INTERSTATE RIVER BOUNDARY MONITORING PROGARMME

SERIES: IRBM/01/2015

Water Quality of Rivers at Interstate Borders

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Foreword

One of the function of the Central Pollution Control Board (CPCB), under Section 16 2(b) of the Water (Prevention and Control of Pollution) Act, 1974 is to "coordinate the activities of the State Pollution Control Boards (SPCBs) and resolve disputes among them.

CPCB identified water quality monitoring stations at interstate river boundaries to monitor the water quality of 83 locations spread over 40 rivers through its Zonal Offices and Head Office to resolve disputes among SPCBs.

Water quality data of interstate rivers from 2005-2013 monitored by CPCB through its Zonal Offices and Head Offices have been evaluated against the primary water quality criteria. Sixteen monitoring locations with respect to four parameters (DO, BOD, TDS and TC) are identified as polluted and need remedial measures for restoration of water quality. Report has highlighted the water quality of each interstate river in terms of DO and BOD. The report also includes the trend analysis for last 04 years alongwith the range of DO and BOD concentration of all the interstate rivers and the polluted river locations are listed based on the analysis.

The overall assessment of the river water quality shows that 51 locations out of 83 are polluted with respect to BOD, 57 locations with poor water quality on the basis of DO, 61 locations showing TDS within the prescribed limit and 13 locations showing TC range within the prescribed limit. This report has also highlighted the actions/steps already taken up by CPCB to improve the water quality of the rivers in chapter 9 and the recommendations are summarized in chapter 10.

Hope, the report will be useful for all the concerned authorities/stakeholders involved in planning and execution of control measures for resolving the disputes among the States and improvement of environment.

The data presented in this report has been assessed, processed and compiled by Sh. R.D. Swami, DEO, Sh. J.K.Vimal, SRF and Sh. Vishal Gandhi, Scientist 'C' under the supervision of Sh. A.K.Sinha, Scientist 'D', Sh. R.M.Bhardwaj, Scientist 'D' and Dr. A.B. Akolkar, Member Secretary. Field investigation & Monitoring work carried out by Sh. Mirajuddin, Sr. Technician and Sh. Satyaveer Singh and all other concerned officials of Zonal Offices is highly appreciated. My strong appreciation is due to Sh. A.K.Sinha, Scientist 'D' for carrying out this task with dedication and for association with SPCBs/PCCs and Zonal Offices for its design, initiation and successful implementation of the project.

(Shashi Shekhar)
Special Secretary & Chairman CPCB

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CHAPTER 1: INTRODUCTION

1.1 Availability of Water Resources

The availability and the quality of the fresh water resources is the most pressing of the many environmental challenges on the national horizon in India. The stress on water resources is from multiple sources and the impacts can take diverse forms. Geometric increase in population coupled with rapid urbanization, industrialization and agricultural development has resulted in high impact on quality and quantity of water in India. The urban population has increased almost 11 fold in last 100 year period from 26 million to 285 million. Unregulated growth of urban areas, particularly over the last two decades, without infrastructural services for proper collection, transportation, treatment and disposal of domestic wastes led to increased pollution & health hazards. The municipalities and such other civic authorities have not been able to cope up with this massive task which could be due to various reasons including erosion of authority, inability to raise revenues and inadequate managerial capabilities. That is why it became necessary to launch the Ganga Action Plan and subsequently the National River Action Plan, which is essentially addressed to the task of trapping, diversion and treatment of municipal waste water. The situation warrants immediate redressal through radically improved water resource and water quality management strategies.

Depletion of available freshwater resources, falling ground water levels and deteriorating water quality are all posing a variety of challenges in managing India's water resources. Competing demands from the needs of a growing population are quite often leading towards disputes among users. The per capita water availability in India is raising concerns.

By the increase in population by the end of 21st century, the per capita availability is likely to drop below 1000 cubic meters a situation labeled as water scarcity. From the East to the West and from the North to the South, water has defined life in the Indian subcontinent for thousands of years. On an average, the combination of rainfall, surface and groundwater resources have been sufficient in providing adequate water to the Indian population. Rise in demand and development pressures are changing the characteristics of water in India. Erosion in the watershed due to the fast growing development and poor land management practices is changing stream hydraulics. Groundwater reserves are becoming more and more depleted as surface water sources have become too polluted for human use.

Water security is emerging as an increasingly important and vital issue for India. Many Indian cities are beginning to experience moderate to severe water shortages, brought on by the effects of agricultural growth, industrialization and urbanization. Population stress, irrigation requirements and industrialization are the major pressures for water insecurity. The environmental challenges of water resource development and management in India are expected to manifest themselves more rapidly in the coming years. These environmental challenges may be addressed through four broad approaches (1) Improving efficiencies and minimizing losses (2) Recharging groundwater aquifers (3) Abatement and treatment of water pollution (4) Reuse and recycling of wastewater (Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.1.1 Current and Future Water Requirements

In 1990, the total water withdrawal was estimated at 552 bcm i.e. 30 per cent of the country's renewable water resources. The contribution from surface water was 362 bcm, while the groundwater withdrawal was estimated at 190 bcm. Approximately 460 bcm was used for irrigation while 25 bcm was used for domestic needs. About 19 bcm and 15 bcm were used for energy and industrial purposes respectively. Currently, more than 80 per cent of the 750 bcm water used in India is for irrigation. The balance 20 per cent is used to meet domestic, energy, industrial and other requirements. With the rapidly growing population, along with industrial and urbanization activities, the demand for water is expected to increase even faster. Estimates indicate that by the year 2025, the total water demand of 1050 bcm will be very close to the total utilizable water resources of 1,122 bcm in the country. Though projections are not available beyond 2025, it is evident that the country may have to face an acute water crisis unless clear and strategic measures are adopted now. It is important to note that more attention is also required to scientifically assess the water requirements for ecosystems security. Today, approximately 40 per cent (748 bcm) of available water resources is considered to be unutilizable due to a variety of factors. Probably, this is a blessing since that water must be used for the requirements of the ecosystems (Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.2 Water Pollution

The key challenges to better management of the water quality in India are temporal and spatial variation of rainfall, uneven geographic distribution of surface water resources, persistent droughts, overuse of ground water and contamination, drainage & salinisation and water quality problems due to treated, partially treated and untreated wastewater from urban settlements, industrial establishments and runoff from irrigation sector besides poor management of municipal solid waste and animal dung in rural areas.

