha	-	-	1.58	1.86	-	0.33	NHS	-	NoHS
6	Singavaram	Chitravathi	Andhra Pradesh	-	1.85	1.60	*	1.07	1.28	*	NoHS	NoHS
7	Thoppur	Thoppaiyar	Tamil Nadu	*	-	1.54	1.35	*	*	*	*	*

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) | Deteriorate (D) | New Hotspot (NHS) | Improved but Hotspot (IBHS)

8.7 Nitrate as N (NO_3^--N):

In 2022, 93 water quality monitoring stations were identified as hotspots during the pre-monsoon, monsoon, and post-monsoon periods. In 2023, 42 water quality stations were observed as hotspots. Seventeen water quality stations—namely Adityapur, Anakapali, Bonaigarh, Domuhani, Ghatshila, Gomti Nagar (Lko D/S), Gummanur, Jamshedpur, Lupungdih, Madhabarida, Munugodu, R.S.P, R.S.P-1, Sorada, Tihar Khera, Tondarpur, and Veligonda—located along twelve rivers (Kharkai, Sarada, Brahmani, Subarnarekha, Gomti, Ponnaiyar, Badanadi, Edduvagu, Rushikulya, Ramganga, Sukheta, Musi) were identified as common hotspot stations during both 2022 and 2023. Thirteen water quality stations showed an improvement in water quality from 2022 to 2023, but these stations remain hotspots during the monsoon season. Gummanur (Ponnaiyar river), Munugodu (Edduvagu river) and Tondarpur (Sukheta river) exhibited raised nitrate concentration during the monsoon and post-monsoon season, making them new hotspot.

Table 25: Comparison of Hot Spots Nitrate as N (NO_3^--N) during year 2022 with 2023

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
1	Adityapur	Kharkai	Jharkhand	-	16.79	-	-	12.81	-	-	IBHS	-
2	Anakapali	Sarada	Andhra Pradesh	-	19.14	-	-	11.32	-	-	IBHS	-
3	Anandapur	Baitarani	Odisha	-	14.05	-	-	6.05	-	-	NoHS	-

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
4	Andhiyar Khore	Hamp	Chhattisgarh	17.24	13.29	12.68	2.66	1.34	0.34	NoHS	NoHS	NoHS
5	Aradei	Aradei	Odisha	-	18.69	-	-	7.96	-	-	NoHS	-
6	Balighat	Burhabalang	Odisha	-	14.09	-	-	6.02	-	-	NoHS	-
7	Bamnidhi	Hasdeo	Chhattisgarh	20.84	10.93	-	1.74	0.83	-	NoHS	NoHS	-
8	Bareilly	Ramganga	Uttar Pradesh	-	11.37	-	-	5.89	-	-	NoHS	-
9	Baridhi	Subarnarekha	Jharkhand	-	13.31	-	5.53	10.49	3.97	-	IBHS	-
10	Baripada	Burhabalang	Odisha	-	17.43	-	-	5.97	-	-	NoHS	-
11	Bhitaura	Ganga	Uttar Pradesh	-	12.88	-	-	4.48	-	-	NoHS	-
12	Bido	Brahmani	Odisha	-	12.03	-	-	9.51	-	-	NoHS	-
13	Bolani	Brahmani	Odisha	-	26.35	-	-	10.11	-	-	NoHS	-
14	Bonaigarh	Brahmani	Odisha	-	26.21	-	-	22.19	-	-	IBHS	-
15	Boudh	Mahanadi	Odisha	14.07	-	-	1.39	-	-	NoHS	-	-
16	Champa Road Bridge	Hasdeo	Chhattisgarh	14.04	11.82	-	1.83	0.92	-	NoHS	NoHS	-
17	Champua	Baitarani	Odisha	-	14.24	-	5.71	7.10	-	-	NoHS	-
18	Chandrika Devi (Lko U/S)	Gomti	Uttar Pradesh	-	14.41	-	2.89	5.35	-	-	NoHS	-
19	Dameracherla	Musi	Telangana	*	-	11.52	2.57	9.17	9.97	*	-	NoHS
20	Dhaneta	Kitcha/Bahgul	Uttar Pradesh	10.16	15.69	-	3.36	5.96	-	NoHS	NoHS	-
21	Domuhani	Subarnarekha	Jharkhand	-	18.55	-	-	12.27	-	-	NoHS	-
22	Etawah	Yamuna	Uttar Pradesh	11.56	14.99	13.33	5.27	4.57	5.61	NoHS	NoHS	NoHS
23	Gatora	Arpa	Chhattisgarh	22.45	13.78	-	6.85	2.69	-	NoHS	NoHS	-
24	Gatora-1	Arpa	Chhattisgarh	27.41	18.39	-	4.40	3.13	-	NoHS	NoHS	-
25	Gatora-2	Arpa	Chhattisgarh	29.87	17.62	-	8.14	3.58	-	NoHS	NoHS	-
26	GH.Rd. Bridge	Subarnarekha	Jharkhand	-	21.64	-	-	12.79	-	-	IBHS	-
27	Ghatshila	Subarnarekha	Jharkhand	-	21.11	-	-	10.36	-	-	IBHS	-
28	Gomlai	Brahmani	Odisha	-	26.20	-	-	6.03	-	-	NoHS	-
29	Gomti Nagar (Lko D/S)	Gomti	Uttar Pradesh	-	16.07	-	-	11.90	-	-	IBHS	-
30	Gopiballavpur	Subarnarekha	West Bengal	-	16.05	-	-	5.69	-	-	NoHS	-
31	Govindpur (NH-5)	Burhabalang	Odisha	-	16.12	-	-	5.36	-	-	NoHS	-
32	Gudari	Vamsadhara	Odisha	13.97	16.75	-	4.74	6.19	-	NoHS	NoHS	-
33	Gummanur	Ponnaiyar	Tamil Nadu	13.71	-	-	10.79	11.14	11.32	IBHS	NHS	NHS
34	Gunupur	Vamsadhara	Odisha	-	19.94	-	-	8.09	-	-	NoHS	-
35	Indupur	Brahmani	Odisha	-	14.61	-	-	6.46	-	-	NoHS	-
36	Jajmau	Ganga	Uttar Pradesh	-	10.93	-	-	7.79	-	-	NoHS	-
37	Jamshedpur	Subarnarekha	Jharkhand	-	17.00	-	-	10.43	-	-	IBHS	-
38	Jamsolaghat	Subarnarekha	Odisha	-	15.47	-	-	7.41	-	-	NoHS	-
39	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	-	15.14	10.53	-	3.44	2.29	-	NoHS	NoHS
40	Kailash Mandir, Near Benpur Village	Yamuna	Uttar Pradesh	17.24	14.61	-	2.30	2.91	-	NoHS	NoHS	-
41	Kalma	Mahanadi	Chhattisgarh	11.98	11.47	-	1.07	0.92	-	NoHS	NoHS	-
42	Kamalanga	Brahmani	Odisha	-	12.61	-	-	7.07	-	-	NoHS	-
43	Kanker	Dhudh	Chhattisgarh	10.87	-	-	3.94	-	-	NoHS	-	-
44	Kannauj	Kali	Uttar Pradesh	-	11.50	10.55	-	0.35	0.59	-	NoHS	NoHS
45	Kanpur	Ganga	Uttar Pradesh	-	10.60	-	-	0.19	-	-	NoHS	-
46	Kasganj	Kali	Uttar Pradesh	-	13.27	-	-	6.23	-	-	NoHS	-
47	Kashinagar	Vamsadhara	Odisha	-	15.80	-	-	7.69	-	-	NoHS	-
48	Katri Umrauli	Ganga	Uttar Pradesh	-	10.84	-	-	7.71	-	-	NoHS	-
49	Kelo	Kelo	Chhattisgarh	11.33	-	-	*	-	*	*	-	*
50	Kenduapada	Kanijhari	Odisha	-	16.60	-	-	6.05	-	-	NoHS	-
51	Keonjhar	Aradei	Odisha	-	18.21	-	-	9.23	-	-	NoHS	-

S.No.	Water Quality Monitoring Station	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
52	Kopergaon	Godavari	Maharashtra	*	-	18.46	*	-	*	*	-	*
53	Korba	Hasdeo	Chhattisgarh	10.41	-	-	0.89	-	-	NoHS	-	-
54	Korba-1	Hasdeo	Chhattisgarh	15.10	-	-	3.43	-	-	NoHS	-	-
55	Kulpatanga	Kharkai	Jharkhand	-	20.00	-	-	8.99	-	-	NoHS	-
56	Kusei	Baitarani	Odisha	-	14.13	-	-	5.99	-	-	NoHS	-
57	Lucknow	Gomti	Uttar Pradesh	-	14.39	-	-	6.90	-	-	NoHS	-
58	Lupungdih	Subarnarekha	Jharkhand	-	19.13	-	-	10.88	-	-	IBHS	-
59	Luwara	Shetrunji	Gujarat	12.94	-	-	6.78	-	-	NoHS	-	-
60	Madhabarida	Badanadi	Odisha	-	23.80	-	-	11.14	-	-	IBHS	-
61	Madhya Bharat Paper Ltd (MBPL)	Hasdeo	Chhattisgarh	14.87	12.40	-	2.19	1.03	-	NoHS	NoHS	-
62	Malkhed	Kangna	Karnataka	*	-	11.77	3.81	-	9.76	*	-	NoHS
63	Mehandipur	Ganga	Uttar Pradesh	-	10.28	11.47	-	7.44	6.23	-	NoHS	NoHS
64	Melliaputty	Mahendratanaya	Andhra Pradesh	-	18.40	10.35	-	9.43	5.68	-	NoHS	NoHS
65	Munugodu	Edduvagu	Andhra Pradesh	*	-	11.14	3.95	13.15	12.20	*	NHS	Deteriorate
66	Muri	Subarnarekha	Jharkhand	-	15.29	-	-	9.19	-	-	NoHS	-
67	Musala	Baitarani	Odisha	-	16.09	-	-	5.65	-	-	NoHS	-
68	Nandira	Brahmani	Odisha	-	13.01	-	-	4.94	-	-	NoHS	-
69	Pachegaon	Pravara	Maharashtra	*	-	14.69	7.93	-	5.66	*	-	NoHS
70	Patharidih	kharun	Chhattisgarh	20.71	14.59	16.40	9.52	3.12	0.60	NoHS	NoHS	NoHS
71	Poiyaghat, Agra	Yamuna	Uttar Pradesh	-	14.82	-	-	3.17	-	-	NoHS	-
72	Prakash Ind Ltd (PIL)	Hasdeo	Chhattisgarh	20.02	11.59	-	2.17	0.95	-	NoHS	NoHS	-
73	Purunagarh	Brahmani	Odisha	-	12.31	-	-	5.61	-	-	NoHS	-
74	Purushottampur	Rushikulya	Odisha	-	18.61	-	-	8.85	-	-	NoHS	-
75	R.S.P	Brahmani	Odisha	-	20.47	-	-	12.21	-	-	IBHS	-
76	R.S.P-1	Brahmani	Odisha	-	19.03	-	-	10.39	-	-	IBHS	-
77	R.S.P-2	Brahmani	Odisha	-	14.41	-	-	7.36	-	-	NoHS	-
78	Raebareli	Sai	Uttar Pradesh	-	13.21	-	-	5.25	-	-	NoHS	-
79	Rajghat	Subarnarekha	Odisha	-	13.78	-	-	6.21	-	-	NoHS	-
80	Seorinarayan	Mahanadi	Chhattisgarh	12.01	10.58	-	1.49	1.11	-	NoHS	NoHS	-
81	Shahjahanpur	Khannaut	Uttar Pradesh	-	12.07	-	-	4.94	-	-	NoHS	-
82	Simga	Seonath	Chhattisgarh	12.96	-	11.95	5.13	-	0.29	NoHS	-	NoHS
83	Sorada	Rushikulya	Odisha	-	22.70	10.52	8.76	11.67	7.38	-	NoHS	NoHS
84	Srikakulam	Nagavali	Andhra Pradesh	-	21.88	-	6.41	7.85	4.47	-	NoHS	-
85	Swampatana	Baitarani	Odisha	-	15.79	-	4.31	6.31	3.82	-	NoHS	-
86	Talcher	Brahmani	Odisha	-	11.78	-	3.75	4.65	3.43	-	NoHS	-
87	Tihar Khera	Ramganga	Uttar Pradesh	10.79	15.83	-	4.49	10.59	-	NoHS	IBHS	-
88	Tikarapara	Mahanadi	Odisha	-	20.59	-	-	5.87	-	-	NoHS	-
89	Tondarpur	Sukheta	Uttar Pradesh	-	10.46	-	-	6.46	12.98	-	NoHS	NHS
90	Vautha	Sabarmati	Gujarat	-	11.87	-	-	6.94	-	-	NoHS	-
91	Veligonda	Musi	Telangana	*	13.77	26.06	9.31	17.43	20.26	*	D	IBHS
92	Yadgir	Bhima	Karnataka	*	-	11.56	*	-	7.75	*	-	NoHS
93	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	15.90	13.46	11.47	2.36	3.97	2.20	NoHS	NoHS	NoHS

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.8 Dissolved Oxygen (DO):

Twelve (12) water quality monitoring stations on 9 rivers- Kwano, Banas, Baitarni, Badinadi, Wyra, Chambal, Nagavali, Mahanadi and Sankh were identified as No Hotspots during pre-monsoon season. Twelve (12) water quality monitoring stations on 10 rivers- Kwano, Banas, Barak, Subarnarekha, Vamsadhara, Kanijhari, Godavari, Koel, Manjira and Bhima were identified as No Hotspots during monsoon season. Four (4) water quality monitoring stations on 4 rivers- Arpa, Baitarni, Mahendratanaya and Ramganga were identified as No Hotspots during post-monsoon season.

Six (6) water quality monitoring stations on 6 rivers- Yamuna, Ramganaga, Brahmani, Paleru, Koel and Sarabenga were identified as New Hotspots during pre-monsoon season. Six (6) water quality monitoring stations on 6 rivers- Parvati, Arpa, Badinadi, Solani, Sukheta and Krishna were identified as New Hotspots during monsoon season. Twenty-five (25) water quality monitoring stations on 18 rivers- Aradei, Baitarni, Brahmani, Badinadi, Burhabalang, Kali, Kharkhai, Krishna, Musi, Nagavali, Paleru, Ponnaiyar, Purna, Rushikulya, Sarabenga, Solani, Subarnarekha and Vamsadhara were identified as New Hotspots during post-monsoon season.

Thirty-Nine (39) water quality monitoring stations on 18 rivers- Aradei, Arkavathy, Baitarni, Brahmani, Burhabalang, Godavari, Hindon Cut, Kali, Kharkai, Koel, Mahendratanaya, Musi, Rushikulya, Sabarmati, Sarada, Subarnarekha, Vamsadhara and Yamuna were identified as Improved but Hotspot during pre-monsoon season. Fifty-Seven (57) water quality monitoring stations on 26 rivers- Baitarni, Brahmani, Burhabalang, Gomti, Hindon, Hindon Cut, Kali, Kanhan, Koel, Kwano, Mahendratanaya, Munneru, Nagavali, Paleru, Ramganga, Rushikulya, Sabarmati, Sahibi, Sai, Sankh, Shipra, Subarnarekha, Vamsadhara, Wardha, Wyra and Yamuna were identified as Improved but Hotspot during monsoon season. Thirteen (13) water quality monitoring stations on 7 rivers- Godavari, Hindon, Hindon Cut, Kanhan, Kharkai, Rushikulya and Yamuna were identified as Improved but Hotspot during post-monsoon season.

Twenty-four (24) water quality monitoring stations on 16 rivers- Arpa, Baitarni, Brahmani, Burhabalang, Churni, Godavari, Hindon, Kanijhari, Krishna, Kwano, Mathabhanga, Ponnaiyar, Sankh, Solani, Subarnarekha and Yamuna were identified as Deteriorate during pre-monsoon season. Twenty-four (24) water quality monitoring stations on 19 rivers- Aradei, Arkavathy, Arpa, Brahmani, Edduvagu, Godavari, Khannaut, Kharkai, Mula Mutha, Musi, Ponnaiyar, Rushikulya, Sankh, Sarabenga, Sarada, Sina, Subarnarekha, Vamsadhara and Yamuna were identified as Deteriorate during monsoon season. Eighteen (18) water quality monitoring stations on 12 rivers- Arkavathy, Brahmani, Godavari, Gomti, Musi, Ponnaiyar, Sabarmati, Sarada, Shipra, Sukheta, Wardha and Yamuna were identified Deteriorate during post-monsoon season.