It is estimated that about 38,000 million litres per day (mld) of wastewater are generated in the urban centres having population more than 50,000 in India (housing more than 70% of urban population). The municipal wastewater treatment capacity developed so far in India is about 11,000 mld accounting for 29% of wastewater generation in these two classes of urban centers. In view of population increase, demand of freshwater for all the uses will be unmanageable. It is estimated that the projected wastewater from urban centres may cross 1,00,000 mld by 2050 and the rural India will also generate not less than 50,000 mld in view of water supply designs for community supplies in rural areas. However, waste water management is not addresses to that pace.

Most human activities whether domestic, agricultural or industrial have an impact on water and the ecosystems. Water borne diseases can be, to a large extent, controlled by managing human consumption and production patterns. It is therefore important to have an understanding of human activities, including water management initiatives, and their impacts on water and the environment (Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.2.1 Domestic Water Pollution

Waste management systems have not been able to keep pace with the huge volumes of organic and non-biodegradable wastes generated daily. As a consequence, garbage in most parts of India is unscientifically disposed and ultimately leads to increase in the pollutant load of surface and groundwater courses. On the other hand, the large population of the poor in

India does not have much choice but to live off the natural resource base and pollute the environment in the process. They deforest for food, fuel, fodder and fibre and pollute the water sources on which they depend, since they cannot afford access to sanitation services. Domestic water use today, though a small fraction of the total water requirement, is under-priced for political reasons. This leads to a considerable waste of the precious resource and inadequate revenues for operation and maintenance. Low revenues result in the loss of the resource due to system inefficiencies. In most parts of the country, waste water from domestic sources is hardly treated, due to inadequate sanitation facilities. This waste water, containing highly organic pollutant load, finds its way into surface and groundwater courses, very often close to dense pockets of human habitation from where further water is drawn for use. Considerable investments will be required to install treatment systems in at least the 500 major cities and towns of the country. Estimates indicate that it is viable to set up decentralized treatment systems for approximately 100 to 200 households where it is possible to convince users to pay for efficient services. Incentives like soft loans may be provided to these initiatives (Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.2.2 Industrial Water Pollution

The Industrial sector, contributing to about 20 per cent of the national income, accounts for about 8 per cent of the current water use. With rapid industrialization and urbanization, the water requirement for energy and industrial use is estimated to rise to about 18 per cent of the total requirements in 2025. Poor environmental management systems, especially in industries such as thermal power stations, chemicals, metals and minerals, leather processing and sugar mills, have led to discharge of highly toxic and organic wastewater. This has resulted in pollution of the surface and groundwater sources from which water is also drawn for irrigation and domestic use. The enforcement of regulations regarding discharge of industrial wastewater and limits to extraction of groundwater needs to be considerably strengthened, while more incentives are required for promoting waste water reuse and recycling(Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.2.3 Agricultural Water Pollution

Two-thirds of India's farm production comes from one-third of its land which is irrigated. The rest is from rainfed areas that employ large populations. In order to meet the increasing demand for food and farm employment, India has to increase the area under irrigation, and enhance productivity in both irrigated and rainfed areas. Cropping patterns and farming practices also do not encourage the judicious use of water. Conservative estimates indicate that the same quantity of irrigation water used today can irrigate double the current area with optimized irrigation and farming practices. With limited revenues and budgetary support, the state engineering departments are unable to operate and maintain the irrigation systems efficiently, leading to increasing deterioration of the structures and systems over time. Consequently, there are further water losses due to breaches and seepage, resulting in water logging and salinity. Water quality is further affected due to the overuse of chemical fertilizers and pesticides (Status of Water Quality in India-2011, CPCB (Series: MINARS/35/2013-14).

1.3 Interstate Water Disputes

Water security is emerging as an increasingly important and vital issue for India. Many Indian cities are beginning to experience moderate to severe water shortages, brought on by the simultaneous effects of agricultural growth, industrialization and urbanization. Another

concern in the region is the growing competition over shared water resources. Conflict over freshwater resources can strain relationships between various states sharing these resources.

1.3.1 The main causes due to which water disputes arise between states are:

- River doesn't follow political limits.
- Uneven distribution of water resources.
- Increasing rainfall variability and frequent draughts.
- Increasing demand of river water.
- Regionalization of the national policy.
- Industrial activity which leads to deterioration of water quality
- Untreated domestic wastewater

Table 1: Major Interstate Water Disputes in India

River(s)	States	Issue
Satluj, Beas	Punjab and Rajasthan	Harike Barrage, Canals originating from Punjab and entering into Rajasthan
Markanda	Himachal Pradesh and Haryana	Wastewater discharge from Kala Amb industrial Area (H.P.). and entering into Haryana
Yamuna	Haryana, Delhi and Uttar Pradesh	Ammonia issue raised frequently for supply of drinking water in Delhi and in Agra(U.P.)
Sahibi	Rajasthan and Haryana	Wastewater discharge from Bhiwadi (Rajasthan) entering into territory of Dharuhera (Haryana).
Dhela, Bahela, Kosi and Ramganga	Uttrakhand and Uttar Pradesh	Magh Mela and Kumbh Mela issue- Wastewater discharge from Uttrakhand into Uttar Pradesh.

Table 2: Disputed Interstate Rivers and States Sharing the River Boundaries

S. No.	Disputed River	States
1.	Vardha	M.P., Maharashtra
2.	Mahi	M.P., Rajasthan, Gujarat
3.	Krishna	Maharashtra, A.P., Karnataka, Tamil Nadu
4.	Bhima	Maharashtra, Karnataka
5.	Sabarmati	Gujarat, Rajasthan,
6.	Manjara	Maharashtra, Karnataka
7.	Tapi	Maharashtra, Gujarat, M.P.
8.	Narmada	Gujarat, M.P.
9.	Wainganga	M.P., Maharashtra
10.	Damanganga	Gujarat, UT of Daman
11.	Indrawati	Orissa/ Chattisgarh
12.	Mahanadi	Orissa, Chattisgarh
13.	Damodar	Jharkhand, W.B.
14.	Subarnrekha	Jharkhand, Orissa, W.B.
15.	Cauvery	Karnataka, Tamil Nadu

S. No.	Disputed River	States
16.	Thenpennai	Karnataka, Tamil Nadu
17.	Tungabhadra	Maharashtra, Karnataka
18.	Churni	W.B./Bangladesh
19.	Godavari	Maharashtra, Karnataka
20.	Pennar	A.P., Karnataka
21.	Ganga	U.P., Bihar, Uttarakhand
22.	Betwa	M.P., U.P.
23.	Sone	M.P., U.P.
24.	Ramganga	Uttarakhand, U.P.
25.	Satluj	HP, Punjab
26.	Beas	HP, Punjab
27.	Markanda	HP, Haryana
28.	Ghaggar	HP, Haryana, Punjab, Rajasthan
29.	Yamuna	U.P., Haryana, Uttarakhand, HP, Delhi
30.	Chambal	Rajasthan, M.P., U.P.
31.	Dhela	U.P., Uttarakhand
32.	Kitcha	U.P., Uttarakhand
33.	Kosi	U.P., Uttarakhand
34.	Bahela	U.P., Uttarakhand
35.	Pilakhar	U.P., Uttarakhand
36.	Sarsa	HP, Punjab
37.	Swan	HP, Punjab
38.	Ravi	J&K, Punjab
39.	Dhansari	Nagaland, Assam
40.	Manjira	Karnataka/A.P.

CHAPTER 2: INTERSTAE RIVER BOUNDARY MONITORING NETWORK

One of the function of the Central Pollution Control Board(CPCB), under the Section 16 2(b) of the Water (Prevention and Control of Pollution) Act, 1974 is to "coordinate the activities of the State Boards and resolve disputes among them.

CPCB is monitoring water quality of rivers at the interstate borders since 2005. At present, the monitoring is carried out at 86 locations. Present report covers only 83 locations (as given in table 3) spread over 40 rivers. Monitoring frequency is preferably on quarterly basis though few river locations are monitored once in a year which are either small/seasonal or not carrying any interstate dispute.

Table 3: List of Water Quality Monitoring Locations at Interstate Boundaries

Sl. No.	River	Location	Interstate Boundaries
1	Vardha	Bangaon Village near Pandhurana Village (M. P.)	MP/Maharashtra
2	Vardha	Belur Dharmadabad (Maharashtra)	Maharashtra/M.P.
3	Mahi	Village Bajna, Ratlam (M. P.)	M.P./Rajasthan
4	Mahi	Kadna Dam, (Gujarat)	Gujarat /Rajasthan
5	Mahi	Gammon Bridge, (Rajasthan)	Rajasthan/MP
6	Krishna	Kurundwad, Kolhapur (Maharashtra)	Maharashtra/A.P.
7	Bhima	Takli, Solapur (Maharashtra)	Maha./Karnataka
8	Sabarmati	Khedbrahma (Gujarat)	Gujarat/Rajasthan
9	Manjara	Aurad Shahajani (Maharashtra	Maharashtra/ Karnataka
10	Tapi	Prakasha (Maharshtra)	Maharashtra/Gujarat
11	Tapi	Ajnad (Marashtra)	Maharashtra/M.P.
12	Tapi	NIzhar (Gujarat)	Maharashtra/Gujarat
13	Narmada	Navagam (Gujarat)	Gujarat/M.P.
14	Wainganga	Bapera, Bhandara (Maharashtra)	M.P./ Maharashtra
15	Damanganga	Jarry Causeway D/S of CETP discharge (Gujarat)	Gujarat/UT of Daman
16	Damanganga	U/S of CETP discharge GIDC Weir (UT of Daman)	UT of Daman/ Gujarat
17	Indrawati	Nowrangpur (Orissa)	Orissa/Chhattisgarh
18	Mahanadi	Hirakund (Orissa)	Orissa/Chattisgarh
19	Churni	Bijoypur (West Bengal)	Bangladesh/W. B.
20	Damodar	Sindri (Jharkhand)	Jharkhand/W.B.
21	Damodar	Dishergarh (West Bengal)	WB/Jharkhand
22	Subarnrekha	Behragora (Jharkhand)	Jharkhand/Orissa

Sl. No.	River	Location	Interstate Boundaries
23	Subarnrekha	Gopiballavpur (West Bengal)	WB/Orissa
24	Subarnrekha	Lakhannath (Orissa)	Orissa/W.B.
25	Cauvery	Satyagala Bridge, Narsipur (Karnataka)	Karnataka /Tamilnadu
26	Thenpennai	Mugalur Bridge, Bangalore (Karnataka)	Karnataka/ Tamilnadu
27	Krishna	Deodurg (Karnataka)	Karnataka/ Tamilnadu
28	Tungabhadra	Hochchelli (Karnataka)	Maharashtra/ Karnataka
29	Bhima	Jewargi, Gangapur, (Karnataka)	Maharashtra/Karnataka
30	Pennar	Mothikepli, (Karnataka)	Karnataka
31	Manjira	Janwada, (Karnataka)	Karnataka/ Maharashtra
32	Godavari	Basra Kavalguda,(Maharashtra)	Karnataka/ Maharashtra
33	Uttra-Pinkhani (North Pennar)	Hindupur (Andhra Pradesh)	A.P./Karnataka
34	Ganga	Tarighat, Gazipur (U. P.)	U.P./Bihar
35	Betwa	Kanjira Bridge , Sagar (M.P.)	M.P./U.P.
36	Betwa	D/S Dukwan Dam Babina, Birdha Road, Distt. Lalitpur (U.P.)	UP/MP
37	Sone	Chopan (U.P.)	M.P./U.P
38	Sone	U/S of Deora before Reservoir, Rihand (U.P.)	M.P./U.P
39	Ramganga	D/S Sherkot, Kalagarh (U. P.)	Uttrakhand/U.P.
40	Ramganga	D/S Kalagarh, Dam (Uttrankhand)	Uttrakhand/U.P.
41	Ganga	Dariganj, Distt. Sonepur, (Bihar)	U.P/Bihar
42	Satluj	Nangal (H.P.)	H.P/Punjab
43	Beas	Talwara U/s (Pong Dam), Kangra (H.P.)	H.P/Punjab
44	Beas	D/S (Changarwa Village), (Punjab)	Punjab/H.P.
45	Markanda	Kala Amb (H.P.)	H.P/Haryana
46	Markanda	Narayangarh (Haryana)	Haryana/H.P.
47	Ghaggar	u/s Parwanoo (H.P.)	H.P/Haryana
48	Ghaggar	Parwanoo D/S , Amravati, (Haryana)	Haryana/H.P.
49	Ghaggar	Mubarakpur (Punjab)	Punjab/Haryana
50	Ghaggar	Tiwana village (Punjab)	Punjab/ Haryana
51	Ghaggar	Sirsa Dabwali Road (Haryana)	Punjab/Haryana
52	Ghaggar	Chandrapur Siphon (Haryana)	Punjab/Haryana