Table 26: Comparison of Hot Spots Dissolved Oxygen (DO) during year 2022 with 2023

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	A.B. Road Crossing	Parwati	Madhya Pradesh	*	-	3.56	*	4.33	*	*	NHS	*
2	Adityapur	Kharkai	Jharkhand	4.01	4.68	4.56	4.03	4.20	4.93	IBHS	D	IBHS
3	Agra Canal	Yamuna	Delhi	0.98	0.54	1.45	0.84	2.88	1.72	D	IBHS	IBHS
4	Anakapali	Sarada	Andhra Pradesh	4.09	4.85	4.95	4.98	4.83	4.90	IBHS	D	D
5	Anandapur	Baitarani	Odisha	4.23	4.65	-	4.46	4.80	4.57	IBHS	IBHS	NHS
6	B.P.M. (Bamni)	Wardha	Maharashtra	*	2.85	4.43	2.64	3.12	3.93	*	IBHS	D
7	Baghpat	Yamuna	Uttar Pradesh	-	4.67	-	4.33	4.63	-	NHS	D	-
8	Baleni	Yamuna	Uttar Pradesh	0.00	0.35	0.00	0.43	3.14	1.48	IBHS	IBHS	IBHS
9	Balighat	Burhabalang	Odisha	4.79	4.65	-	4.74	4.72	-	D	IBHS	-
10	Banpur	Mathabhanga/ Bhagirathi	West Bengal	1.85	1.84	2.26	1.76	*	*	D	*	*
11	Bareilly	Ramganga	Uttar Pradesh	-	3.88	-	4.87	4.18	-	NHS	IBHS	-
12	Baridhi	Subarnarekha	Jharkhand	3.32	3.96	-	4.48	4.92	4.79	IBHS	IBHS	NHS
13	Basti	Kwano	Uttar Pradesh	4.47	3.53	-	5.35	4.00	-	NoHS	IBHS	-
14	Basti D/S	Kwano	Uttar Pradesh	4.55	3.05	-	4.47	4.41	-	D	IBHS	-
15	Basti U/S	Kwano	Uttar Pradesh	4.96	3.15	-	6.61	5.38	-	NoHS	NoHS	-
16	Bido	Brahmani	Odisha	4.97	4.16	-	4.93	4.23	4.62	D	IBHS	NHS
17	Bigod	Banas	Rajasthan	3.55	4.47	-	6.45	6.18	*	NoHS	NoHS	*
18	Bolani	Brahmani	Odisha	4.07	3.84	-	4.81	4.74	4.87	IBHS	IBHS	NHS
19	Bonaigarh	Brahmani	Odisha	-	4.62	-	-	4.93	4.65	-	IBHS	NHS
20	Chapra	Jalangi/ Bhagirathi	West Bengal	-	4.07	-	-	*	*	-	*	*
21	Chilla Gaon	Hindon Cut	Delhi	0.39	1.07	1.26	0.98	1.99	1.17	IBHS	IBHS	IBHS
22	Chotabekra	Barak	Manipur	-	4.30	*	-	6.75	*	-	NoHS	*
23	Dameracherla	Musi	Telangana	4.31	4.29	-	4.69	4.12	4.61	IBHS	D	NHS
24	Delhi Railway Bridge	Yamuna	Delhi	0.36	0.89	0.91	0.18	1.19	0.41	D	IBHS	D
25	Dhansa	Sahibi	Delhi	*	2.80	*	*	3.07	*	*	Improved but Hotspot	*
26	Domuhani	Subarnarekha	Jharkhand	4.38	4.20	-	4.71	4.61	-	IBHS	IBHS	-
27	Etawah	Yamuna	Uttar Pradesh	4.14	2.83	3.51	4.41	3.65	4.19	IBHS	IBHS	IBHS
28	Galeta	Hindon	Uttar Pradesh	0.0	0.0	0.0	0.0	1.90	0.2	D	IBHS	IBHS
29	Gatora-1	Arpa	Chhattisgarh	4.63	-	-	4.62	4.42	-	D	NHS	-
30	Gatora-2	Arpa	Chhattisgarh	4.24	-	4.95	4.05	2.03	5.03	D	D	NoHS
31	GH.Rd. Bridge	Subarnarekha	Jharkhand	4.79	4.30	-	4.80	4.88	-	IBHS	D	-
32	Ghatshila	Subarnarekha	Jharkhand	-	4.44	-	-	5.22	-	-	NoHS	-
33	Gokul Barrage II Mathura D/S	Yamuna	Uttar Pradesh	2.31	1.57	2.67	1.87	2.39	1.59	D	IBHS	D
34	Gomlai	Brahmani	Odisha	4.78	4.82	-	4.81	4.89	-	IBHS	IBHS	-
35	Gomti Nagar (Lko D/S)	Gomti	Uttar Pradesh	*	1.64	3.96	2.99	2.36	2.55	*	IBHS	D
36	Gopiballavpur	Subarnarekha	West Bengal	4.56	4.22	-	4.46	5.02	-	D	NoHS	-
37	Govindpur (NH-5)	Burhabalang	Odisha	4.47	4.54	-	4.57	4.75	4.47	IBHS	IBHS	NHS
38	Gudari	Vamsadhara	Odisha	4.39	4.77	-	4.85	5.23	4.70	IBHS	NoHS	NHS

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
39	Gummanur	Ponnaiyar	Tamil Nadu	4.55	4.78	-	3.36	2.42	2.24	D	D	NHS
40	Gunupur	Vamsadhara	Odisha	4.39	4.39	-	4.86	4.58	4.85	IBHS	IBHS	NHS
41	Hanskhali	Churni/ Bhagirathi	West Bengal	3.40	2.33	2.97	2.36	*	*	D	*	*
42	Indupur	Brahmani	Odisha	4.08	4.55	-	4.70	4.65	4.28	IBHS	IBHS	NHS
43	Jamshedpur	Subarnarekha	Jharkhand	4.05	4.06	-	3.88	4.30	-	D	IBHS	-
44	Jaraikela	Koel	Odisha	4.68	4.60	-	4.96	4.77	-	IBHS	IBHS	-
45	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	2.80	2.47	3.87	2.78	3.21	3.83	D	IBHS	D
46	Jenapur	Brahmani	Odisha	-	4.67	-	-	4.51	-	-	D	-
47	K.T.(Satrapur)	Kanhan	Maharashtra	*	0.60	0.00	0.73	0.65	0.20	*	IBHS	IBHS
48	Kailash Mandir, Near Benpur Village	Yamuna	Uttar Pradesh	2.75	2.53	3.30	2.83	3.41	4.19	IBHS	IBHS	IBHS
49	Kamalanga	Brahmani	Odisha	-	4.49	-	-	4.65	-	-	IBHS	-
50	Kasganj	Kali	Uttar Pradesh	3.30	2.54	-	4.20	4.41	3.85	IBHS	IBHS	NHS
51	Kashinagar	Vamsadhara	Odisha	4.55	4.61	-	4.70	4.46	4.46	IBHS	D	NHS
52	Keesara	Munneru	Andhra Pradesh	-	4.29	-	-	4.95	-	-	IBHS	-
53	Kenduapada	Kanijhari	Odisha	4.81	4.52	-	4.21	5.53	-	D	NoHS	-
54	Keonjhar	Aradei	Odisha	4.69	4.40	-	4.84	4.07	4.66	IBHS	D	NHS
55	Kopergaon	Godavari	Maharashtra	1.30	4.75	-	*	4.59	*	*	D	*
56	Kulpatanga	Kharkai	Jharkhand	3.61	4.65	-	4.59	4.01	4.63	IBHS	D	NHS
57	Kusei	Baitarani	Odisha	4.83	4.63	4.58	5.07	4.79	5.12	NoHS	IBHS	NoHS
58	Lucknow	Gomti	Uttar Pradesh	*	2.06	2.89	0.90	2.93	1.58	*	IBHS	D
59	Lupungdih	Subarnarekha	Jharkhand	2.80	4.15	-	4.33	4.58	-	IBHS	IBHS	-
60	Madhabarida	Badanadi	Odisha	3.98	-	-	5.04	4.85	3.81	NoHS	NHS	NHS
61	Madhira	Wyra	Telangana	4.34	3.94	-	5.72	4.95	-	NoHS	IBHS	-
62	Mandawara	Chambal	Rajasthan	4.37	-	-	5.82	-	-	NoHS	-	-
63	Manderial	Chambal	Rajasthan	0.0	-	-	6.52	5.76	7.54	NoHS	-	-
64	Melliaputty	Mahendratanaya	Andhra Pradesh	4.31	4.05	4.88	4.87	4.91	5.11	IBHS	IBHS	NoHS
65	Mirawadi	Mula Mutha	Maharashtra	*	4.62	4.66	*	4.62	*	*	D	*
66	Mohna	Yamuna	Haryana	1.22	1.79	0.56	0.20	1.75	0.32	D	D	D
67	Moradabad	Ramganga	Uttar Pradesh	*	2.83	3.75	2.53	3.81	5.27	*	IBHS	NoHS
68	Munugodu	Edduvagu	Andhra Pradesh	-	4.59	-	-	4.58	-	-	D	-
69	Muri	Subarnarekha	Jharkhand	4.29	4.38	-	4.33	5.25	-	IBHS	NoHS	-
70	Nanded	Godavari	Maharashtra	0.85	-	4.60	0.37	2.78	1.87	D	D	D
71	Nandira	Brahmani	Odisha	-	4.56	-	4.88	4.83	-	NHS	IBHS	-
72	Nashik	Godavari	Maharashtra	3.07	2.95	1.85	4.06	5.32	4.20	IBHS	NoHS	IBHS
73	Noida	Yamuna	Uttar Pradesh	0.50	0.00	0.00	0.11	1.26	0.93	D	IBHS	IBHS
74	Okhla Barrage	Yamuna	Delhi	1.02	1.11	0.48	1.07	2.94	1.72	IBHS	IBHS	IBHS
75	Paleru Bridge	Paleru	Andhra Pradesh	-	4.23	-	4.85	4.30	4.48	NHS	IBHS	NHS
76	Pali	Chambal	Rajasthan	0.00	-	-	7.11	-	-	NoHS	-	-
77	Panposh	Brahmani	Odisha	4.41	4.16	-	4.47	4.31	5.43	IBHS	IBHS	-
78	Panposh-1	Sankh	Odisha	4.80	4.36	-	4.69	4.94	-	D	IBHS	-
79	Panposh-2	Koel	Odisha	-	4.47	-	4.80	5.14	-	NHS	NoHS	-
80	Poiyaghat, Agra	Yamuna	Uttar Pradesh	2.20	2.90	4.76	2.50	2.97	3.86	IBHS	IBHS	D
81	Purna	Purna	Maharashtra	3.55	-	-	*	-	4.84	*	-	NHS
82	Purunagarh	Brahmani	Odisha	4.06	3.77	-	4.47	4.29	4.92	IBHS	IBHS	NHS
83	Purushottampur	Rushikulya	Odisha	4.33	4.74	-	4.77	4.74	4.66	IBHS	D	NHS
84	R.S.P	Brahmani	Odisha	3.16	2.32	4.46	3.50	3.93	3.46	IBHS	IBHS	D
85	R.S.P-1	Brahmani	Odisha	4.17	3.40	-	4.22	4.20	-	IBHS	IBHS	-

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post-M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
86	R.S.P-2	Brahmani	Odisha	4.04	3.53	-	4.48	4.01	-	IBHS	IBHS	-
87	Raebareli	Sai	Uttar Pradesh	*	3.83	-	3.67	4.01	-		IBHS	-
88	Roorkee D/S	Solani	Uttarakhand	0.98	-	-	0.35	1.60	0.52	D	NHS	NHS
89	Saigaon	Manjira	Karnataka	4.19	4.71	-	*	6.06	*		NoHS	
90	Shahjahanpur	Khannaut	Uttar Pradesh	*	4.68	-	3.79	4.44	-		D	-
91	Singasadanapalli	Ponnaiyar	Tamil Nadu	0.45	0.00	0.00	0.00	0.00	0.00	D	D	D
92	Sorada	Rushikulya	Odisha	4.68	4.30	4.50	4.85	4.50	4.87	IBHS	IBHS	IBHS
93	Srikakulam	Nagavali	Andhra Pradesh	4.28	4.83	-	5.04	4.94	4.88	NoHS	IBHS	NHS
94	Swampatana	Baitarani	Odisha	4.76	-	-	4.70	-	4.57	D	-	NHS
95	T Bekuppe	Arkavathy	Karnataka	2.98	4.09	4.61	3.86	2.80	2.59	IBHS	D	D
96	Talcher	Brahmani	Odisha	-	4.68	-	-	4.99	-	-	IBHS	-
97	Thevur	Sarabenga	Tamil Nadu	-	4.01	-	3.38	0.92	3.32	NHS	D	NHS
98	Thoppur	Thoppaiyar	Tamil Nadu	*	4.03	4.63	4.32	*	*			
99	Tikarapara	Mahanadi	Odisha	4.27	-	-	5.45	-	-	NoHS	-	-
100	Tilga	Sankh	Jharkhand	4.89	4.26	-	5.40	4.15	-	NoHS	D	-
101	Tondarpur	Sukheta	Uttar Pradesh	*	-	4.46	4.34	3.07	3.82		NHS	D
102	Ujjain	Shipra	Madhya Pradesh	*	3.37	3.51	*	3.60	0.00		IBHS	D
103	Vautha	Sabarmati	Gujarat	0.00	0.91	1.00	0.12	0.95	0.17	IBHS	IBHS	D
104	Veligonda	Musi	Telangana	2.08	2.58	2.06	2.58	1.40	1.50	IBHS	D	D
105	Vrindawan Bridge (Mathura U/S)	Yamuna	Uttar Pradesh	*	1.83	1.84	1.31	2.16	1.16		IBHS	D
106	Wadakbal	Sina	Maharashtra	*	4.06	4.78	*	2.73	*		D	
107	Wadenapally	Krishna	Telangana	4.34	-	-	2.56	4.27	4.08	D	NHS	NHS
108	Yadgir	Bhima	Karnataka	4.56	4.88	-	*	5.42	-		NoHS	-
109	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	2.44	2.47	3.17	3.19	3.28	4.87	IBHS	IBHS	IBHS

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) NHS (NHS) IBHS (IBHS)

8.9 Biochemical Oxygen Demand (BOD):

Seventeen (17) water quality monitoring stations on 10 rivers- Budhi Rapti, Chandrabhaga, Jam, Kanhan, Noyyal, Pench, Rapti, Subarnarekha, Wainganga and Wardha were identified as No Hotspots during pre-monsoon season. Seventeen (17) water quality monitoring stations on 10 rivers- Ganga, Godavari, Gomti, Jam, Kanhan, Penganga, Pranhita, Wainganga, Wardha and Yamuna were identified as No Hotspots during monsoon season. Fifteen (15) water quality monitoring stations on 10 rivers- Chambal, Giri, Godavari, Jam, Krishna, Penganga, Subarnarekha, Wainganga, Wardha and Yamuna were identified as No Hotspots during post-monsoon season.

Seven (7) water quality monitoring stations on 6 rivers- Banas, Churni, Ganga, Kalisindh, Parwati and Sarabenga were identified as New Hotspots during pre-monsoon season. Nine (9) water quality monitoring stations on 8 rivers- Arpa, Bhima, Chandrabhaga, Ganga, Godavari, Krishna, Tons and Wainganga were identified as New Hotspots during monsoon season. Seventeen (17) water quality monitoring stations on 10 rivers- Budhi Rapti, Ganga, Kwano, Pench, Ramganga, Rapti, Sai, Sarabenga, Sarayan and Yamuna were identified as New Hotspots during post-monsoon season.

Thirty-Nine (39) water quality monitoring stations on 18 rivers- Arkavathy, Arpa, Chambal, Ganga, Godavari, Gomti, Hindon, Hindon Cut, Kunwari, Kwano, Musi, Ramganga, Rapti, Tons, Wainganga, Wardha, Wunna and Yamuna were identified as Improved but Hotspot during pre-monsoon season. Forty-nine (49) water quality monitoring stations on 25 rivers- Arkavathy, Banas, Chambal, Parwati, Chhoti Sarju, Ganga, Gomti, Hindon Cut, Kalisindh, Kanhan, Khannaut, Kunwari, Kwano, Musi, Noyyal, Parwan, Parwati, Pench, Rapti, Sai, Sengar, Shipra, Wardha, Wunna and Yamuna were identified as Improved but Hotspot during monsoon season. Seventeen (17) water quality monitoring stations on 12 rivers- Arkavathy, Chhoti Sarju, Ganga, Giri, Godavari, Hindon Cut, Kanhan, Musi, Rapti, Shipra, Tons and Yamuna were identified as Improved but Hotspot during post-monsoon season.

Thirty-two (32) water quality monitoring stations on 16 rivers- Chhoti Sarju, Ganga, Giri, Godavari, Gomti, Kali, Kanhan, Kitcha/Bahgul, Mathabhanga, Penganga, Ponnaiyar, Ramganga, Sabarmati, Sai, Sarayan and Yamuna were identified as Deteriorate during pre-monsoon season. Forty-nine (49) water quality monitoring stations on 23 rivers- Budhi Rapti, Cauvery, Chambal, Ganga, Giri, Gomti, Hindon, Kali, Kalisindh, Kitcha/Bahgul, Kwano, Mula Mutha, Ponnaiyar, Ramganga, Rapti, Sabarmati, Sahibi, Sarabenga, Sarayan, Solani, Sukheta, Wainganga and Yamuna were identified as Deteriorate during monsoon season. Forty-three (43) water quality monitoring stations on 16 rivers- Ganga, Gomti, Hindon, Kali, Khannaut, Kitcha/Bahgul, Kunwari, Kwano, Ponnaiyar, Ramganga, Rapti, Sabarmati, Solani, Sukheta, Wardha and Yamuna were identified Deteriorate during post-monsoon season.

Table 27: Comparison of Hot Spots Biochemical Oxygen Demand (BOD) during year 2022 with 2023

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
1	A.B. Road Crossing	Parwati	Madhya Pradesh	*	15.15	22.41	*	13.15	*	*	IBHS	*
2	A.P. Puram	Chittar	Tamil Nadu	4.59	*	*	*	*	1.18	*	*	*
3	A.P.M.(Ashti)	Wainganga	Maharashtra	*	5.20	3.63	7.53	2.69	2.80	*	NoHS	NoHS
4	Agra Canal	Yamuna	Delhi	34.10	32.01	26.33	29.19	29.03	28.19	IBHS	IBHS	D
5	Akbarpur	Chhoti sarju	Uttar Pradesh	4.46	3.56	3.90	4.89	3.52	3.68	D	IBHS	IBHS
6	Aklera	Parwan	Rajasthan	*	9.33	8.89	1.79	4.14	*	*	IBHS	*
7	Allahabad	Ganga	Uttar Pradesh	3.49	3.37	3.30	3.13	3.43	3.58	IBHS	D	D
8	Ankinghat	Ganga	Uttar Pradesh	3.49	3.58	-	4.33	4.25	4.25	D	D	NHS
9	Asthi	Wainganga	Maharashtra	8.21	-	-	1.96	3.43	-	NoHS	NHS	-
10	Auraiya	Yamuna	Uttar Pradesh	7.60	6.07	6.11	9.51	6.54	9.25	D	D	D
11	B.P.M. (Bamni)	Wardha	Maharashtra	*	50.67	21.43	42.00	26.69	33.33	*	IBHS	D
12	Baghpat	Yamuna	Uttar Pradesh	9.90	16.03	15.61	21.44	22.16	4.25	D	D	IBHS
13	Bakhari	Wainganga	Madhya Pradesh	-	5.21	3.13	-	2.29	2.17	-	NoHS	NoHS
14	Baleni	Yamuna	Uttar Pradesh	38.68	26.91	22.97	26.14	21.27	38.17	IBHS	IBHS	D
15	Bamni (Nagpur)	Wardha	Maharashtra	7.65	5.79	3.33	4.00	2.97	2.87	IBHS	NoHS	NoHS
16	Banpur	Mathabhanga/ Bhagirathi	West Bengal	3.50	5.52	4.59	6.55	*	*	D	*	*
17	Bansi	Rapti	Uttar Pradesh	3.04	5.24	-	2.00	4.70	6.61	NoHS	IBHS	NHS
18	Baranwada	Banas	Rajasthan	*	14.60	7.06	*	13.12	*	*	IBHS	*
19	Bareilly	Ramganga	Uttar Pradesh	8.51	10.07	-	18.23	16.23	7.13	D	D	NHS
20	Baridhi	Subarnarekha	Jharkhand	12.80	-	-	1.90	-	-	NoHS	-	-
21	Barod	Kalisindh	Rajasthan	-	6.43	-	7.02	4.18	-	NHS	IBHS	-
22	Basti	Kwano	Uttar Pradesh	8.04	8.79	-	5.95	16.05	7.33	IBHS	D	NHS
23	Basti D/S	Kwano	Uttar Pradesh	8.83	9.18	3.55	8.51	11.53	7.51	IBHS	D	D
24	Basti U/S	Kwano	Uttar Pradesh	7.03	8.49	4.41	6.14	8.07	5.74	IBHS	IBHS	D
25	Bhadana Village D/s of Kota City	Chambal/Parwati	Rajasthan	*	11.10	*	*	8.12	*	*	IBHS	*
26	Bhind	Kunwari	Madhya Pradesh	3.44	4.68	3.39	3.42	3.98	3.41	IBHS	IBHS	D
27	Bhitaura	Ganga	Uttar Pradesh	4.91	4.83	-	8.81	12.49	6.85	D	D	NHS
28	Bhitoor	Ganga	Uttar Pradesh	4.31	3.67	3.06	4.22	8.74	4.10	IBHS	D	D
29	Bigod	Banas	Rajasthan	-	17.69	8.30	12.28	7.81	*	NHS	IBHS	*
30	Birdghat	Rapti	Uttar Pradesh	4.39	4.97	3.18	3.29	4.57	3.54	IBHS	IBHS	D
31	Chandrika Devi (Lko U/S)	Gomti	Uttar Pradesh	3.41	4.70	3.54	3.91	4.78	6.37	D	D	D
32	Chapra	Jalangi/ Bhagirathi	West Bengal	-	4.45	-	-	*	*	-	*	*
33	Chilla Gaon	Hindon Cut	Delhi	44.92	27.52	28.52	28.34	23.37	27.58	IBHS	IBHS	IBHS

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
34	D/S (Ashti)	Wainganga	Maharashtra	*	3.07	4.23	3.51	5.13	2.93	*	D	NoHS
35	Daund	Bhima	Maharashtra	*	-	3.75	*	6.69	*	*	NHS	*
36	Delhi Railway Bridge	Yamuna	Delhi	32.71	28.86	25.51	28.61	25.83	26.28	IBHS	IBHS	D
37	Dhaneta	Kitcha/Bahgul	Uttar Pradesh	3.96	4.33	4.00	8.53	17.60	14.03	D	D	D
38	Dhansa	Sahibi	Delhi	*	20.87	*	*	32.03	*	*	D	*
39	Dhareri	Chambal	Madhya Pradesh	*	12.12	*	*	12.49	*	*	D	*
40	Elunuthi Mangalam	Noyyal	Tamil Nadu	5.52	4.70	-	1.99	4.36	-	NoHS	IBHS	-
41	Etawah	Yamuna	Uttar Pradesh	33.46	21.26	30.48	29.85	15.83	56.33	IBHS	IBHS	D
42	Fatehgarh	Ganga	Uttar Pradesh	-	-	3.96	4.79	18.95	5.77	NHS	NHS	D
43	Galeta	Hindon	Uttar Pradesh	46.07	27.87	22.71	27.26	34.78	67.68	IBHS	D	D
44	Ganguwala	Yamuna	Himachal Pradesh	-	4.94	-	-	7.30	-	-	D	-
45	Gatora-2	Arpa	Chhattisgarh	4.52	-	-	3.69	5.18	-	IBHS	NHS	-
46	Ghazipur	Ganga	Uttar Pradesh	3.13	3.61	3.97	3.46	3.63	3.63	D	D	IBHS
47	Gokul Barrage II Mathura D/S	Yamuna	Uttar Pradesh	27.09	29.78	26.12	35.27	30.31	28.59	D	D	D
48	Gomti Nagar (Lko D/S)	Gomti	Uttar Pradesh	18.27	18.21	3.69	20.23	25.53	20.77	D	D	D
49	Gorakhpur D/S	Rapti	Uttar Pradesh	3.79	4.80	3.56	2.71	4.45	4.26	NoHS	IBHS	D
50	Gorakhpur U/S	Rapti	Uttar Pradesh	-	4.13	3.39	-	5.03	3.33	-	D	IBHS
51	Gummanur	Ponnaiyar	Tamil Nadu	9.77	20.19	7.44	21.63	32.75	43.56	D	D	D
52	Hamirpur	Yamuna	Uttar Pradesh	4.63	-	4.66	4.85	-	3.41	D	*-	IBHS
53	Hanskhali	Churni/ Bhagirathi	West Bengal	-	3.83	-	4.27	*	*	NHS	*	*
54	Hathi Khana	Ganga	Uttar Pradesh	3.90	4.78	4.19	13.21	12.91	11.08	D	D	D
55	Huvinhedgi	Krishna	Karnataka	-	-	5.93	-	4.57	2.42	-	NHS	NoHS
56	Jajmau	Ganga	Uttar Pradesh	5.03	4.04	-	4.57	7.91	5.98	IBHS	D	NHS
57	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	32.61	25.03	16.01	20.00	12.75	32.35	IBHS	IBHS	D
58	Jhalawad	Kalisindh	Rajasthan	*	13.46	*	*	13.89	*	*	D	*
59	K.T.(Satrapur)	Kanhan	Maharashtra	*	62.00	73.33	70.09	55.41	66.67	*	IBHS	IBHS
60	Kachlabridge	Ganga	Uttar Pradesh	-	5.35	3.18	3.12	4.26	4.62	NHS	IBHS	D
61	Kailash Mandir Near Benpur Village	Yamuna	Uttar Pradesh	41.67	23.97	18.76	25.68	15.51	29.82	IBHS	IBHS	D
62	Kalanaur	Yamuna	Uttar Pradesh	12.03	13.34	4.14	5.89	9.63	1.15	IBHS	IBHS	NHS
63	Kalpi	Yamuna	Uttar Pradesh	5.29	-	4.17	4.81	-	3.29	IBHS	-	IBHS
64	Karnal	Yamuna	Haryana	5.57	11.76	9.15	3.25	9.91	1.43	IBHS	IBHS	NHS
65	Kasganj	Kali	Uttar Pradesh	11.63	14.48	4.18	15.09	14.76	15.07	D	D	D
66	Katri Umrauli	Ganga	Uttar Pradesh	4.78	3.75	-	3.65	4.81	5.22	IBHS	D	NHS
67	Kaziupura	Ramganga	Uttar Pradesh	4.92	4.17	3.56	3.73	10.84	4.38	IBHS	D	D

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
68	Keolari	Wainganga	Madhya Pradesh	-	3.33	-	-	2.80	-	-	NoHS	-
69	Khatoli	Parwati	Rajasthan	-	9.34	-	5.18	4.89	-	NHS	IBHS	-
70	Kokiwada	Pench	Madhya Pradesh	3.23	4.30	-	2.57	4.08	3.27	NoHS	IBHS	NHS
71	Kopergaon	Godavari	Maharashtra	12.70	3.09	-	*	1.75	*	*	NoHS	*
72	Kumhari	Wainganga	Madhya Pradesh	4.41	12.01	4.97	1.47	2.05	1.20	NoHS	NoHS	NoHS
73	Lalpur	Sengar	Uttar Pradesh	-	3.78	-	-	3.07	-	-	IBHS	-
74	Lodhikheda	Jam	Madhya Pradesh	19.60	4.67	6.07	2.14	1.75	2.10	NoHS	NoHS	NoHS
75	Lucknow	Gomti	Uttar Pradesh	22.27	19.27	4.90	27.24	15.06	19.18	D	IBHS	D
76	Lupungdih	Subarnarekha	Jharkhand	14.30	-	3.12	2.00	-	2.26	NoHS	-	NoHS
77	Magardhara	Wainganga	Madhya Pradesh	9.19	20.87	-	2.87	1.91	-	NoHS	NoHS	-
78	Mahalgaon	Wainganga	Maharashtra	-	4.37	-	-	1.77	-	-	NoHS	-
79	Mahidpur	Shipra	Madhya Pradesh	*	19.46	*	*	15.93	*	*	IBHS	*
80	Mandawara	Chambal	Rajasthan	23.29	9.43	5.93	13.50	8.70	1.61	IBHS	IBHS	NoHS
81	Manderial	Chambal	Rajasthan	*	9.80	5.92	12.42	10.04	2.43		D	NoHS
82	Mawi	Yamuna	Uttar Pradesh	9.88	15.48	13.76	11.71	14.31	2.36	D	IBHS	NoHS
83	Mirawadi	Mula Mutha	Maharashtra	*	3.45	3.73	*	7.72	*	*	D	*
84	Mirzapur	Ganga	Uttar Pradesh	3.74	3.55	3.38	3.08	3.41	3.49	IBHS	IBHS	D
85	Mohna	Yamuna	Haryana	29.42	26.81	25.10	27.48	30.49	34.71	IBHS	D	D
86	Moradabad	Ramganga	Uttar Pradesh	13.50	13.11	4.94	23.93	16.29	11.15	D	D	D
87	Mungoli	Penganga	Maharashtra	6.07	13.40	3.10	6.32	2.20	2.03	D	NoHS	NoHS
88	Nanded	Godavari	Maharashtra	13.62	-	8.94	18.04	10.20	3.99	D	NHS	IBHS
89	Nandgaon	Wunna	Maharashtra	14.40	15.92	-	7.52	5.44	-	IBHS	IBHS	-
90	Nashik	Godavari	Maharashtra	4.74	-	5.09	3.25	3.91	2.02	IBHS	NHS	NoHS
91	Naugaon	Yamuna	Uttarakhand	-	7.41	-	-	1.47	-	-	NoHS	-
92	Noida	Yamuna	Uttar Pradesh	32.77	29.07	25.06	25.85	28.26	53.87	IBHS	IBHS	D
93	Okhla Barrage	Yamuna	Delhi	31.18	27.62	26.46	29.21	29.81	37.14	IBHS	D	D
94	Pali	Chambal	Rajasthan	*	13.39	-	6.54	9.43	-	*	IBHS	-
95	Palla	Yamuna	Delhi	12.93	17.18	10.94	18.46	12.43	9.00	D	IBHS	IBHS
96	Parmat Ghat	Ganga	Uttar Pradesh	3.56	3.75	-	3.77	8.33	5.85	D	D	NHS
97	Parsohan Ghat	Budhi Rapti	Uttar Pradesh	3.94	5.31	-	2.14	6.76	12.62	NoHS	D	NHS
98	Patala	Wardha	Maharashtra	4.51	5.24	-	2.29	2.57	-	NoHS	NoHS	-
99	Patansaongi	Chandrabhaga	Maharashtra	3.78	-	-	1.63	4.90	-	NoHS	NHS	-
100	Pauni	Wainganga	Maharashtra	6.81	-	-	5.72	-	-	IBHS	-	-
101	Poiyaghat, Agra	Yamuna	Uttar Pradesh	31.34	30.46	10.47	23.43	14.63	23.14	IBHS	IBHS	D
102	Purna	Purna	Maharashtra	4.19	-	-	*	-	-	*	-	-
103	Raebareli	Sai	Uttar Pradesh	13.31	12.17	-	13.81	9.37	7.55	D	IBHS	NHS