Sl. No.	River	Location	Interstate Boundaries
54	Ghaggar	Ottu Weir (Haryana)	Haryana/Rajasthan
55	Ghaggar	Sirsa Hanumangarh Road (Rajasthan)	Rajasthan/Haryana
56	Ganga	Sultanpur (Uttrakhand)	Uttrakhand/U.P.
57	Ganga	Bijnour (U.P.)	UP/ Uttrakhand
58	Yamuna	Shergarh, Juhika (U. P.)	UP/Haryana
59	Yamuna	Mohena Palwal Road (Haryana)	Haryana/U.P.
60	Yamuna	Pontasahib (H. P.)	HP/ Uttrakhand
61	Yamuna	Buriya U/S Jagadhari, Mandoli, (Haryana)	Haryana/HP
62	Yamuna	Sonipat Baghpat Road (Haryana)	Haryana/U.P.
63	Yamuna	Palla, Wazirabad (Delhi)	Delhi/Haryana
64	Yamuna	Asgarpur village, (U.P.)	U.P./Delhi
65	Yamuna	Hasanpur, Mohali (Haryana)	UP/Haryana
66	Chambal	Udi (U.P.)	U.P./M.P.
67	Chambal	Fish farm , Gandhisagar Dam, (M.P)	Rajasthan/MP
68	Dhela	Adampur Village, Bhojpur	UP/Uttrakhand
69	Kitchha	Pull Bhatta, Bareili Road, (Uttrakhand)	UP/Uttrakhand
70	Kosi	Dadiyal Bridge, (Uttrakhand)	UP/Uttrakhand
71	Bahela	Badli Village, Tehseel - Tanda (U.P.)	UP/Uttrakhand
72	Pilakhar	Rampur, Bhot (Uttar Pradesh)	UP/Uttrakhand
73	Sarsa	Badhi D/S, (Ghanoli Village B/C to R. Satluj, (Punjab)	H.P./Punjab
74	Sarsa	U/s Saini Mazra , (Punjab)	H.P./Punjab
75	Swan	Dhangla Village, Santoshgarh (Punjab)	H.P./Punjab
76	Ravi	Madhopur U/S , (Punjab)	Punjab/J&K
77	Ravi	Lakhanpur, D/s Madhopur (Jammu)	Punjab/J&K
78	Dhansari	U/S Ganesh nagar , (Nagaland)	Nagaland/ Assam
79	Dhansari	U/S, Nagarjan Bridge, Dimarpur Town, (Nagaland)	Nagaland/ Assam
80	Dhansari	D/S Dimarpur Town , Khatkati Gate, (Nagaland)	Nagaland/ Assam
81	Dhansari	Bokajan, (Assam)	Nagaland /Assam
82	Dhansari	Nimligarh, (Assam)	Nagaland /Assam
83	Yamuna	Dak Pather (Uttranchal)	Uttranchal/H.P.

Table 4: State Wise Distribution of Monitoring Stations

Sl. No.	States/UT	No. of Stations
1.	Delhi	2
2.	Andhra Pradesh	2
3.	UT of Daman	2
4.	Chattisgarh	2
5.	Bihar	2
6.	J & K	2
7.	Jharkhand	3
8.	Tamil Nadu	3
9.	West Bengal	5
10.	Nagaland	3
11.	Assam	2
12.	Rajasthan	6
13.	Orissa	6
14.	Gujarat	7
15.	Uttarakhand	9
16.	Maharashtra	11
17.	Karnataka	11
18.	Punjab	11
19.	M.P	13
20.	Himachal Pradesh	14
21.	Haryana	16
22.	U.P.	21

CHAPTER 3: METHODOLOGY

3.0 Methodology

The methodology adopted for collection of information and preparation of this report is as follows:

3.1 Source of information

Monitoring is conducted by CPCB on quarterly basis in a year, however few designated locations are monitored once in a year which are either small/seasonal or not carrying any interstate dispute. After analysis of samples, laboratories of Head Office and Zonal Offices produce result of water quality parameters.

3.2 Dry Inventory

To carry out the present study, first desk inventory was performed based on background information available inhouse. During desk inventory, sites were finalized for the survey & monitoring of the interstate rivers. The concerned Zonal Offices were also informed about the programme to depute those officers who have sufficient knowledge of rivers and interstate boundary locations.

3.3 Wet Inventory

The team visited the locations at which the rivers share the interstate boundaries.

The identified sampling points from the possible sources were selected out to carry the water quality monitoring.

3.4 Analysis

The data collected out through dry and wet inventories was analyzed and processed further.

3.5 Data Interpretation and Processing

The data collected from laboratories of Head offices and Zonal Office of Central Pollution Control Board was structured through MS-Excel and stored. Data was compiled and processed to remove inconsistencies.

CHAPTER 4: WATER QUALITY OF RIVERS

4.0 Water Quality

The water quality monitoring results based on the observations made during 2005 to 2013 indicate that the organic and bacterial contamination are continued to be critical in water bodies. This is mainly due to discharge of domestic wastewater mostly in untreated form from the urban centres of the country. The municipal corporations at large are not able to treat increasing load of municipal sewage flowing into water bodies without treatment. Furthermore, the receiving water bodies also do not have adequate water for dilution. Therefore, the oxygen demand and bacterial pollution is increasing day by day.

The water quality monitoring results obtained were analyzed with respect to indicator of oxygen consuming substances (Bio-chemical Oxygen Demand), Dissolved Oxygen, indicator of pathogenic bacteria (Total coliform and Fecal coliform), Total Dissolved Solids and Chemical Oxygen Demand.

The water quality of the rivers covered under Interstate River Boundary Monitoring (IRBM) Network is discussed below based on the data analyzed from Table 5.

The water quality of river is assessed with respect to primary water quality data criteria for bathing . the primary water quality criteria is placed in Table 6.

4.1 Water Quality of River Satluj:

Water quality monitoring of the river Satluj is carried out at the interstate boundaries of H.P. and Punjab(Detail of location is provided in Table 3) . BOD and DO concentrations are within the prescribed range i.e.1.11mg/l and 8.11 mg/l respectively. The Total Coliform range is exceeding the prescribed limit.