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
104	Rajegaon	Pranhita	Madhya Pradesh	-	6.32	-	-	2.05	-	-	NoHS	-
105	Ramakona	Kanhan	Madhya Pradesh	3.68	8.29	-	4.11	3.20	-	D	IBHS	-
106	Regauli	Rapti	Uttar Pradesh	3.27	3.41	-	1.64	4.30	3.33	NoHS	D	NHS
107	Renukaji	Giri	Himachal Pradesh	-	6.26	5.58	-	7.74	1.76	-	D	NoHS
108	Roorkee D/S	Solani	Uttarakhand	*	16.01	20.90	25.09	26.85	21.00	*	D	D
109	Saidpur	Ganga	Uttar Pradesh	3.70	-	3.22	3.86	-	3.09	D	-	IBHS
110	Saigaon	Manjira	Karnataka	4.22	-	-	*	-	*	*	-	*
111	Sakhara	Wainganga	Maharashtra	6.09	-	-	2.16	-	-	NoHS	-	-
112	Sakmur	Wardha	Maharashtra	8.31	12.11	-	2.72	2.96	-	NoHS	NoHS	-
113	Sangod	Parwan	Rajasthan	*	11.51	-	*	4.12	*	*	IBHS	*
114	Sarangpur	Kalisindh	Madhya Pradesh	*	13.21	*	*	15.28	*	*	D	*
115	Satna	Tons	Madhya Pradesh	3.73	-	3.61	3.34	3.10	3.29	IBHS	NHS	IBHS
116	Satrapur	Kanhan	Maharashtra	19.24	9.83	-	1.79	2.76	-	NoHS	NoHS	-
117	Seohara	Ramganga	Uttar Pradesh	3.74	3.70	-	4.12	8.47	4.40	D	D	NHS
118	Shahjahanpur	Khannaut	Uttar Pradesh	*	12.96	5.52	15.47	11.54	7.05	*	IBHS	D
119	Singasadanapalli	Ponnaiyar	Tamil Nadu	50.77	35.35	31.70	50.86	79.46	75.80	D	D	D
120	Sitapur	Sarayan	Uttar Pradesh	3.21	4.15	-	14.85	15.14	6.53	D	D	NHS
121	Sultanpur	Gomti	Uttar Pradesh	4.48	3.05	3.17	3.78	2.95	3.20	IBHS	NoHS	D
122	T Bekuppe	Arkavathy	Karnataka	17.51	12.38	11.02	9.17	11.38	6.72	IBHS	IBHS	IBHS
123	Tal	Chambal	Madhya Pradesh	*	16.89	*	*	3.98	*	*	IBHS	*
124	Thevur	Sarabenga	Tamil Nadu	-	4.10	-	3.61	6.92	6.05	NHS	D	NHS
125	Thoppur	Thoppaiyar	Tamil Nadu	*	6.42	-	2.89	*	*	*	*	*
126	Tihar Khera	Ramganga	Uttar Pradesh	4.73	5.21	3.29	7.49	14.21	5.18	D	D	D
127	Tondarpur	Sukheta	Uttar Pradesh	*	4.58	5.73	7.44	13.36	10.33	*	D	D
128	Tonk	Banas	Rajasthan	*	15.13	*	*	8.00	*	*	IBHS	*
129	U/S (Bamni)	Wardha	Maharashtra	*	12.85	3.63	3.91	3.27	2.63	*	IBHS	NoHS
130	Ujjain	Shipra	Madhya Pradesh	*	24.05	20.88	*	20.09	16.04	*	IBHS	IBHS
131	Urachikottai	Cauvery	Tamil Nadu	-	4.90	-	-	4.90	*	-	D	*
132	V S Bridge	Ganga	Uttar Pradesh	3.64	3.49	3.48	3.33	3.70	3.76	IBHS	D	D
133	Varanasi	Ganga	Uttar Pradesh	4.07	3.46	3.41	3.65	2.86	3.20	IBHS	NoHS	IBHS
134	Vautha	Sabarmati	Gujarat	23.28	12.72	25.17	30.14	15.02	26.09	D	D	D
135	Veligonda	Musi	Telangana	19.94	20.15	12.95	16.53	16.67	11.53	IBHS	IBHS	IBHS
136	Vrindawan Bridge (Mathura U/S)	Yamuna	Uttar Pradesh	*	29.85	24.53	36.03	32.07	35.10	*	D	D
137	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	35.94	27.13	17.54	27.20	17.48	33.55	IBHS	IBHS	D
138	Yashwant	Giri	Himachal	4.77	9.16	11.25	7.08	9.89	7.08	D	D	IBHS

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post-M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post-M
	Nagar		Pradesh									

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.10 Total Coliform (TC):

An analysis of water quality hotspots across various sites and rivers during 2022 and 2023 reveals significant trends and changes. Sites were categorized based on pre-monsoon (Pre-M), monsoon (M), and post-monsoon (Post-M) periods.

Several locations showed improved water quality during the pre-monsoon, monsoon, and post-monsoon periods of 2023 compared to 2022. The analysis reveals the distribution of stations categorized as Improved but Hotspot across different seasons. The number of such stations varied, with the highest count observed during the monsoon period 81 stations at 45 rivers Amaravathi, Amba, Banas, Betwa, Bharathapuzha , Bhavani, Bhavani / Moyar, Bhima, Cauvery, Chambal, Chandrabhaga, Chhoti sarju, Gandhayar, Ganga, Gomti, Jam, Kal, Kalisindh, Kallar, Kanhan, Kanhar, Koyna, Krishna, Mahi, Maruthaiyar, Mula Mutha, Noyyal, Palar, Panchganga, Parwan, Parwati, Peddavagu, Penganga, Ponnaiyar, Rind, Sahibi, Sarabenga, Shetrunji, Tambraparani, Tons, Vagai/Suruliar, Wainganga, Wardha, Wunna and Yamuna.

This suggests favorable conditions during this season that contribute to some improvement in water quality despite ongoing pollution concerns. During the pre-monsoon and post-monsoon periods, fewer stations were classified as Improved but Hotspot compared to the monsoon period, with relatively stable numbers (63 and 75 stations respectively). During the pre-monsoon season 63 stations at 31 rivers Betwa, Bharathapuzha , Cauvery, Cauvery, Chambal, Chhoti sarju, Ganga, Godavari, Gomti, Indravathi, Kanhar, Ken, Kinnerasani, Mahi, Manjira, Maruthaiyar, Noyyal, Peddavagu, Pench, Ponnaiyar, Pranhita, Pravara, Rind, Sabarmati, Sai, Sengar, Som, Tons, Tungabhadra, Wainganga, Wardha, Wyra and Yamuna River showing the Improved but Hotspot.

Similarly at 75 stations at 44 rivers Amaravathi, Betwa, Bhadra, Bharathapuzha , Bhavani, Bhavani / Moyar, Cauvery, Chambal, Chandrabhaga, Chhoti sarju, Chittar, Gad, Gandhayar, Ganga, Gomti, Haridra, Hindon, Kallar, Kanhan, Kanhar, Ken, Khobragadi, Kodaganar, Kunwari, Maruthaiyar, Noyyal, Peddavagu, Ponnaiyar, Pranhita, Rind, Sai, Sarabenga, Sengar, Sone, Tambraparani, Tons, Tungabhadra, Ulhas, Vagai/Suruliar, Vaigai, Wainganga, Wardha, Wunna and Yamuna showing the Improved but Hotspot during the post monsoon period.

Conversely, the number of stations showing deteriorated water quality was notably higher across all seasons, reflecting ongoing challenges and potential environmental stressors impacting rivers. The pre-monsoon period recorded the highest number of stations with deteriorated water quality (104 stations), indicating initial impacts of seasonal changes and human activities preceding the monsoon. During the monsoon (99 stations) and post-monsoon periods (59 stations), the number of deteriorated stations remained elevated, underscoring persistent pollution pressures, runoff effects, and potentially exacerbated impacts during and after the rainy season.

The absence of hot spot conditions at two stations Gudam Bridge (Pranhita River), Magardhara (Wainganga River) during the post-monsoon period suggests relatively stable or improved water quality conditions, highlighting potential successes in pollution management or self-purification capacity of the river at these locations.

A few locations emerged as new hot spots in 2023, indicating worsening water quality issues compared to the previous year. The emergence of new hot spots during the pre-monsoon 2 stations at Hariharapura (Tunga River), Mungoli (Penganga River) and post-monsoon periods 1 station at Kumhari (Wainganga River) underscores ongoing challenges in water quality management, emphasizing the need for heightened attention and targeted interventions to address newly identified pollution sources affecting these locations.

Table 28: Comparison of Hot Spots Total Coliform (TC) during year 2022 with 2023

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
1	A.B. Road Crossing	Parwati	Madhya Pradesh	*	115500	47500	*	113990	*	*	IBHS	*
2	A.P. Puram	Chittar	Tamil Nadu	3300	*	*	*	*	7450	*	*	*
3	Abu Road	Banas	Rajasthan	16000	16000	*	*	18600	18200	*	D	*
4	Akbarpur	Chhoti sarju	Uttar Pradesh	8867	8267	9333	7873	7920	5367	IBHS	IBHS	IBHS
5	Akkihebbal	Hemavati	Karnataka	1203	24553	18333	92245	248267	136800	D	D	D
6	Aklera	Parwan	Rajasthan	*	48545	42667	79000	63889	*	*	D	*
7	Alanthurai	Noyyal	Tamil Nadu	30725	54050	30800	4900	26000	*	IBHS	IBHS	*
8	Allahabad	Ganga	Uttar Pradesh	10467	8000	7967	7227	8067	6883	IBHS	D	IBHS
9	Ambarampalayam	Bharathapuzha	Tamil Nadu	14207	12000	21483	11547	11613	12150	IBHS	IBHS	IBHS
10	Ambasamudram	Vaigai	Tamil Nadu	30180	7417	42650	37633	*	3050	D	*	IBHS
11	Arjunwad	Krishna	Maharashtra	*	64664	16767	*	42071	*	*	IBHS	*
12	Asthi	Wainganga	Maharashtra	2827	3327	7383	1642	4187	3430	IBHS	D	IBHS
13	Auraiya	Yamuna	Uttar Pradesh	76453	32353	67483	110360	62980	58140	D	D	IBHS
14	Avarankuppam	Palar	Tamil Nadu	4300	35550	50150	9633	3300	*	D	IBHS	
15	Badalapur	Ulhas	Maharashtra	23467	93000	318000	72067	104000	63333	D	D	IBHS
16	Baghpat	Yamuna	Uttar Pradesh	870667	446467	509667	477867	105000	136667	IBHS	IBHS	IBHS
17	Bakhari	Wainganga	Madhya Pradesh	2109	9187	1833	3771	1511	1405	D	IBHS	IBHS
18	Baleni	Yamuna	Uttar Pradesh	878667	1570000	1550000	1766000	996000	833333	D	IBHS	IBHS
19	Baluaghat	Ganga	Uttar Pradesh	12007	6680	7817	7027	7393	7117	IBHS	D	IBHS
20	Bamni (Nagpur)	Wardha	Maharashtra	3049	7007	2450	3709	3552	2750	D	IBHS	D
21	Banda	Ken	Uttar Pradesh	15988	2548	2182	1780	6742	1830	IBHS	D	IBHS
22	Baranwada	Banas	Rajasthan	*	170300	117600	*	127583	*	*	IBHS	*
23	Barod	Kalisindh	Rajasthan	58889	73583	34500	111917	43455	45000	D	IBHS	D
24	Basoda	Betwa	Madhya Pradesh	3100	2350	3383	3800	3913	*	D	D	*
25	Bawapuram	Tungabhadra	Andhra Pradesh	3500	*	*	2981	1800	1900	IBHS	*	*
26	Belne Bridge	Gad	Maharashtra	622	40607	30450	20217	381333	26040	D	D	IBHS
27	Bendrahalli	Suvarnavathi	Karnataka	1700	60267	62167	450067	469933	334000	D	D	D
28	Bhadana Village D/s of Kota City	Chambal/Parwati	Rajasthan	*	76727	*	*	119750	*	*	D	*
29	Bhadrachelam	Godavari	Telangana	5400	*	*	1559	2367	2900	D	*	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
30	Bhatpalli	Peddavagu	Telangana	2415	4914	4633	2876	3417	2900	D	IBHS	IBHS
31	Bhind	Kunwari	Madhya Pradesh	6893	13920	13400	16144	24867	3900	D	D	IBHS
32	Bigod	Banas	Rajasthan	*	198167	102833	89333	119667	*	*	IBHS	*
33	Biligundulu	Cauvery	Tamil Nadu	5493	9300	16217	14919	9220	5933	D	IBHS	IBHS
34	Byladahalli	Haridra	Karnataka	-	26220	25500	*	277625	21750	*	D	IBHS
35	Chindnar	Indravathi	Chhattisgarh	2800	*	*	1836	3173	2928	IBHS	*	*
36	Cholachagudda	Malaprabha	Karnataka	*	49707	37667	59314	496556	*	*	D	*
37	Chopan	Sone	Uttar Pradesh	4193	4433	6067	4753	4693	3600	D	D	IBHS
38	Chunchunkatte	Cauvery	Karnataka	*	17480	55667	160000	411900	*		D	*
39	Dameracherla	Musi	Telangana	790	*	*	2253	2372	2700	D	*	*
40	Daund	Bhima	Maharashtra	*	79000	160000	*	60500	*		IBHS	*
41	Delhi Railway Bridge	Yamuna	Delhi	15093333	10324667	11766667	74533333	22333333	10500000	D	D	IBHS
42	Deongaon Bridge	Bhima	Karnataka	790	*	*	*	4733	*	*	*	*
43	Deosugar	Krishna	Karnataka	1400	*	*	3253	2207	2100	D	*	*
44	Derol Bridge	Sabarmati	Gujarat	*	11000	*	8460	34364	20167	*	D	*
45	Dhalegaon	Godavari	Maharashtra	1400	*	*	*	1960	1717	*	*	*
46	Dhansa	Sahibi	Delhi	*	828889	*	*	611667	*	*	IBHS	*
47	Dhareri	Chambal	Madhya Pradesh	*	332500	*	*	762000	*	*	D	*
48	Dholpur	Chambal	Rajasthan	9507	8129	18183	16033	14618	8260	D	D	IBHS
49	Duddhi	Kanhar	Uttar Pradesh	6080	3860	6950	4673	3333	3233	IBHS	IBHS	IBHS
50	Elunuthi Mangalam	Noyyal	Tamil Nadu	15027	62667	42833	20320	16240	29000	D	IBHS	IBHS
51	Etawah	Yamuna	Uttar Pradesh	581429	290667	516667	715467	206267	980000	D	IBHS	D
52	Gaisabad	Bearma	Madhya Pradesh	*	2121	1270	3050	2957	3167		D	D
53	Galeta	Hindon	Uttar Pradesh	31533333	4919333	32333333	50960000	7173333	14800000	D	D	IBHS
54	Gandhavayal	Gandhayar	Tamil Nadu	32667	44420	21167	49658	15667	4867	D	IBHS	IBHS
55	Gandlapet	Peddavagu	Telangana	5400	*	*	3335	1810	2433	IBHS	*	*
56	Ganguwala	Yamuna	Himachal Pradesh	1691	27800	14333	16653	35400	24500	D	D	D
57	Ganod	Bhadar	Gujarat	10500	14500	*	*	27190	*	*	D	*
58	Garhakota	Sonar	Madhya Pradesh	*	3923	4900	*	6150	*	*	D	*
59	Garrauli	Dhasan	Madhya Pradesh	1586	2105	1610	1651	11267	5016	D	D	D

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
60	Ghazipur	Ganga	Uttar Pradesh	10373	7413	8183	6733	7393	5833	IBHS	D	IBHS
61	Gokak	Ghataprabha	Karnataka	*	39867	16250	*	447300	17000	*	D	D
62	Gokul Barrage II Mathura D/S	Yamuna	Uttar Pradesh	1611333	2694200	2633333	5004667	9133333	9700000	D	D	D
63	GR Bridge	Godavari	Maharashtra	2200	*	*	2353	2440	2450	D	*	*
64	Gudam Bridge	Pranhita	Maharashtra	*	1329	5445	739	1342	285	*	D	NoHS
65	Gummanur	Ponnaiyar	Tamil Nadu	27338	43867	57833	79533	26947	17133	D	IBHS	IBHS
66	Halia	Halia	Telangana	1400	*	*	1992	3425	*	D	*	*
67	Hamirpur	Yamuna	Uttar Pradesh	32533	8307	32317	38887	17203	9020	D	D	IBHS
68	Haralahalli	Tungabhadra	Karnataka	1488	14747	16417	40086	295727	24250	D	D	D
69	Hariharapura	Tunga	Karnataka	-	23393	27833	101800	181667	90800	NHS	D	D
70	Haripur	Tons	Uttarakhand	6098	13060	10150	14927	40200	25167	D	D	D
71	Hivra	Wardha	Maharashtra	1667	2887	3400	1571	2634	933	IBHS	IBHS	IBHS
72	Hogenakkal	Chinnar	Tamil Nadu	*	102125	39500	28000		54000	*	*	D
73	Holehonnur	Bhadra	Karnataka	2696	13013	54833	112400	411533	56560	D	D	D
74	Honnali	Tungabhadra	Karnataka	1279	22533	34183	190427	565400	20240	D	D	IBHS
75	Hoovinahole	Swarnamukhi	Karnataka	*	68186	15000	30800		*	*	*	*
76	Huvinhedgi	Krishna	Karnataka	1400	*	*	2293	2383	3033	D	*	*
77	Jagdalpur	Indravathi	Chhattisgarh	5400	*	*	1973	2940	1440	IBHS	*	*
78	Jaunpur	Gomti	Uttar Pradesh	9260	6713	8033	6927	6813	6617	IBHS	D	IBHS
79	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	690667	330000	211667	414000	147867	338000	IBHS	IBHS	D
80	Jhalawad	Kalisindh	Rajasthan	*	827800	*	*	60700	*	*	IBHS	*
81	Jhansi Mirjapur Highway Road Bridge	Betwa	Uttar Pradesh	6167	5340	14317	4493	6213	3780	IBHS	D	IBHS
82	K M Vadi	Cauvery/ Lakshmanthirth	Karnataka	2200	55073	59167	84667	319000	169750	D	D	D
83	Kailash Mandir, Near Benpur Village	Yamuna	Uttar Pradesh	716667	370000	256667	606000	196733	310000	IBHS	IBHS	D
84	Kalanaur	Yamuna	Uttar Pradesh	81667	121786	31333	63653	90933	36667	IBHS	IBHS	D
85	Kalpi	Yamuna	Uttar Pradesh	35247	9567	34567	40427	15800	23800	D	D	IBHS
86	Karad	Krishna	Maharashtra	*	81000	10100	*	31750	*	*	IBHS	*
87	Karnal	Yamuna	Haryana	200333	35133	149833	114933	32867	135000	IBHS	IBHS	IBHS
88	Keesara	Munneru	Andhra Pradesh	790	*	*	2000	2015	4025	D	*	*
89	Keolari	Wainganga	Madhya Pradesh	683	6015	677	1035	3483	1972	D	IBHS	D
90	Khanpur	Mahi	Gujarat	18693	2600	*	7077	25753	13767	IBHS	D	*
91	Khatoli	Parwati	Rajasthan	18000	103200	66500	77000	101545	73500	D	IBHS	D

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
92	Kodumudi	Cauvery	Tamil Nadu	8827	20247	16300	7121	14893	6067	IBHS	IBHS	IBHS
93	Koggedoddi	Arkavathy	Karnataka	1324	40260	32500	202480	440067	32160	D	D	D
94	Kokiwada	Pench	Madhya Pradesh	3874	3287	693	3424	5222	6417	IBHS	D	D
95	Kollegal	Cauvery	Karnataka	1683	51132	22667	225071	322533	14500	D	D	IBHS
96	Konta	Sabari	Chhattisgarh	1400	*	*	2167	2526	1427	D	*	*
97	Kopergaon	Godavari	Maharashtra	5400	*	*	*	2750	*	*	*	*
98	Kora	Rind	Uttar Pradesh	4336	3803	4010	3332	3159	2500	IBHS	IBHS	IBHS
99	Kudige	Cauvery	Karnataka	1491	17587	36333	75640	254667	62200	D	D	D
100	Kuldahbridge	Sone	Madhya Pradesh	5087	5900	8683	5660	6053	3750	D	D	IBHS
101	Kumhari	Wainganga	Madhya Pradesh	-	1591	-	-	3041	538	-	D	NHS
102	Kuppelur	Kumudavathi	Karnataka	1700	24800	29833	*	249000	*	*	D	*
103	Kurundwad	Krishna	Maharashtra	*	16192	6500	*	15417	*	*	IBHS	*
104	Lakkavalli	Bhadra	Karnataka	668	18740	42967	95680	218667	20440	D	D	IBHS
105	Lakshmanapatti	Kodaganar	Tamil Nadu	12767	14660	43167	26583	24433	18733	D	D	IBHS
106	Lalpur	Sengar	Uttar Pradesh	6838	9245	4700	4689	13720	3035	IBHS	D	IBHS
107	Lodhikheda	Jam	Madhya Pradesh	8235	10187	9550	8564	3335	11967	D	IBHS	D
108	Luwara	Shetrunji	Gujarat	17613	32667	*	22377	23133	16400	D	IBHS	*
109	M H Halli	Hemavati	Karnataka	1279	14327	24800	103667	170500	45160	D	D	D
110	Madhira	Wyra	Telangana	2800	*	*	2152	1792	1820	IBHS	*	*
111	Madla	Ken	Madhya Pradesh	*	1498	1947	*	2362	2850	*	D	D
112	Magardhara	Wainganga	Madhya Pradesh	5323	5907	5090	2135	4647	477	IBHS	IBHS	NoHS
113	Mahalgaon	Wainganga	Maharashtra	2922	1542	1052	2619	2343	2818	IBHS	D	D
114	Mahidpur	Shipra	Madhya Pradesh	*	134800	*	*	168250	*	*	D	*
115	Maighat	Gomti	Uttar Pradesh	8440	6947	6717	6047	7173	5417	IBHS	D	IBHS
116	Malkhed	Kangna	Karnataka	790	*	*	3055	2193	1427	D	*	*
117	Mancherial	Godavari	Telangana	1400	*	*	2006	1961	2910	D	*	*
118	Mandawara	Chambal	Rajasthan	54769	79000	94500	118467	85800	100333	D	D	D
119	Manderial	Chambal	Rajasthan	*	132545	69833	56067	87267	70833	*	IBHS	D
120	Mangaon	Kal	Maharashtra	*	55667	9000	*	20417	*	*	IBHS	*
121	Mantralayam	Tungabhadra	Andhra Pradesh	2200	*	*	1791	1820	1058	IBHS	*	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
122	Marella	Gundlakamma	Andhra Pradesh	790	*	*	1958	2800	1320	D	*	*
123	Marol	Varada	Karnataka	5400	27769	4100	*	172200	*	*	D	*
124	Mataji	Mahi	Madhya Pradesh	18017	15000	*	27636	20567	18500	IBHS	D	*
125	Mawi	Yamuna	Uttar Pradesh	129867	1029333	1231667	907267	784667	775000	D	IBHS	IBHS
126	Mejaroad	Tons	Uttar Pradesh	6980	4073	2950	4107	4107	3800	IBHS	D	D
127	Mirawadi	Mula Mutha	Maharashtra	*	100609	136667	*	75250	*	*	IBHS	*
128	Mirzapur	Ganga	Uttar Pradesh	8587	8753	8517	7093	8013	7067	IBHS	IBHS	IBHS
129	Mohana	Betwa	Uttar Pradesh	5447	3896	13007	15596	16407	7440	D	D	IBHS
130	Mohna	Yamuna	Haryana	844000	1092667	1566667	5313333	2258667	10550000	D	D	D
131	Mungoli	Penganga	Maharashtra	-	4111	1487	2115	965	1633	NHS	IBHS	D
132	Munugodu	Edduvagu	Andhra Pradesh	790	*	*	1906	1821	2250	D	*	*
133	Muradpur	Vashishti	Maharashtra	2175	19593	5000	*	46182	*	*	D	*
134	Murappanadu	Tambraparani	Tamil Nadu	6487	7520	10600	8486	7050	6483	D	IBHS	IBHS
135	Musiri	Cauvery	Tamil Nadu	17760	12107	17667	10269	16440	7167	IBHS	D	IBHS
136	Muthankera	Kabini	Kerala	2314	32133	24833	99953	528733	55400	D	D	D
137	Nagothane	Amba	Maharashtra	-	52000	5000	*	19383	*	*	IBHS	*
138	Nallamaranpatty	Amaravathi	Tamil Nadu	2800	16018	12983	7933	4850	4900	D	IBHS	IBHS
139	Nanded	Godavari	Maharashtra	2400	*	*	2100	4213	1407	IBHS	*	*
140	Nandgaon	Wunna	Maharashtra	2155	7151	8450	5257	3950	7183	D	IBHS	IBHS
141	Nashik	Godavari	Maharashtra	5400	*	*	2800	1967	3517	IBHS	*	*
142	Naugaon	Yamuna	Uttarakhand	8573	29143	10060	11213	61733	21833	D	D	D
143	Nellithurai	Bhavani	Tamil Nadu	*	32000	*	3800	*	*	*	*	*
144	Noida	Yamuna	Uttar Pradesh	50466667	38746667	81166667	60533333	15466667	10366667	IBHS	IBHS	IBHS
145	Nowrangpur	Indravathi	Odisha	1700	*	*	2322	2060	1960	D	*	*
146	Odenthurai	Kallar	Tamil Nadu	24933	51067	57833	53073	16164	15733	D	IBHS	IBHS
147	Orai Rath marg Road Bridge, Chikasi	Betwa	Uttar Pradesh	5120	3767	13650	15207	14627	7760	D	D	IBHS
148	P.G. Bridge	Penganga	Maharashtra	945	3842	795	996	2970	1072	D	IBHS	D
149	Pachawali	Sindh	Madhya Pradesh	2975	1390	1700	*	3214	*	*	D	*
150	Pachegaon	Pravara	Maharashtra	2800	*	*	2433	1963	2567	IBHS	*	*
151	Padardibadi	Mahi	Rajasthan	16327	14517	*	33038	13400	24833	D	IBHS	*
152	Pali	Chambal	Rajasthan	*	116154	47167	82600	62533	57667		IBHS	D
153	Palla	Yamuna	Delhi	167067	1172000	398167	1813333	672000	2068000	D	IBHS	D
154	Paramkudi	Vaigai	Tamil Nadu	*	27943	10383.3	12971	*	41333	*	*	D

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										Pre-M	M	Post- M
155	Pargaon	Bhima	Maharashtra	*	79436	88500	*	46083	*	*	IBHS	*
156	Patala	Wardha	Maharashtra	3004	5387	2243	2375	4221	5877	IBHS	IBHS	D
157	Patansaongi	Chandrabhaga	Maharashtra	3956	8515	9467	6908	5169	1967	D	IBHS	IBHS
158	Pathagudem	Indravathi	Chhattisgarh	1700	*	*	2321	2469	2960	D	*	*
159	Pauni	Wainganga	Maharashtra	3580	3464	8033	5107	3887	2700	D	D	IBHS
160	Perur	Godavari	Telangana	1700	*	*	2193	2140	3117	D	*	*
161	Phulgaon	Bhima	Maharashtra	*	93000	*	*	55333	*	*	IBHS	*
162	Poanta	Yamuna	Himachal Pradesh	25733	55000	14667	209720	139933	24667	D	D	D
163	Poiyaghat, Agra	Yamuna	Uttar Pradesh	620000	404000	193333	555333	173067	262000	IBHS	IBHS	D
164	Polavaram	Godavari	Andhra Pradesh	1400	*	*	2145	3300	2257	D	*	*
165	Pratap pur	Yamuna	Uttar Pradesh	15293	6140	4200	6446	5773	3572	IBHS	IBHS	IBHS
166	Pratapgarh	Sai	Uttar Pradesh	8433	5800	8167	7267	6347	3683	IBHS	D	IBHS
167	Purna	Purna	Maharashtra	2200	*	*	*	2264	1833	*	*	*
168	Rajapur	Yamuna	Uttar Pradesh	15360	6362	4800	9973	8333	7080	IBHS	D	D
169	Rajegaon	Pranhita	Madhya Pradesh	2348	1829	1922	945	3092	672	IBHS	D	IBHS
170	Rajghat (Agra)	Betwa	Uttar Pradesh	1476	892	1733	2683	2123	2560	D	D	D
171	Ramakona	Kanhan	Madhya Pradesh	2731	9667	10550	5391	7927	5700	D	IBHS	IBHS
172	Rangeli	Som	Rajasthan	18573	5465	*	15992	26393	16267	IBHS	D	*
173	Renukaji	Giri	Himachal Pradesh	2504	28893	14367	9680	31000	16167	D	D	D
174	Sahijana	Betwa	Uttar Pradesh	9723	5500	13650	4747	3703	3020	IBHS	IBHS	IBHS
175	Saidpur	Ganga	Uttar Pradesh	8633	9020	8300	6913	7353	4583	IBHS	IBHS	IBHS
176	Saigaon	Manjira	Karnataka	2400	*	*	*	2625	*	*	*	*
177	Sakhara	Wainganga	Maharashtra	5363	4649	6217	3661	3772	2567	IBHS	IBHS	IBHS
178	Sakleshpura	Hemavati	Karnataka	800	36387	38333	51127	362800	362600	D	D	D
179	Sakmur	Wardha	Maharashtra	2033	2385	1072	2519	4388	2222	D	D	D
180	Saloora	Manjira	Telangana	5400	*	*	2053	2113	1900	IBHS	*	*
181	Samdoli	Warna	Maharashtra	*	26145	4333	*	32143	*	*	D	*
182	Sangam (LGD)	Kinnerasani	Telangana	9200	*	*	1893	1727	2167	IBHS	*	*
183	Sangod	Parwan	Rajasthan	*	94364	94500	*	76500	*	*	IBHS	*
184	Saradaput	Sabari	Chhattisgarh	1700	*	*	1985	1926	1780	D	*	*
185	Sarangpur	Kalisindh	Madhya Pradesh	*	137600	*	*	103800	*	*	IBHS	*

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										Pre-M	M	Post- M
186	Satna	Tons	Madhya Pradesh	6827	4147	8167	6213	4627	5050	IBHS	D	IBHS
187	Satrapur	Kanhan	Maharashtra	4500	10680	5517	7480	5353	2433	D	IBHS	IBHS
188	Savandapur	Bhavani	Tamil Nadu	16693	15279	38317	17893	14260	4283	D	IBHS	IBHS
189	Seondha	Sindh	Madhya Pradesh	1834	1235	1807	2032	2693	3060	D	D	D
190	Sevanur	Chittar	Tamil Nadu	21750	45600	22500	31467	*	7900	D	*	IBHS
191	Shahzadpur	Ganga	Uttar Pradesh	8380	7173	5833	7027	8280	5950	IBHS	D	D
192	Shastri Bridge	Ganga	Uttar Pradesh	8980	7993	7850	7567	7933	6033	IBHS	D	IBHS
193	Shimoga	Tunga	Karnataka	*	13608	33167	68667	535909	780000	*	D	D
194	Singasadanapalli	Ponnaiyar	Tamil Nadu	2912267	6733333	1781667	1959867	2038667	4583333	IBHS	IBHS	D
195	Suddakallu	Dindi	Telangana	1400	*	*	1759	2820	1567	D	*	*
196	Sultanpur	Gomti	Uttar Pradesh	8773	7073	8383	6607	6227	7300	IBHS	IBHS	IBHS
197	T Bekuppe	Arkavathy	Karnataka	9913	160127	59833	489667	661200	358000	D	D	D
198	T K Halli	Shimsha	Karnataka	3375	52045	71667	329700	584091	132500	D	D	D
199	T Narsipura	Kabini	Karnataka	2286	61220	54500	64827	374400	74200	D	D	D
200	T. Ramapuram	Hagari	Karnataka	1400	*	*	2485	3625	1657	D	*	*
201	Tal	Chambal	Madhya Pradesh	*	112600	*	*	113333	*	*	D	*
202	Tandalaiputhur	Ayyar	Tamil Nadu	4100	45400	39667	63667	*	*	D	*	*
203	Terwad	Panchganga	Maharashtra	*	40750	75667	*	18525	*	*	IBHS	*
204	Thengumarahada	Bhavani / Moyar	Tamil Nadu	7747	48567	29980	16813	6012	3233	D	IBHS	IBHS
205	Theni	Vagai/Suruliar	Tamil Nadu	18980	51250	43167	20747	14173	8683	D	IBHS	IBHS
206	Thevur	Sarabenga	Tamil Nadu	4850	33667	46500	10843	6400	39333	D	IBHS	IBHS
207	Thimmanahalli	Yagachi	Karnataka	899	34333	25833	140000	414000	237400	D	D	D
208	Thoppur	Thoppaiyar	Tamil Nadu	*	39600	42400	31000	*	*	*	*	*
209	Tonk	Banas	Rajasthan	*	151429	*	*	154000	*	*	D	*
210	Tuini	Tons	Uttarakhand	1235	28067	13300	32420	27733	13617	D	IBHS	D
211	Udi	Chambal	Uttar Pradesh	8320	5969	10483	7100	8300	9180	IBHS	D	IBHS
212	Ujjain	Shipra	Madhya Pradesh	*	181273	104500	*	931083	1700000	*	D	D
213	Urachikottai	Cauvery	Tamil Nadu	15667	19627	11000	4025	9592	*	IBHS	IBHS	
214	V S Bridge	Ganga	Uttar Pradesh	8233	8293	7317	7320	7860	5533	IBHS	IBHS	IBHS
215	Varanasi	Ganga	Uttar Pradesh	10367	8120	8333	7427	8067	6267	IBHS	IBHS	IBHS
216	Varanavasi	Maruthaiyar	Tamil Nadu	16386	27600	18150	7950	4700	7900	IBHS	IBHS	IBHS
217	Vautha	Sabarmati	Gujarat	1328667	208333	*	995385	852000	280000	IBHS	D	*
218	Veligonda	Musi	Telangana	940	*	*	5815	4023	2875	D	*	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
219	Vijayawada	Krishna	Andhra Pradesh	1400	*	*	2096	1801	1833	D	*	*
220	Vrindawan Bridge (Mathura U/S)	Yamuna	Uttar Pradesh	*	4332000	4466667	2402857	1143333	1058333	*	IBHS	IBHS
221	Wadakbal	Sina	Maharashtra	*	84600	113333	*	125000	*	*	D	*
222	Wadenapally	Krishna	Telangana	940	*	*	1866	2433	1640	D	*	*
223	Wairagarh	Khobragadi	Maharashtra	765	4093	3317	800	5650	957	D	D	IBHS
224	Warunji	Koyna	Maharashtra	*	83800	16333	*	50000	*	*	IBHS	*
225	Watrak Nr Vautha	Watrak	Gujarat	*	21817	*	140000	27750	17667	*	D	*
226	Yadgir	Bhima	Karnataka	1400	*	*	*	1950	1400	*	*	*
227	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	502857	393333	293333	652667	225533	364000	D	IBHS	D
228	Yashwant Nagar	Giri	Himachal Pradesh	12273	32133	13300	12967	54786	19500	D	D	D
229	Yelli	Godavari	Maharashtra	3500	*	*	2421	3380	2400	IBHS	*	*

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

8.11 Faecal Coliform (FC):

The analysis reveals the distribution of stations categorized as 'Improved but Hotspot' across different seasons. The number of such stations varied, with the highest count observed during the monsoon period, totaling 61 stations across 38 rivers including Amba, Betwa, Bhavani, Bhavani/Moyar, Bhima, Cauvery, Chambal, Chandrabhaga, Chhoti Sarju, Gandhayar, Ganga, Gomti, Jam, Kal, Kalisindh, Kanhan, Kanhar, Khobragadi, Koyna, Krishna, Mula Mutha, Munneru, Noyyal, Palar, Peddavagu, Penganga, Ponnaiyar, Pranhita, Rind, Shetrunji, Sone, Tons, Vagai/Suruliar, Wainganga, Wardha, Wunna, and Yamuna. This suggests favorable conditions during this season contributing to some improvement in water quality despite ongoing pollution concerns.