4.2 Water Quality of River Beas:

Water quality monitoring of the river Beas is carried out at 02 locations at the interstate boundaries of H.P. and Punjab at Talwara U/s (Pong Dam), Kangra (H.P.) and Changwara Village, Punjab. The analysis results show that the BOD concentration is exceeding to the prescribed range at both the locations i.e., however DO concentration is meeting to the prescribed standard at both the locations. Total Coliform range is also exceeding the prescribed limit.

4.3 Water Quality of River Markanda:

Water quality monitoring of the river is carried out at 02 different locations at the interstate boundaries of H.P. and Haryana. The analytical results show that BOD and DO concentrations at Naraingarh (Haryana) are not meeting the prescribed limit. However, at Kala Amb (H.P.), the water quality is meeting to prescribed standards in respect of DO and BOD. Total Coliform is not meeting the prescribed limit at both the locations.

4.4 Water Quality of River Ghaggar:

Water quality monitoring of the river Ghaggar is carried out at 09 different locations at the interstate boundaries of H.P./ Haryana, Punjab/ Haryana and Haryana/ Rajasthan. Analytical results indicate that water quality in respect of DO and BOD concentrations is not meeting to

the prescribed standards except at Parwanoo(H.P.) and Amravati (Haryana). Total Coliform range is also exceeding the prescribed standard.

4.5 Water Quality of River Ganga:

Water quality monitoring of the river is carried out at 04 different locations at the interstate boundaries of Uttarakhand/ U.P. and U.P./ Bihar. At all these 4 locations, the BOD and DO concentrations are meeting the prescribed standards. However, the Total Coliform count is deviating at all locations.

4.6 Water Quality of River Yamuna:

Water quality monitoring of the river Yamuna is carried out at 9 different locations at the interstate boundaries of U.P./ Haryana, HP/Uttarakhand, Haryana/H.P., Delhi/Haryana and U.P./Delhi. The water quality results are meeting to prescribed norms with respect to DO and BOD except at 3 locations i.e. Asgarpur Village (U.P.), Hasanpur (Haryana) and Buriya U/S, Jagadhari (Haryana). Total Coliform count is exceeding the prescribed standards at all locations.

4.7 Water Quality of River Chambal:

Water quality monitoring of the river is carried out at 02 locations at the interstate boundaries of U.P/M.P. and Rajasthan/M.P. The BOD and DO concentrations are meeting to the prescribed standards at both the locations. However, Total Coliform count is exceeding at the location Udi (U.P.).

4.8 Water Quality of River Dhela:

Water quality monitoring of the river is carried out at the location at the interstate boundary of U.P./Uttarakhand. The BOD, DO and Total Coliform concentration are not meeting the prescribed standards indicating polluted condition of the river at the monitoring location.

4.9 Water Quality of River Kitchha:

Water quality monitoring of the river is carried out at the interstate boundary of U.P./Uttarakhand. At the monitoring location, BOD and DO concentrations are within the prescribed standard, However, Total Coliform Count is exceeding to the prescribed standard.

4.10 Water Quality of River Kosi:

Water quality monitoring of the river is carried out at the location at the interstate boundary of U.P./Uttarakhand. The water quality is meeting the prescribed standards with respect to BOD and DO whereas Total Coliform Count is exceeding the prescribed standards.

4.11 Water Quality of River Bahela:

Water quality monitoring of the river is carried out at the location at the interstate boundary of U.P./Uttarakhand. At the location, BOD, DO and Total Coliform Count is exceeding the prescribed standards.

4.12 Water Quality of River Pilakhar:

Water quality monitoring of the river is carried out at the interstate boundary of U.P./Uttarakhand. BOD and DO are within the range at the location whereas the Total Coliform Count is exceeding .

4.13 Water Quality of River Sarsa:

Water quality monitoring of the river is carried out at 2 locations at the interstate boundary of H.P./Punjab. At both the locations, BOD and DO concentrations are meeting the prescribed range. Total Coliform count is exceeding to the prescribed standards at both the locations.

4.14 Water Quality of River Swan:

Water quality monitoring of the river is carried out at the interstate boundary of H.P./Punjab. The BOD and DO concentrations are within the prescribed standards at the location whereas Total Coliform count is exceeding to the prescribed standards.

4.15 Water Quality of River Ravi:

Water quality monitoring of the river Ravi is carried out at 2 different locations of the interstate boundary of J.K./Punjab. The BOD and DO concentration are within the prescribed standards at the location whereas Total Coliform count is exceeding at said locations.

4.16 Water Quality of River Mahi:

Water quality monitoring of the river is carried out at 2 different locations of interstate boundary of M.P./Rajasthan and Gujarat/ Rajasthan. The BOD and DO concentrations are within the prescribed range at both the locations. Total Coliform count is exceeding at Kadna Dam, (Gujarat).

4.17 Water Quality of River Ramganga:

Water quality monitoring of the river is carried out at 2 different locations of interstate boundary Uttarakhand/U.P. The BOD and DO concentrations are within the prescribed range whereas the Total Coliform count is exceeding at both the locations.

4.18 Water Quality of River Betwa:

Water quality monitoring of the river is carried out at 2 different locations of interstate boundary M.P./U.P. Concentration of BOD and DO is meeting the prescribed standards whereas Total Coliform count is exceeding at both the locations.

4.19 Water Quality of River Sone:

Water quality monitoring of the river is carried out at 2 different locations of the interstate boundary M.P./U.P. The BOD and DO level are within the prescribed range whereas Total Coliform count is exceeding at both the locations.

4.20 Water Quality of River Vardha:

Water quality monitoring of the river is carried out at 2 different locations at the interstate boundary M.P./Maharashtra. The BOD and DO level are meeting to the prescribed standards. However, Total Coliform count is exceeding at one location i.e. Belur Dhemadabad (Maharashtra).

4.21 Water Quality of River Bhima:

Water quality monitoring of the river is carried out at 2 different locations at the interstate boundary of Maharashtra/Karnataka. The BOD and DO concentrations are meeting the prescribed range. However, Total Coliform count is exceeding at both the locations.

4.22 Water Quality of River Sabarmati:

Water quality monitoring of the river is carried out at the interstate boundary of Gujarat/Rajasthan. The BOD and DO concentration are meeting to the prescribed standard at the location. Total Coliform count is exceeding at the location to the prescribed standard.