During the pre-monsoon and post-monsoon periods, fewer stations were classified as 'Improved but Hotspot' compared to the monsoon period, with relatively stable numbers (48 and 58 stations respectively). Specifically, during the pre-monsoon season, 48 stations across 27 rivers such as Betwa, Bhavani, Chambal, Chhoti Sarju, Dhasan, Ganga, Godavari, Gomti, Hindon, Indravathi, Kanhar, Ken, Kinnerasani, Kodaganar, Manjira, Peddavagu, Pravara, Rind, Sabari, Sai, Sengar, Tons, Tungabhadra, Wainganga, Wardha, Wyra, and Yamuna showed improved conditions but were still considered hotspots. Similarly, during the post-monsoon period, 58 stations across 34 rivers including Betwa, Bharathapuzha, Bhavani, Bhavani/Moyar, Cauvery, Chambal, Chandrabhaga, Chhoti Sarju, Chinnar, Chittar, Gandhayar, Ganga, Gomti, Kabini, Kallar, Kanhan, Kanhar, Kunwari, Noyyal, Penganga, Ponnaiyar, Rind, Sai, Sarabenga, Sengar, Sone, Tons, Ulhas, Vagai/Suruliar, Vaigai, Wainganga, Wardha, Wunna, and Yamuna exhibited similar 'Improved but Hotspot' characteristics.

Conversely, the number of stations indicating deteriorated water quality was notably higher across all seasons, reflecting persistent pollution pressures, runoff effects, and potentially exacerbated impacts during and after the rainy season. The monsoon period recorded the highest number of stations with deteriorated water quality (113 stations), suggesting initial impacts of seasonal changes and human activities preceding the monsoon. During the pre-monsoon (83 stations) and post-monsoon periods (61 stations), the number of stations with deteriorated water quality remained elevated.

In contrast, there were instances where no hotspot conditions were observed. During the pre-monsoon period, eight (08) stations including Biligundulu (Cauvery River), Gudam Bridge (Pranhita River), Kumhari (Wainganga River), Murappanadu (Tambraparani River), Nallamaranpatty (Amaravathi River), Rajegaon (Pranhita River), Tandalaiputhur (Ayyar River), and Wairagarh (Khobragadi River), as well as six (06) stations during the post-monsoon season including Gudam Bridge (Pranhita River), Hivra (Wardha River), Bakhari, Kumhari, Magardhara (Wainganga River), and Wairagarh (Khobragadi River), indicated stable or improved water quality conditions. This highlights potential successes in pollution management or the natural self-purification capacity of these rivers at those specific locations.

A few locations emerged as new hot spots in 2023, indicating worsening water quality issues compared to the previous year. During the pre-monsoon season, 21 stations emerged as new hotspots across 16 rivers including Hemavathi, Suvarnavathi, Yamuna, Tungabhadra, Tunga, Bhadra, Cauvery/Lakshmanthirth, Arkavathy, Cauvery, Kabini, Penganga, Giri, Wardha, Shimsha, Yagachi and Tons. During the monsoon season, 4 stations emerged as new hotspots across 4 rivers including Tungabhadra, Amaravathi, Betwa and Sarabenga.During post-monsoon season, 9 stations emerged as new hotspots across 9 rivers including at Banas, Tungabhadra, Bearma, Pench, Shetrunji, Wainganga, Tambraparani, Amaravathi and Wardha. This underscores ongoing challenges in water quality management, emphasizing the need for heightened attention and targeted interventions to address newly identified pollution sources affecting these locations.

Table 29: Comparison of Hot Spots Faecal Coliform (FC) during year 2022 with 2023

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
1	A.B. Road Crossing	Parwati	Madhya Pradesh	*	15333	12500	*	18000	*	*	D	*
2	A.P. Puram	Chittar	Tamil Nadu	680	*	*	*	*	1100	*	*	*
3	Abu Road	Banas	Rajasthan	1633	2400	-	*	6262	5300	*	D	NHS
4	Akbarpur	Chhoti sarju	Uttar Pradesh	4767	4273	4917	4060	4100	2633	IBHS	IBHS	IBHS
5	Akkihebbal	Hemavati	Karnataka	-	5993	2567	24560	39953	11760	NHS	D	D
6	Aklera	Parwan	Rajasthan	*	9600	8300	9300	17789	*	*	D	*
7	Alanthurai	Noyyal	Tamil Nadu	885	1820	2700	1100	2500	*	D	D	*
8	Allahabad	Ganga	Uttar Pradesh	5673	4080	4083	3987	4220	3400	IBHS	D	IBHS
9	Ambarampalayam	Bharathapuzha	Tamil Nadu	640	667	2080	827	853	932	D	D	IBHS
10	Ambasamudram	Vaigai	Tamil Nadu	1032	580	2093	1693	*	518	D	*	IBHS
11	Arjunwad	Krishna	Maharashtra	*	10136	2133	*	7414	*	*	IBHS	*
12	Asthi	Wainganga	Maharashtra	753	1016	1565	989	1682	843	D	D	IBHS
13	Auraiya	Yamuna	Uttar Pradesh	51513	18619	40083	61193	39953	39420	D	D	IBHS
14	Avarankuppam	Palar	Tamil Nadu	648	2799	8163	1300	780	*	D	IBHS	*
15	Badalapur	Ulhas	Maharashtra	4167	15487	40567	14707	33133	5283	D	D	IBHS
16	Baghpat	Yamuna	Uttar Pradesh	51800	32987	87333	81320	22373	23833	D	IBHS	IBHS
17	Bakhari	Wainganga	Madhya Pradesh	621	2533	957	1840	783	487	D	IBHS	NoHS
18	Baleni	Yamuna	Uttar Pradesh	52387	191333	151667	216000	165733	193333	D	IBHS	D
19	Baluaghat	Ganga	Uttar Pradesh	6640	3393	4350	3840	3973	3333	IBHS	D	IBHS
20	Bamni (Nagpur)	Wardha	Maharashtra	799	2574	1312	1797	1448	912	D	IBHS	IBHS
21	Banda	Ken	Uttar Pradesh	9930	1496	1090	994	4157	1222	IBHS	D	D
22	Baranwada	Banas	Rajasthan	*	11140	7240	*	13733	*	*	D	*
23	Barod	Kalisindh	Rajasthan	10233	5433	4333	38242	8255	22383	D	D	D
24	Basoda	Betwa	Madhya Pradesh	2218	1377	2098	2373	2435	*	D	D	*
25	Bawapuram	Tungabhadra	Andhra Pradesh	1700	-	-	1651	985	570	D	NHS	NHS
26	Bendrahalli	Suvarnavathi	Karnataka	-	9233	3767	75860	100453	50200	NHS	D	D
27	Bhadana Village D/s of Kota City	Chambal/Parwati	Rajasthan	*	10927	*	*	15950	*	*	D	*
28	Bhadrachelam	Godavari	Telangana	2200	*	*	1213	915	762	IBHS	*	*
29	Bhatpalli	Peddavagu	Telangana	520	1676	825	1053	1275	1090	D	IBHS	D
30	Bhind	Kunwari	Madhya Pradesh	4384	8173	6483	9144	16417	2700	D	D	IBHS
31	Bigod	Banas	Rajasthan	*	13050	10450	8467	35067	*	*	D	
32	Biligundulu	Cauvery	Tamil Nadu	-	723	503	377	707	668	NoHS	IBHS	D
33	Byladahalli	Haridra	Karnataka	-	1433	1547	*	43288	5525	*	D	D
34	Chindnar	Indravathi	Chhattisgarh	1400	*	*	1176	1360	548	IBHS	*	*
35	Cholachagudda	Malaprabha	Karnataka	*	2246	1547	6686	35556	*	*	D	*
36	Chopan	Sone	Uttar Pradesh	2053	2320	3150	2653	2287	1700	D	IBHS	IBHS

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
37	Chunchunkatte	Cauvery	Karnataka	*	2978	3847	2600	49330	*	*	IBHS	*
38	Daund	Bhima	Maharashtra	*	14800	45667	*	15333	*	*	D	*
39	Delhi Railway Bridge	Yamuna	Delhi	2311333	4718667	2080000	21038000	11869333	4100000	D	D	D
40	Deosugar	Krishna	Karnataka	1100	*	*	2001	1199	580	D	*	*
41	Derol Bridge	Sabarmati	Gujarat	*	2300	*	5100	3718	4900	*	D	*
42	Dhalegaon	Godavari	Maharashtra	940	*	*	*	997	652	*	*	*
43	Dhansa	Sahibi	Delhi	*	75556	*	*	123000	*	*	D	*
44	Dhareri	Chambal	Madhya Pradesh	*	27025	*	*	292000	*	*	D	*
45	Dholpur	Chambal	Rajasthan	6467	4549	8350	8746	9955	5860	D	D	IBHS
46	Duddhi	Kanhar	Uttar Pradesh	3147	1886	3983	2873	1480	1400	IBHS	IBHS	IBHS
47	Elunuthi Mangalam	Noyyal	Tamil Nadu	747	1861	7017	2091	733	1433	D	IBHS	IBHS
48	Etawah	Yamuna	Uttar Pradesh	358500	178000	311667	426667	137267	556000	D	IBHS	D
49	Gaisabad	Bearma	Madhya Pradesh	*	1149	-	2000	1859	1960	*	D	NHS
50	Galeta	Hindon	Uttar Pradesh	8568667	571133	4650000	6992667	1274667	9900000	IBHS	D	D
51	Gandhavayal	Gandhayar	Tamil Nadu	812	3919	2508	2579	1402	572	D	IBHS	IBHS
52	Gandlapet	Peddavagu	Telangana	2200	*	*	1804	1009	607	IBHS	*	*
53	Ganguwala	Yamuna	Himachal Pradesh	-	5033	3500	6560	5907	9017	NHS	D	D
54	Ganod	Bhadar	Gujarat	1775	1800	*	*	5880	*	*	D	*
55	Garhakota	Sonar	Madhya Pradesh	*	2099	2300	*	3685	*	*	D	*
56	Garrauli	Dhasan	Madhya Pradesh	1064	1164	993	1008	6944	3212	IBHS	D	D
57	Ghazipur	Ganga	Uttar Pradesh	5740	3773	4183	3887	3973	2967	IBHS	D	IBHS
58	Gokak	Ghataprabha	Karnataka	*	3654	1370	*	41900	6800	*	D	D
59	Gokul Barrage II Mathura D/S	Yamuna	Uttar Pradesh	111467	325800	525000	874667	2006667	2730000	D	D	D
60	GR Bridge	Godavari	Maharashtra	1400	*	*	1583	1403	700	D	*	*
61	Gudam Bridge	Pranhita	Maharashtra	*	656	2035	389	575	120	NoHS	IBHS	NoHS
62	Gummanur	Ponnaiyar	Tamil Nadu	553	1337	10867	1713	1339	1780	D	D	IBHS
63	Hamirpur	Yamuna	Uttar Pradesh	21360	4520	19983	23513	10520	6740	D	D	IBHS
64	Haralahalli	Tungabhadra	Karnataka	-	1691	1822	11971	41218	21950	NHS	D	D
65	Hariharapura	Tunga	Karnataka	-	2304	2233	42740	33880	33460	NHS	D	D
66	Haripur	Tons	Uttarakhand	2289	3600	9833	6773	9193	13967	D	D	D
67	Hivra	Wardha	Maharashtra	595	1245	657	700	1487	422	D	D	NoHS
68	Hogenakkal	Chinnar	Tamil Nadu	*	1059	5980	4900	*	3300	*	*	IBHS
69	Holehonnur	Bhadra	Karnataka	-	1729	3333	29967	37653	12760	NHS	D	D
70	Hoovinahole	Swarnamukhi	Karnataka	*	4971	1310	5140	*	*	*	*	*
71	Huvinhedgi	Krishna	Karnataka	940	*	*	1399	1318	647	D	*	*
72	Jagdalpur	Indravathi	Chhattisgarh	2400	*	*	1358	1218	238	IBHS	*	*
73	Jaunpur	Gomti	Uttar Pradesh	4860	3447	4200	3887	3440	3167	IBHS	IBHS	IBHS
74	Jawahar Bridge, Agra	Yamuna	Uttar Pradesh	429333	210667	140000	258667	97933	224000	IBHS	IBHS	D
75	Jhalawad	Kalisindh	Rajasthan	*	130400	*	*	14510	*	*	IBHS	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
76	Jhansi Mirjapur Highway Road Bridge	Betwa	Uttar Pradesh	3933	3333	7467	2953	3826	2640	IBHS	D	IBHS
77	K M Vadi	Cauvery/ Lakshmanthirth	Karnataka	-	13167	2480	7693	50375	19200	NHS	D	D
78	Kailash Mandir, Near Benpur Village	Yamuna	Uttar Pradesh	446667	225933	160000	377267	126213	208000	IBHS	IBHS	D
79	Kalanaur	Yamuna	Uttar Pradesh	6207	8464	7583	10687	11320	8233	D	D	D
80	Kalpi	Yamuna	Uttar Pradesh	21413	5846	18750	22880	9779	15640	D	D	IBHS
81	Karad	Krishna	Maharashtra	*	20960	2867	*	11250	*	*	IBHS	*
82	Karnal	Yamuna	Haryana	42867	7387	12800	15107	9600	14133	IBHS	D	D
83	Keesara	Munneru	Andhra Pradesh	790	2314	*	1224	1021	535	D	IBHS	*
84	Khanpur	Mahi	Gujarat	2079	900	*	3200	5347	3300	D	D	*
85	Khatoli	Parwati	Rajasthan	4173	8350	8117	21800	16000	10600	D	D	D
86	Kodumudi	Cauvery	Tamil Nadu	847	1968	1130	889	1161	933	D	IBHS	IBHS
87	Koggedoddi	Arkavathy	Karnataka	-	7295	3900	37217	42613	7380	NHS	D	D
88	Kokiwada	Pench	Madhya Pradesh	849	1151	-	1813	1833	2548	D	D	NHS
89	Kollegal	Cauvery	Karnataka	-	12304	4383	47700	76920	3920	NHS	D	IBHS
90	Konta	Sabari	Chhattisgarh	700	*	*	1304	1255	655	D	*	*
91	Kopergaon	Godavari	Maharashtra	1400	*	*	*	1387	*	*	*	*
92	Kora	Rind	Uttar Pradesh	2795	2294	2438	2131	1885	1720	IBHS	IBHS	IBHS
93	Kudige	Cauvery	Karnataka	-	3774	1983	17467	57840	10060	NHS	D	D
94	Kuldahbridge	Sone	Madhya Pradesh	2587	3020	4533	3060	3080	1650	D	D	IBHS
95	Kumhari	Wainganga	Madhya Pradesh	-	799	-	201	1134	338	NoHS	D	NoHS
96	Kuppelur	Kumudavathi	Karnataka	-	5612	4567	*	42256	*	*	D	*
97	Kurundwad	Krishna	Maharashtra	*	4533	2050	*	5967	*	*	D	*
98	Lakkavalli	Bhadra	Karnataka	-	1693	5333	39320	70993	6820	NHS	D	D
99	Lakshmanapatti	Kodaganar	Tamil Nadu	843	616	588	640	2250	1533	IBHS	D	D
100	Lalpur	Sengar	Uttar Pradesh	5329	5245	2600	2539	8540	2073	IBHS	D	IBHS
101	Lodhikheda	Jam	Madhya Pradesh	1391	2087	2373	3006	1547	5783	D	IBHS	D
102	Luwara	Shetrunji	Gujarat	3440	6267	-	10092	5713	5517	D	IBHS	NHS
103	M H Halli	Hemavati	Karnataka	-	1273	1856	39544	23800	7440	NHS	D	D
104	Madhira	Wyra	Telangana	1400	*	*	1143	962	422	IBHS	*	*
105	Madla	Ken	Madhya Pradesh	*	905	953	*	1418	1900	*	D	D
106	Magardhara	Wainganga	Madhya Pradesh	859	2001	2532	1357	1873	178	D	IBHS	NoHS
107	Mahalgaon	Wainganga	Maharashtra	1089	-	-	871	-	650	IBHS	-	NHS
108	Mahidpur	Shipra	Madhya Pradesh	*	8890	*	*	40350	*	*	D	*
109	Maighat	Gomti	Uttar Pradesh	3933	3367	3667	3173	3513	2600	IBHS	D	IBHS
110	Mancherial	Godavari	Telangana	790	*	*	1497	1236	547	D	*	*
111	Mandawara	Chambal	Rajasthan	4662	5086	5983	11580	13027	10500	D	D	D
112	Manderial	Chambal	Rajasthan	*	10418	7233	6953	12840	17000	*	D	D