4.23 Water Quality of River Manjira:

Water quality monitoring of the river is carried out at 2 different locations of the interstate boundary Karnataka/Maharashtra. The BOD and DO concentration are within the prescribed standard. However, Total Coliform count is exceeding at one location i.e. Janwada (Karnataka).

4.24 Water Quality of River Tapi:

Water quality monitoring of the river is carried out at 3 different locations at the interstate boundaries of Maharashtra/Gujarat and Maharashrta/M.P. The BOD and DO level are meeting the prescribed standard. However, Total Coliform count is exceeding the prescribed standards at all 03 locations.

4.25 Water Quality of River Narmada:

Water quality monitoring of the river is carried out at the location at the interstate boundary of Gujarat/M.P. The BOD and DO level are meeting the prescribed Standards. Whereas the Total Coliform count is exceeding at said location.

4.26 Water Quality of River Wainganga:

Water quality monitoring of the river is carried out at the location of interstate boundary of Maharashrta/M.P. The BOD and DO level are within the prescribed range indicating the good water quality at the location. Total Coliform count is exceeding at the aforesaid location.

4.27 Water Quality of River Damanganga:

Water quality monitoring of the river is carried out at 2 different locations at the interstate boundary of Gujarat/ UT of Daman. The BOD and DO level are exceeding the prescribed limit at Jarry Causeway D/S of CETP Discharge (Gujarat). Total Coliform count is within the range at both the locations.

4.28 Water Quality of River Indrawati:

Water quality monitoring of the river is carried out at the location at the interstate boundary of Orissa/Chattisgarh. The BOD and DO level are within the prescribed range indicating the good water quality at the location. But the Total Coliform count is exceeding at the location.

4.29 Water Quality of River Mahanadi:

Water quality monitoring of the river is carried out at the location at the interstate boundary of Orissa/ Chhattisgarh. The BOD and DO level are within the prescribed range and Total Coliform count is exceeding at the location.

4.30 Water Quality of River Churni:

Water quality monitoring of the river is carried out at the interstate boundary of Bangladesh/W.B. The BOD and DO level are not meeting to the prescribed standards and Total Coliform count is exceeding the prescribed standards.

4.31 Water Quality of River Damodar:

Water quality monitoring of the river is carried out at 2 different locations at the interstate boundary Jharkhand/W.B. BOD and DO concentration are meeting to the prescribed standards at the locations. However, Total Coliform count is exceeding at all the locations.

4.32 Water Quality of River Subarnrekha:

Water quality monitoring of the river is carried out at 3 different locations at the interstate boundaries of Jharkhand/Orissa and W.B./Orissa. BOD and DO concentration is meeting the

prescribed standard. However, the Total Coliform count is exceeding to the prescribed standards at all the locations.

4.33 Water Quality of River Cauvery:

Water quality monitoring of the river is carried at the interstate boundary of Karnataka/Tamil Nadu. BOD and DO concentrations are meeting the prescribed standards. Total Coliform count is also meeting to the prescribed standard at the said location.

4.34 Water Quality of River Thenpennai:

Water quality monitoring of the river is carried out at the location of the interstate boundary of Karnataka/Tamil Nadu. BOD, DO and TC concentrations are exceeding to the prescribed standards.

4.35 Water Quality of River Krishna:

Water quality monitoring of the river is carried out at 2 different locations of the interstate boundaries of Karnataka/Tamil Nadu and Maharashtra/A.P. BOD and DO concentration are meeting at the prescribed standards. Total Coliform count is exceeding the prescribed standard at all the locations.

4.36 Water Quality of River Tungabhadra:

Water quality monitoring of the river is carried out at the location of the interstate boundary of Karnataka/ Maharashtra. BOD and DO concentrations are meeting the prescribed standards and the Total Coliform count is not meeting to the prescribed standard at the location.

4.37 Water Quality of River Pennar:

Water quality monitoring of the river is carried out at the boundary of Karnataka. Observation of monitoring results reveal that water quality is meeting to the prescribed standard.

4.38 Water Quality of River Godavari:

Water quality monitoring of the river is carried out at the interstate boundary of Karnataka/ Maharashtra. BOD, DO & Total Coliform concentrations are meeting to the prescribed standards.

4.39 Water Quality of River Uttra Pinkhani:

Water quality monitoring of the river is carried out at the interstate boundary of Karnataka/ A.P. BOD, DO & Total Coliform concentrations are meeting to the prescribed standards.

4.40 Water Quality of River Dhansari:

Water quality monitoring of the river is carried out at 05 different locations at the interstate boundary of Assam/Nagaland. BOD, DO & Total Coliform concentrations are meeting to the prescribed standards.