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
113	Mangaon	Kal	Maharashtra	*	15258	-	*	6592	*	*	IBHS	*
114	Mantralayam	Tungabhadra	Andhra Pradesh	1400	*	*	1146	874	435	IBHS	*	*
115	Marol	Varada	Karnataka	-	2874	1440	*	58200	*	*	D	*
116	Mataji	Mahi	Madhya Pradesh	2725	1250	*	9455	6600	8525	D	D	*
117	Mawi	Yamuna	Uttar Pradesh	16360	97333	140000	143267	137067	156667	D	D	D
118	Mejaroad	Tons	Uttar Pradesh	3587	2041	1200	2100	1987	1767	IBHS	IBHS	D
119	Mirawadi	Mula Mutha	Maharashtra	*	18700	27333	*	13083	*	*	IBHS	*
120	Mirzapur	Ganga	Uttar Pradesh	4273	4367	4233	3607	4220	3550	IBHS	IBHS	IBHS
121	Mohana	Betwa	Uttar Pradesh	3402	2367	6832	9735	10879	4480	D	D	IBHS
122	Mohna	Yamuna	Haryana	176533	143267	143333	718000	960667	2433333	D	D	D
123	Mungoli	Penganga	Maharashtra	-	1563	855	-	564	762	-	IBHS	IBHS
124	Muradpur	Vashishti	Maharashtra	525	6873	2700	*	8336	*	*	D	*
125	Murappanadu	Tambraparani	Tamil Nadu	515	611	-	308	717	903	NoHS	D	NHS
126	Musiri	Cauvery	Tamil Nadu	589	1646	1580	877	2723	1097	D	D	D
127	Muthankera	Kabini	Kerala	-	3665	2650	26750	57733	25000	NHS	D	D
128	Nagothane	Amba	Maharashtra	*	14617	1400	*	4900	*	*	IBHS	*
129	Nallamaranpatty	Amaravathi	Tamil Nadu	565	-	-	283	865	615	NoHS	NHS	NHS
130	Nanded	Godavari	Maharashtra	1300	*	*	1118	1543	412	IBHS	*	*
131	Nandgaon	Wunna	Maharashtra	515	2369	2183	2421	1192	1700	D	IBHS	IBHS
132	Nashik	Godavari	Maharashtra	2200	*	*	1495	1218	630	IBHS	*	*
133	Naugaon	Yamuna	Uttarakhand	2427	3900	6800	4693	6040	7067	D	D	D
134	Nellithurai	Bhavani	Tamil Nadu	*	1800	*	325	*	*	*	*	*
135	Noida	Yamuna	Uttar Pradesh	7113333	8320000	13650000	10793333	2833333	3683333	D	IBHS	IBHS
136	Nowrangpur	Indravathi	Odisha	790	*	*	1411	1070	692	D	*	*
137	Odenthurai	Kallar	Tamil Nadu	773	2248	3513	2691	993	1063	D	IBHS	IBHS
138	Orai Rath marg Road Bridge, Chikasi	Betwa	Uttar Pradesh	3373	2465	8100	10113	9865	5340	D	D	IBHS
139	P.G. Bridge	Penganga	Maharashtra	-	1575	-	617	1263	-	NHS	IBHS	-
140	Pachawali	Sindh	Madhya Pradesh	2048	813	843	*	2096	*	*	D	*
141	Pachegaon	Pravara	Maharashtra	1700	*	*	1357	1160	420	IBHS	*	*
142	Padardibadi	Mahi	Rajasthan	2160	4550	*	14894	5540	7283	D	D	*
143	Pali	Chambal	Rajasthan	*	12615	5983	10573	11427	10633	*	IBHS	D
144	Palla	Yamuna	Delhi	25253	163533	75000	199333	146800	155833	D	IBHS	D
145	Paramkudi	Vaigai	Tamil Nadu	*	627	872	1080	*	3350	*	*	D
146	Pargaon	Bhima	Maharashtra	*	18018	15500	*	12233	*	*	IBHS	*
147	Patala	Wardha	Maharashtra	836	1721	*	681	3035	1872	IBHS	D	*
148	Patansaongi	Chandrabhaga	Maharashtra	563	3128	2388	1909	1281	768	D	IBHS	IBHS
149	Pathagudem	Indravathi	Chhattisgarh	1400	*	*	1527	1010	812	D	*	*
150	Pauni	Wainganga	Maharashtra	881	1291	2550	1825	1485	1445	D	D	IBHS
151	Phulgaon	Bhima	Maharashtra	*	24350	*	*	20333	*	*	IBHS	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
152	Poanta	Yamuna	Himachal Pradesh	5793	4343	4333	27800	9860	6433	D	D	D
153	Poiyaghat, Agra	Yamuna	Uttar Pradesh	388667	243933	129833	337267	112533	171800	IBHS	IBHS	D
154	Polavaram	Godavari	Andhra Pradesh	1100	*	*	1516	1549	452	D	*	*
155	Pratap pur	Yamuna	Uttar Pradesh	9431	3638	3000	4016	3511	2143	IBHS	IBHS	IBHS
156	Pratapgarh	Sai	Uttar Pradesh	4333	2985	4150	4240	3260	1650	IBHS	D	IBHS
157	Purna	Purna	Maharashtra	1400	*	*	*	1249	550	*	*	*
158	Rajapur	Yamuna	Uttar Pradesh	9587	3807	2817	6060	5533	4720	IBHS	D	D
159	Rajegaon	Pranhita	Madhya Pradesh	606	682	-	406	1555	-	NoHS	D	-
160	Rajghat (Agra)	Betwa	Uttar Pradesh	844	-	1002	1613	1323	1716	D	NHS	D
161	Ramakona	Kanhan	Madhya Pradesh	654	3274	1467	2307	3313	2053	D	D	D
162	Rangeli	Som	Rajasthan	1978	1344	*	5277	8027	3833	D	D	*
163	Renukaji	Giri	Himachal Pradesh	-	4107	3417	4527	6620	5900	NHS	D	D
164	Sahijana	Betwa	Uttar Pradesh	5233	3155	6983	2767	2379	1996	IBHS	IBHS	IBHS
165	Saidpur	Ganga	Uttar Pradesh	4313	4480	3867	3353	3620	2100	IBHS	IBHS	IBHS
166	Saigaon	Manjira	Karnataka	1300	*	*	*	1335	*	*	*	*
167	Sakhara	Wainganga	Maharashtra	983	1428	1682	1161	1573	823	D	D	IBHS
168	Sakleshpura	Hemavati	Karnataka	-	3677	6167	28183	105587	16080	NHS	D	D
169	Sakmur	Wardha	Maharashtra	-	860	-	1267	1040	1142	NHS	D	NHS
170	Saloora	Manjira	Telangana	2200	*	*	1297	1491	455	IBHS	*	*
171	Samdoli	Warna	Maharashtra	*	9027	2133	*	9079	*	*	D	*
172	Sangam (LGD)	Kinnerasani	Telangana	5400	*	*	1181	1019	447	IBHS	*	*
173	Sangod	Parwan	Rajasthan	*	9800	9900	*	10320	*		D	*
174	Saradaput	Sabari	Chhattisgarh	1400	*	*	1292	957	838	IBHS	*	*
175	Sarangpur	Kalisindh	Madhya Pradesh	*	14880	*	*	20280	*	*	D	*
176	Satna	Tons	Madhya Pradesh	3467	2007	4267	3513	2327	2400	D	D	IBHS
177	Satrapur	Kanhan	Maharashtra	1938	2893	2645	2607	2079	1150	D	IBHS	IBHS
178	Savandapur	Bhavani	Tamil Nadu	705	4381	3397	681	881	755	IBHS	IBHS	IBHS
179	Seondha	Sindh	Madhya Pradesh	1212	722	902	1233	1681	2088	D	D	D
180	Sevanur	Chittar	Tamil Nadu	1238	1019	1590	3513	*	1100	D	*	IBHS
181	Shahzadpur	Ganga	Uttar Pradesh	4213	3673	3217	3447	3980	3000	IBHS	D	IBHS
182	Shastri Bridge	Ganga	Uttar Pradesh	4593	4067	4233	3900	3953	2867	IBHS	IBHS	IBHS
183	Shimoga	Tunga	Karnataka	*	1917	3233	18967	39800	30600	*	D	D
184	Singasadanapalli	Ponnaiyar	Tamil Nadu	260013	805333	985000	631000	430000	433333	D	IBHS	IBHS
185	Suddakallu	Dindi	Telangana	790	*	*	1192	1252	400	D	*	*
186	Sultanpur	Gomti	Uttar Pradesh	4287	3553	4017	3400	3227	3900	IBHS	IBHS	IBHS
187	T Bekuppe	Arkavathy	Karnataka	1338	22197	4767	209691	156067	77600	D	D	D
188	T K Halli	Shimsha	Karnataka	-	14087	5967	94696	78345	22750	NHS	D	D
189	T Narsipura	Kabini	Karnataka	-	7000	16883	16263	56200	14960	NHS	D	IBHS
190	T. Ramapuram	Hagari	Karnataka	940	*	*	1415	713	342	D	*	*
191	Tal	Chambal	Madhya Pradesh	*	15280	*	*	11433	*	*	IBHS	*

S.No.	Water Quality Monitoring Stations	River	State	Pre-M (2022)	M (2022)	Post- M (2022)	Pre-M (2023)	M (2023)	Post- M (2023)	Status of Hotspots stations of year 2022 during 2023		
										Pre-M	M	Post- M
192	Tandalaiputhur	Ayyar	Tamil Nadu	775	3192	1558	450	*	*	NoHS	*	*
193	Terwad	Panchganga	Maharashtra	*	5658	14667	*	6358	*	*	D	*
194	Thengumarahada	Bhavani / Moyar	Tamil Nadu	863	3001	5550	2301	531	505	D	IBHS	IBHS
195	Theni	Vagai/Suruliar	Tamil Nadu	901	3910	1163	1181	1130	877	D	IBHS	IBHS
196	Thevur	Sarabenga	Tamil Nadu	565	-	3772	2621	775	1467	D	NHS	IBHS
197	Thimmanahalli	Yagachi	Karnataka	-	3779	4630	29489	56207	10160	NHS	D	D
198	Thoppur	Thoppaiyar	Tamil Nadu	*	880	1492	3026	*	*	*	*	*
199	Tonk	Banas	Rajasthan	*	9143	*	*	12600	*	*	D	*
200	Tuini	Tons	Uttarakhand	-	4020	3417	5147	4747	5567	NHS	D	D
201	Udi	Chambal	Uttar Pradesh	4867	3509	5750	4159	5511	5920	IBHS	D	D
202	Ujjain	Shipra	Madhya Pradesh	*	19545	19500	*	186917	330000	*	D	D
203	Urachikottai	Cauvery	Tamil Nadu	546	4097	2658	1090	555	*	D	IBHS	*
204	V S Bridge	Ganga	Uttar Pradesh	4127	4267	3483	3700	4207	2650	IBHS	IBHS	IBHS
205	Varanasi	Ganga	Uttar Pradesh	5453	4127	4483	4173	3920	2817	IBHS	IBHS	IBHS
206	Varanavasi	Maruthaiyar	Tamil Nadu	870	584	727	1090	883	780	D	D	D
207	Vautha	Sabarmati	Gujarat	89133	27000	*	418615	85933	65833	D	D	*
208	Veligonda	Musi	Telangana	700	*	*	3438	1342	755	D	*	*
209	Vijayawada	Krishna	Andhra Pradesh	790	*	*	1383	1022	457	D	*	*
210	Vrindawan Bridge (Mathura U/S)	Yamuna	Uttar Pradesh	*	526133	681667	432857	208667	333333	*	IBHS	IBHS
211	Wadakbal	Sina	Maharashtra	*	27600	37000	*	60000	*	*	D	*
212	Wairagarh	Khobragadi	Maharashtra	-	2033	965	465	1267	490	NoHS	IBHS	NoHS
213	Warunji	Koyna	Maharashtra	*	20140	8167	*	15325	*	*	IBHS	*
214	Watrak Nr Vautha	Watrak	Gujarat	*	7850	*	33000	11225	5000	*	D	*
215	Yadgir	Bhima	Karnataka	790	*	*	*	1086	700	*	*	*
216	Yamuna Expessway Road Bridge, Etamadpur	Yamuna	Uttar Pradesh	1130000	261267	193333	412000	149333	252000	IBHS	IBHS	D
217	Yashwant Nagar	Giri	Himachal Pradesh	2383	5780	4633	5607	11879	8200	D	D	D
218	Yelli	Godavari	Maharashtra	2400	*	*	1341	1244	502	IBHS	*	*

(-) means No Hotspot

(*) means Data not available/ river dry.

No Hot Spot (NoHS) Deteriorate (D) New Hotspot (NHS) Improved but Hotspot (IBHS)

CHAPTER – 9

Conclusion

The study conducted covered a total of 759 water quality monitoring stations situated in important rivers across the country to identify water quality hotspots. The study report is based on the average values recorded during pre-monsoon, monsoon and post-monsoon seasons at these monitoring stations for 2023. The report provides a detailed analysis of 13 water quality parameters, highlighting the water quality status at various locations in India. The report also sheds light on the variations observed in the parameters essential for both the Central Pollution Control Board (CPCB) and Bureau of Indian Standards (BIS) classifications, along with parameters specific to the primary water quality criteria for bathing water as per the Ministry of Environment, Forest and Climate Change (MoEFCC). Based on the water quality data analysis, the following observations have been found:

pH

The pH levels of water across various rivers in India exhibit significant variability, influenced by seasonal factors and human activities. The analysis spanning pre-monsoon, monsoon, and post-monsoon seasons reveals widespread deviations from the recommended pH range of 6.5 to 8.5, with numerous monitoring stations exceeding these limits. In 2023, average pH levels ranged from a minimum of 4.15 at Kharkhana (Myntdu River, Meghalaya) to a maximum of 8.92 at Bhind (Kunwari River, Madhya Pradesh), with 23 stations across 20 rivers exceeding the acceptable pH limits. During each season, pH levels fluctuated widely, with notable exceedances persisting, especially during the pre-monsoon period due to reduced dilution of pollutants and increased human activities like industrial discharge and agriculture runoff.

Comparisons between 2022 and 2023 highlighted consistent patterns, with the pre-monsoon season consistently showing the highest number of exceedances. In contrast, the monsoon season shows a mitigating effect, suggesting natural dilution processes help restore pH balance in river ecosystems.

Electrical Conductivity (EC)

The analysis of electrical conductivity (EC) across various water quality monitoring stations reveals significant fluctuations influenced by seasonal variations and human activities. The comparison between 2022 and 2023 underscores consistent trends in EC levels, particularly exceeding the prescribed limits during all seasons at several key monitoring stations. These stations, located along rivers like Wardha, Noyyal, Kodaganar, Shetrunji, Vaitarna, and Sarabenga, consistently recorded EC values above 2250 µS/cm, indicating potential environmental stressors such as industrial discharge and runoff pollutants. Notably, stations such as B.P.M. (Bamni) on the Wardha River, Elunuthi Mangalam on the Noyyal River and Luwara on the Shetrunji River emerged as persistent hotspots across both years, suggesting ongoing challenges in managing

water quality in these areas. The fluctuating EC levels observed across seasons highlight the dynamic nature of pollutant inputs and dilution effects, particularly evident during the monsoon period when increased runoff can either exacerbate or mitigate EC levels depending on local conditions.

Ammonia as N (NH_3-N)

The assessment of ammonia levels in water quality monitoring stations across various rivers in both 2022 and 2023 reveals concerning trends and widespread exceedances of permissible limits. These exceedances, particularly during the pre-monsoon, monsoon, and post-monsoon seasons, highlight persistent challenges in managing water quality. During 2022, 28 monitoring stations along 11 rivers exceeded the prescribed ammonia concentration limit of 1.2 mg/L. This issue intensified in 2023, with 42 monitoring stations along 20 rivers surpassing the same threshold. The rivers Brahmani, Hindon, Kanhan, Ponnaiyar, Wardha, and others emerged as consistent hotspots, demonstrating elevated ammonia levels attributed primarily to industrial discharges, agricultural runoff, and urban wastewater.