Table 5: Statistical Summary of Water Quality at Identified Locations

S. No	River	Location	N	Period of Observation	BOD(mg/l)				DO(mg/l)			
					Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
1	Yamuna	Paonta Sahib, (H.P.)	28	2005-2013	0	3.6	1.19	0.62	6.1	10.7	7.8	1.40
		Sonipat Baghpat Road, (Haryana)	25	2005-2013	1	8.2	2.38	1.55	4.5	11.3	7.29	0.83
		Palla, (Delhi)	25	2005-2012	1	4	1.85	1.77	5.5	10.7	7.55	1.58
		Asgarpur Village, (U.P.)	17	2005-2013	6	50	18.76	14.43	0	4	2.75	1.82
		Buriya U/S Jagadhari (Haryana)	17	2005-2013	1	4	1.48	0.91	1	12	8.52	1.13
		Mohena Palwal Road (Haryana)	18	2005-2013	2	37	14.9	9.58	0	12	3	3.24
		Shergarh (U. P.)	25	2005-2010	1	10	3.79	2.38	4.1	20.6	9.05	3.29
		Dak Pathar, (Uttarakhnad)	22	2005-2013	1	3.8	1.42	0.80	6.7	10.2	8.47	0.97
		Hasanpur, Maholi,	7	2009-2013	4	26	7.68	8.35	0	1.35	2.62	2.90
2	Ghaggar	Parwanoo,(H.P.)	14	2006-2013	1	27	1.22	0.80	3.8	7.5	8.49	3.40
		Sirsa Dabwali Road, (Haryana)	13	2006-2013	2	31	8.79	8.86	0	2.1	2.75	3.60
		Mubarakpur, (Punjab)	15	2006-2013	3	24	7.94	7.16	1.8	7.4	4.94	1.69
		Tiwana Village, (Punjab)	15	2006-2013	2	25	9.88	8.40	0.8	19.8	3.31	4.36
		Chandrapur Siphon, (Haryana)	15	2006-2013	3	30	9.84	7.84	0	4.5	2.76	1.72
		Sirdulgarh, (Punjab)	14	2006-2013	3	22	10.35	6.02	0	10.2	2.52	2.77
		Parwanoo D/S , Amravati, (Haryana)	14	2006-2013	1	27	1.03	7.10	3.8	7.5	8.13	1.86
		Ottu Weir (Haryana)	12	2005-2012	0	28	6.01	8.03	0	7	3.65	1.87
		Sirsa Hanumangarh Road (Rajasthan)	7	2005-2012	1	24	8.24	8.25	1.5	6.3	4.28	2.38
3	Ganga	Tarighat, Gazipur, (U.P.)	14	2005-2012	1	6	2.52	1.61	5.2	8.8	7.81	1.11
		Sultanpur (Uttrakhand)	22	2005-2013	1	3	1.38	0.62	8	12	8.75	1.18
		Bijnor Deoband Road (U. P.)	16	2005-2013	1	9.5	1.59	0.94	7	9	8.10	0.80
		Dari Ganj, Sonepur, (Bihar)	10	2008-2012	1.6	4.8	2.55	1.11	5.8	8.7	7.26	1.21
4	Beas	Changwara Village, (Punjab)	17	2006-2013	1	5	1.37	1.32	6.1	17.1	9.87	2.72
		Talwara U/S (Pong Dam) Distt	18	2005-2013	1	6	1.48	1.26	6	9	7.69	1.05
5	Markanda	Naraingarh, (Haryana)	17	2005-2013	1	85	6.44	5.54	1.5	6.7	3.34	1.91
		Kala Amb U/S (H. P.)	19	2005-2013	1	4	1.69	2.34	4.4	11.2	8.02	1.93
6	Satluj	Nangal (H. P.)	16	2006-2013	1	2	1.11	0.37	6	9.4	8.11	0.87
7	Dhela	Kashipur-Muradabad Road, Adampur Village(U.P.)	13	2008-2013	6	131	53.15	44.04	0	2.3	0.80	1.13

S. No	River	Location	N	Period of Observation	BOD(mg/l)				DO(mg/l)			
					Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
8	Bahela	Badli Village, Tehseel-Tanda (U.P.)	12	2008-2013	2	77	22.64	30.69	0.2	1.5	1.15	2.75
9	Kosi	Dadyal Bridge(U.P.)	13	2008-2013	1	4	2.30	1.24	3.5	10.4	6.70	1.52
10	Kitcha	Pull Bhatta, Bareli road, (Uttrakhand)	14	2008-2013	0	8	4.63	3.26	2.2	26	6.30	6.96
11	Sarsa	Badhi D/S, (Ghanoli Village) Punjab (B/C to R. Satluj)	5	2009-2010	1	10	2.75	2	3	7.8	6.70	2.21
		U/S at Saini Mazra, Punjab	6	2009-2013	3	4.21	3.68	1.09	10.4	12.8	9.64	2.90
12	Swan	Dhangla Village, Santoshgarh	8	2009-2013	1	4	2.35	1.37	2.4	11.2	6.25	2.96
13	Pilakhar	Rampur, Bhot (Uttar Pradesh)	7	2009-2013	1	2	2.76	1.06	0	7.8	6.25	1.26
14	Ravi	Madhopur U/S , Punjab	7	2009-2013	1	2	1.12	0.40	7.8	9.2	8.61	0.54
		Lakhanpur, D/s, Madhopur	4	2010-2012	1	2	1.18	0.5	7.4	9.8	8.92	1.38
15	Vardha	Pandhurana Village, (M.P.)	17	2006-2012	1	6	2.24	1.34	5.2	9.1	6.62	1.08
		Belur Dharmadabad & Karwar (Mosi) village (Maharashtra)	4	2006- 2007	0.1	2.1	0.61	1	6.6	9.2	7.65	1.17
16	Mahi	Bajna,R., Ratlam, (M.P.)	18	2006-2012	1	20	2.44	4.30	4.7	7.11	6.19	1.58
		Bajaj Sagar, near Bansawara, (Rajasthan)	19	2006-2012	1	8	2.60	0.85	4	8.6	6.23	1.75
17	Chambal	Fish farm , Gandhisagar Dam, (M.P)	19	2006-2012	1	4.7	2.10	1.66	6.1	9.8	6.65	1.63
		Udi (U.P.)	25	2006-2013	1	4	1.81	0.96	6.7	11	8.16	1.26
18	Churni	Bijoypur (West Bengal)	17	2005-2013	2	31	7.7	7.23	1	5.8	1.84	1.94
19	Betwa	D/S Dukwan Dam at Babina,Birdha Road,Distt. Lalitpur, (U.P.)	13	2005-2012	0	7.6	1.39	1.48	5.3	10.8	6.98	1.82
		Kanjia bridge sagar, (M.P.)	15	2005-2012	0.8	4	1.54	0.90	2.8	10.4	7.24	1.93
20	Thenpennai	Mugalur Bridge, (Karnataka)	11	2005-2011	2	19	7.42	7.24	1	6	2.43	1.70