Fluoride (F^-)

The BIS recommends an upper desirable limit of 1.0 mg/l of fluoride in drinking water, which can be extended to 1.5 mg/l if no alternative source is available. During both 2022 and 2023, several monitoring stations across different regions consistently reported fluoride levels above the permissible thresholds. These included locations such as Kamalapuram, Lingdem (HS), and R.S.P/R.S.P-1 stations, indicating persistent challenges in managing fluoride contamination. The presence of elevated fluoride levels, particularly in regions like Andhra Pradesh, Sikkim, and Odisha, can be attributed to geological factors such as the weathering of fluoride-rich minerals from rocks. Monitoring data revealed fluctuations in fluoride concentrations across seasons, with notable peaks observed during the pre-monsoon period at various stations. For instance, Lingdem Hot Spring recorded significant increases in fluoride concentrations during different seasons, highlighting seasonal variations in water quality.

Total Hardness (TH))

The assessment of total hardness levels at water quality monitoring stations reveals consistent exceedances of permissible limits set by IS 10500:2012, which specifies 200 mg/L as acceptable and extends to 600 mg/L in the absence of alternative water sources. The presence of minerals like calcium and magnesium contributes to elevated hardness levels, impacting industrial processes, agricultural practices, and domestic water use. During both 2022 and 2023, three (03) monitoring stations consistently reported total hardness levels exceeding regulatory thresholds across all seasons. These stations include B.P.M. (Bamni) on the Wardha River, Lakshmanapatti on the Kodaganar River and Luwara on the Shetrunji River. The highest recorded value of 1046 mg/L during the pre-monsoon season at Luwara on the Shetrunji River underscores the variability and intensity of hardness levels in these regions.

Chloride (Cl^-)

The evaluation of chloride concentrations at water quality monitoring stations reveals concerning exceedances of permissible limits defined by IS 10500:2012. The acceptable limit for chloride in drinking water is set at 250 mg/L, with a permissible limit extending to 1000 mg/L in the absence of alternative water sources. During 2023, three monitoring stations—Durvesh on the Vaitarna River, Lakshmanapatti on the Kodaganar River, and Luwara on the Shetrunji River—consistently reported chloride levels surpassing the permissible threshold of 1000 mg/L at various times throughout the year. Notably, Durvesh station in Maharashtra recorded an average chloride concentration of 1374 mg/L during the pre-monsoon season, indicating persistent contamination issues. Lakshmanapatti station in Tamil Nadu exhibited fluctuating chloride levels across seasons, influenced by factors such as precipitation patterns and anthropogenic activities. Luwara station in Gujarat stood out with exceptionally high chloride concentrations, notably averaging 2306 mg/L during the Pre-Monsoon period in 2023, highlighting severe contamination. In 2022, only Luwara station exceeded acceptable chloride limits, while in 2023, all three aforementioned stations exceeded these limits consistently. Luwara station emerged as a recurring hotspot in both years, underscoring ongoing challenges in managing chloride contamination, likely stemming from industrial effluents, agricultural runoff, and urban waste inputs.

Boron (B)

Boron, a vital element present in the earth's crust, plays significant roles in natural and industrial processes. The Central Pollution Control Board (CPCB) regulates boron levels, setting a stringent limit of 2 mg/l for specific classes such as irrigation, industrial cooling, and controlled waste disposals. Monitoring conducted across seasons—pre-monsoon, monsoon, and post-monsoon—consistently indicates that average boron concentrations at various stations remain within the permissible limit prescribed by CPCB.

Nitrate as N (NO_3^--N)

The assessment of nitrate concentrations across numerous water quality monitoring stations during 2023 reveals significant findings. Nitrate levels fluctuated widely, with minimum average concentrations observed at Jamtara on River Ajoy (10.30 mg/L) and maximum average concentrations at Hanskhali WQ station on River Churni/Bhagirathi (23.04 mg/L). Throughout the year, 42 stations across 27 rivers exceeded the permissible nitrate concentration limits set by regulatory standards. Notably, during the monsoon season, 35 stations exceeded these limits, reflecting the impact of seasonal variations and environmental factors on water quality. Comparing trends between 2022 and 2023, the number of identified hotspots decreased from 93 to 42 stations. This reduction indicates some improvement; however, concerns remain due to increased exceedances during the post-monsoon season in 2023 compared to 2022. The rivers Bhagirathi, Brahmani, Ganga, Hoogly/Bhagirathi, and Subarnarekha consistently hosted stations that exceeded acceptable nitrate levels, highlighting ongoing challenges in managing and mitigating nitrate pollution. Specifically, stations like Gummanur in the

Ponnaiyar River showed seasonal variations in nitrate concentrations, underscoring localized impacts and the need for targeted management strategies.

Dissolved Oxygen (DO)

The assessment of dissolved oxygen (DO) levels across numerous water quality monitoring stations during 2023 reveals a concerning trend, indicating potential risks to outdoor bathing in rivers. The Central Pollution Control Board (CPCB) recommends a minimum concentration of 5.0 mg/l of DO for safe outdoor bathing in Class B waters. However, data from one hundred fifteen (115) stations across sixty-one (61) rivers indicate that during various seasons, average DO values fell below this critical threshold. Comparing the years 2022 and 2023 highlights persistent challenges in maintaining adequate DO levels in river waters. In 2022, the pre-monsoon, monsoon, and post-monsoon seasons collectively saw 79, 96, and 41 stations reporting DO values below 5.0 mg/l, respectively. Transitioning to 2023, the pre-monsoon season began with 86 stations below the threshold, marking a slight increase from the previous year. The monsoon season of 2023 recorded an alarming rise, with 99 stations reporting inadequate DO levels, reflecting a worsening situation compared to 2022. The trend continued into the post-monsoon season of 2023, with 62 stations underscoring ongoing challenges in maintaining DO concentrations suitable for outdoor activities.

Biochemical Oxygen Demand (BOD)

The Biochemical Oxygen Demand (BOD) serves as a critical indicator of river water quality, reflecting the impact of human activities on aquatic ecosystems and guiding pollution control efforts. Throughout 2023, alarming trends in BOD levels were observed across India's river systems. During the pre-monsoon season of 2023, 108 water quality monitoring stations spanning 15 states reported BOD values exceeding 3.0 mg/l, with extremes ranging from a minimum average of 3.07 mg/L at Jaunpur on the Gomti River to a maximum average of 70.09 mg/L at Satrapur on the Kanhan River. These findings highlight varying degrees of organic pollution, with lower BOD values indicating relatively cleaner water at stations like Jaunpur and higher values pointing to severe contamination at locations such as Satrapur.

In the monsoon season, BOD levels continued to exceed acceptable limits at 132 stations across 14 states, reinforcing concerns about organic pollution exacerbated by increased runoff and pollutant transport during heavy rains. Minimum average BOD values recorded was 3.10 mg/L at Satna on the Tons River, while the maximum average surged to 79.46 mg/L at Singasadanapalli on the Ponnaiyar River, reflecting the seasonal variability and impact of local environmental factors.

Similarly, the post-monsoon season saw 102 stations across 12 states recorded elevated BOD values, emphasizing ongoing challenges in maintaining water quality standards across affected rivers. Minimum average BOD Value 3.07 mg/L was recorded at Turtipar station on Ghaghra River in Uttar Pradesh and maximum average BOD Value was recorded 75.80 mg/L at Singasadanapalli station on the Ponnaiyar River in Tamil Nadu. Comparative analysis between 2022 and 2023 reveals a troubling

escalation in BOD concentrations during all seasons, indicating a worsening trend in river water quality year-over-year. The identification of 111 common hotspot stations across 48 rivers in both 2022 and 2023 underscores persistent areas of concern requiring targeted remediation efforts.

Total Coliform (TC)

During the pre-monsoon season, 199 water quality monitoring stations in 16 Indian states reported average Total Chloride (TC) values exceeding 500 MPN/100 ml. In the monsoon season, 258 stations in 17 states reported similar findings. In the post-monsoon season, 215 stations in 18 states also recorded TC values exceeding 500 MPN/100 ml. During the 2023 monitoring period, significant concerns regarding Total Coliform (TC) levels in India's river water quality were evident across all seasons, reflecting widespread contamination and potential health risks associated with microbial pollution. In the pre-monsoon season, 199 water quality monitoring stations spread across 16 states reported TC values exceeding 500 MPN/100 ml. This indicates a pervasive presence of coliform bacteria, often originating from sewage discharge, agricultural runoff, and other human activities, highlighting compromised water quality across numerous river systems. The monsoon season further exacerbated these concerns, with 258 monitoring stations in 17 states registering TC levels above the permissible threshold. This seasonal increase is attributed to heightened runoff and pollutant transport during heavy rains, contributing to microbial contamination and posing significant challenges for water resource management and public health protection. Similarly, the post-monsoon season maintained a consistent pattern, with 215 stations across 18 states recording TC values exceeding 500 MPN/100 ml. This underscores the persistence of microbial pollution in river waters even after the rainy season, necessitating continuous monitoring and targeted remediation efforts to mitigate health risks and ensure water safety. The widespread occurrence of elevated TC levels throughout all seasons in 2023 highlights the urgent need for comprehensive strategies aimed at improving sanitation infrastructure, controlling non-point source pollution, and promoting sustainable practices to safeguard the quality of India's rivers.

Faecal coliform (FC)

Faecal coliforms (FC) serve as crucial indicators of faecal contamination in river water, reflecting potential risks associated with microbial pathogens originating from human and animal waste. The prevalence of elevated FC levels in India's river systems during all season of 2023 underscores significant challenges in maintaining water quality and safeguarding public health. Throughout the pre-monsoon season, 184 water quality monitoring stations across 16 states reported FC values exceeding 500 MPN/100 ml. This widespread contamination highlights the pervasive impact of human activities, agricultural runoff, and inadequate sanitation infrastructure on river water quality across diverse geographical regions. During the monsoon season, the number of stations detecting elevated FC levels increased to 238 across 17 states, emphasizing the seasonal variability and the intensified impact of rainfall-induced runoff carrying contaminants into rivers. This periodical surge in faecal coliform levels underscores the

dynamic nature of microbial pollution and the urgent need for adaptive water management strategies. In the post-monsoon season, 181 monitoring stations across 17 states recorded FC values above the permissible threshold, indicating persistent contamination even after the rainy season subsides. This continuation of high FC levels signifies ongoing challenges in pollution control and sanitation practices, necessitating sustained efforts to mitigate health risks and improve water quality management. The consistent detection of elevated FC levels across all seasons in 2023 underscores the critical importance of implementing robust monitoring protocols, enhancing wastewater treatment infrastructure, promoting responsible agricultural practices, and fostering public awareness to protect and preserve India's river ecosystems.

Sodium Adsorption Ratio (SAR)

All the samples have been found within the acceptable limit of the SAR.

ABBREVIATION

Ammonia	**= NH_3**
Andhra Pradesh	**= AP**
Alpha Benzenehexachloride	**= BHC**
Biochemical Oxygen Demand	**= BOD**
Bureau of Indian Standards	**= BIS**
Boron	**= B**
Calcium	**= Ca^{+2}**
Cauvery Division	**= CD**
Central Pollution Control Board	**= CPCB**
Central Water Commission	**= CWC**
Chambal Division	**= CD**
Chenab Division	**= CD**
Chloride	**= Cl^{-}**
Dissolved Oxygen	**= DO**
Dichlorodiphenyltrichloroethane	**= DDT**
Eastern River Division	**= ERD**
Electrical Conductance	**= EC**
Godavari Division	**= GD**
Himachal Pradesh	**= HP**
Himalayan Ganga Division	**= HGD**
Hydrology Division **Hot Spring**	**= HD** **= HS**
Iron	**= Fe**
Lower Krishna Division	**= LKD**
Lower Yamuna Division	**= LYD**
Madhya Pradesh	**= MP**
Magnesium	**= Mg^{+2}**
Mahanadi Division	**= MD**
Mahi Division	**= MD**
Middle Brahmaputra Division	**= MBD**
Middle Ganga Division	**= MGD**
Monsoon Season	**=M**
Narmada Division	**= ND**
Nitrate	**= NO_3^{-1}**
Pre-Monsoon Season	**=Pre-M**
Post-Monsoon Season	**= Post-M**
Sodium Absorption Ratio	**= SAR**
South Western Rivers Division	**= SWR**
Southern Rivers Division	**= SRD**
Sulphate	**= SO_4^{-2}**
Tapi Division	**= TD**
Total Dissolved Solids	**= TDS**
Total Coliforms	**= TC**
Total Hardness	**= TH**
Upper Yamuna Division	**= UYD**
Uttar Pradesh	**= UP**
Wainganga Division	**= WGD**
Rourkela Steel Plant	**= RSP**
Madhya Bharat Paper Ltd	**= MBPL**

Annexure-I

Water Quality Laboratories of CWC& NABL accreditation Status

Out of 23 Water Quality Laboratories in CWC, 22 laboratories got accredited by NABL as on November, 2024.

List of Water Quality Labs in CWC			
S. No.	**Location of laboratory**	**Level of Laboratory**	**Organisation**
1	National River Water Quality Laboratory, New Delhi	III	YBO, New Delhi
2	Lower Cauvery Water Quality Laboratory, Coimbatore	III	C&SRO, Coimbatore
3	Upper and Middle Ganga Water Quality Laboratory, Varanasi	III	LGBO, Patna
4	Krishna and Godavari River Water Quality Laboratory, Hyderabad	III	K&GBO, Hyderabad
5	Upper Cauvery Water Quality Laboratory, Bangalore	II	MSO, Bangalore
6	South Western Flowing Rivers Water Quality Laboratory, Kochi	II	C&SRO, Coimbatore
7	Upper Krishna Division Water Quality Laboratory, Pune	II	K&GBO, Hyderabad
8	Mahi Division Water Quality Laboratory, Gandhinagar	II	MTBO, Gandhinagar
9	Lower Yamuna Water Quality Laboratory, Agra	II	YBO, New Delhi
10	Eastern Rivers Water Quality Laboratory, Bhubaneswar	II	M&ERO, Bhubaneswar
11	Hydrology Division, Chennai	II	C&SRO, Coimbatore
12	Wainganga Division, Nagpur	II	MCO, Nagpur
13	Chenab Division, Jammu	II	IBO, Chandigarh
14	Middle Ganga Division -I, Lucknow	II	UGBO, Lucknow
15	Mahanadi Division, Raipur	II	M&ERO, Bhubaneswar
16	Middle Brahmaputra Division, Guwahati	III	BBO, Guwahati
17	Lower Brahmaputra Division, Jalpaiguri	II	T&BDBO, Kolkata
18	U.B. Division, Dibrugarh	II	BBO, Guwahati
19	Lower Ganga Division-3, Berhampore	II	T&BDBO, Kolkata
20	Middle Ganga Division-5, Patna	II	LGBO, Patna
21	Narmada Division, Bhopal	II	NBO, Bhopal
22	Tapi Division, Surat	II	MTBO, Gangdinagar
23	Himalayan Ganga Division, Haridwar	II	UGBO, Lucknow

Annexure-II

List of Parameters analyzed in different levels of Water Quality Labs of CWC

S. No.	Level-I	Level-II	Level-III
1	Temperature	Temperature	Temperature
2	Colour	pH	pH
3	Odour	Electrical Conductivity	Electrical Conductivity
4	pH	Total Dissolved Solids	Total Dissolved Solids
5	Electrical Conductivity	Turbidity	Turbidity
6	Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen
7		Biochemical Oxygen Demand	Biochemical Oxygen Demand
8		Chemical Oxygen Demand	Chemical Oxygen Demand
9		Sodium	Sodium
10		Calcium	Calcium
11		Magnesium	Magnesium
12		Potassium	Potassium
13		Carbonate	Carbonate
14		Bicarbonate	Bicarbonate
15		Chloride	Chloride
16		Sulphate	Sulphate
17		Fluoride	Fluoride
18		Boron	Boron
19		Ammonia (Nitrogen)	Ammonia (Nitrogen)
20		Nitrate	Nitrate
21		Nitrite	Nitrite
22		Silicate	Silicate
23		Phosphate	Phosphate
24		Total Coliform	Total Coliform
25		F. Coliform	F. Coliform
26			Arsenic
27			Cadmium
28			Chromium
29			Copper
30			Iron
31			Lead
32			Nickel
33			Mercury
34			Zinc
35			Alpha Benzenehexachloride (BHC), Beta BHC, Gama BHC (Lindane)
36			OP-Dichlorodiphenyltrichloroethane (OP DDT), PP-DDT
37			AlphaEndosulphan, Beta Endosulphan,
38			Aldrin, Dieldrin,
39			Carbaryl (Carbamate),
40			Malathian, Methyl parathion
41			Anilophos, Chloropyriphos

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River Data Compilation-2 Directorate
Central Water Commission,
West Block-2, Wing 7, First Floor,
R.K. Puram, New Delhi