S. No	River	Location	N	Period of Observation	BOD(mg/l)				DO(mg/l)			
					Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
21	Sone	Chopan, (D/S before Reservoir Rihand), (U.P.)	15	2005-2012	1	3	1.52	0.87	5.5	10.2	7.09	1.54
		Deora (U/S before Reservoir Rihand), (M.P.)	15	2005-2012	0.5	2	1.08	0.52	5.7	10.5	7.21	1.46
22	Tapi	Prakasha, (Maharashtra)	5	2006-2012	0.5	8.3	3.45	3.00	7	9.7	8.24	1.20
		Nizhar, (Gujarat)	5	2006-2012	1	5.5	2.21	1.72	7.1	8.1	7.13	1.00
		Ajnad (Maharashtra)	6	2006-2012	0.7	12.6	2.92	4.68	7.1	14.5	10.38	3.12
23	Manjara	Aurad Shahajani	2	2006-2007	4.3	4.3	4.3	-	7.3	7.3	7.3	-
24	Bhima	Takli, Solapur, (Maharashtra)	9	2005-2011	1	5.7	2.30	1.38	6.8	11.2	8.34	1.64
		Jewargi, (Ganagapur),(Karnataka)	8	2005-2011	0.5	10	2.13	3.73	6.2	8	7.27	0.61
25	Krishna	Khurundward, Kolhapur, (Maharashtra)	10	2005-2011	0.6	4.6	1.42	1.16	5.8	11.5	7.57	2.18
		Deodurg (Karnataka)	10	2005-2011	0	1.6	0.97	0.77	5.5	7.9	7.21	3.17
26	Damanganga	Jerry Causways, D/S of CETP, (Gujarat)	18	2007-2013	1.41	29	5.92	8.18	0.3	8.47	3.07	2.35
		U/S of CETP discharge GIDC Weir	18	2007-2013	0.7	4.2	1.73	1.02	6.1	9.1	7.62	0.80
27	Dhansari	Bokajan, (Assam)	16	2005-2010	1.6	4.7	3.10	1.49	4.8	9	7.00	1.89
		Ganeshnagar, (Nagaland)	16	2005-2010	0.7	16.5	1.88	4.42	0.3	10	5.35	3.18
		Nagarjan Bridge, (Nagaland)	16	2005-2010	0.1	10.2	1.91	2.64	1	10	6.33	2.34
		Khatkati Gate, (Nagaland)	16	2005-2010	0.3	2.6	1.61	0.68	5.8	10.5	7.85	1.38
		Numaligarh, (Assam)	16	2005-2010	0.6	4.4	1.96	1.11	0.6	15.4	6.63	3.00
28	Damodar	Sindri (Jharkhand)	17	2005-2013	0	3	2.10	0.63	4.9	8.9	7.42	0.85
		Dishergarh (West Bengal)	17	2005-2013	0	3	1.94	0.65	6.1	9.3	7.48	0.70
29	Indravati	Nowrangpur (Orissa)	13	2005-2013	1.1	3	2.03	0.49	6.1	8	7.20	0.50
30	Cauvery	Satyagala Bridge, Narsipur Karnataka	8	2005-2011	0	5	1.18	1.57	6.2	8.6	6.59	1.29

S. No	River	Location	N	Period of Observation	BOD(mg/l)				DO(mg/l)			
					Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
31	Tungabhadra	Hochchelli (Karnataka)	8	2005-2011	0	7.4	2.56	3.53	4	9	7.73	2.36
32	Pennar	Mothukapalli (Karnataka)	2	2005	1.1	1.1	1.1	-	5.3	5.3	5.3	-
33	Godavari	Basra Kavalguda, (Maharashtra)	5	2005-2012	1	3	1.84	1.00	4	6.8	5.46	1.44
34	Ramganga	D/S Sherkot, Kalagarh (U.P.)	12	2005-2012	1	4.9	1.88	1.03	4.4	8.5	7.39	1.18
		D/S Kalagarh, Dam (Uttrakhand)	12	2005-2012	1	2.6	1.79	0.55	6.2	9.2	7.79	0.92
35	Mahanadi	Hirakud (Orissa)	14	2005-2013	0	3	2.15	0.75	6.4	8.3	7.35	0.43
36	Narmada	Navagam (Gujarat)	8	2006-2012	0.8	3.5	1.68	0.90	4.8	9.84	7.33	1.28
37	Wainganga	Bapera, Bhandara (Maharashtra)	7	2006-2012	0.3	6.4	0.94	0.42	5.8	8.2	6.82	2.95
38	Sabarmati	Khedbrahma (Gujarat)	2	2005-2006	1.1	1.1	1.1	-	6.7	10.5	8.38	2.68
39	Subarnarekha	Bheragora (Jharkhand)	17	2005-2013	0	3	2.14	0.86	7	9.7	7.67	0.79
		Gopiballavpur (West Bengal)	17	2005-2013	0	3	2.28	1.00	6.4	8.7	7.55	0.64
		Lakhannath (Orissa)	17	2005-2013	0	2.6	2.05	0.2	6.1	9.7	7.69	0.90
40	Uttra-Pinkhani	Hindupur(Andhra Pradesh)	5	2005-2010	1	6	1.21	0.48	0.8	5.4	2.89	1.69

CHAPTER 5: STATUS OF WATER QUALITY

5.1 Identified polluted river locations:

Close observation of the results indicate that water quality of interstate rivers is deteriorating in respect to BOD, DO, TDS & TC and observed not fit for any designated usage. Discharge of untreated/partially treated wastewater or dumping solid waste into the rivers directly or through the drains are the main factor for the increase in pollution at these locations. Observed range of water quality parameters is summarized in Table 7:

Table 7: Observed Range of Water Quality Parameters

Sl. No.	River	N	Period of observation	DO (mg/l)	BOD (mg/l)	COD (mg/l)	TDS (mg/l)	TC (MPN/ 100 ml)	FC (MPN/ 100ml)
1	Vardha Bangaon at Bangaon Village near Pandhurana Village (M. P.)	17	2006-12	5.2-9.1	1-6	7-29	12-331	18-350	3-180
2	Vardha at Belur Dharmadabad (Maharashtra)	4	2006-07	6.6-9.2	0.1-2.1	6.5-22	4-193	110-900	130-300
3	Mahi at Village Bajna, Ratlam (M. P.)	18	2006-12	4.7-7.11	1-20	6-27	25-296	15-440	2-210
4	Mahi Bajaj sagar Dam at Gammon Bridge, (Rajasthan)	19	2006-12	4.0-8.6	1-8	7-32	5-390	23-320	4-140
5	Krishna at Kurundwad, Kolhapur (Maharashtra)	10	2005-11	5.8-11.5	0.6-4.6	8.8-36.0	4.0-380	1700-5000	800-2800
6	Bhima at Takli, Solapur (Maharashtra)	9	2005-11	6.8-11.2	1.0-5.7	8.2-36.0	12.3-844	90-700	40-500
7	Mahi at Kadna Dam, Gujarat	8	2005-12	4.5-9.3	0.7-5.9	12-31	9-192	40-90000	40-90000
8	Sabarmati at Khedbrahma (Gujarat)	2	2005-06	6.7-10.5	1.1	7.5-14	2-18	2400-500000	300-500
9	Manjara at Aurad Shahajani (Maharashtra)	2	2006	7.3	4.3	4.3	26	130	-
10	Tapi at Prakasha (Maharshtra)	5	2006-12	7-9.7	0.5-8.3	18-69	53-311	2300-9000	910-5000
11	Tapi at Ajnad (Marashtra)	6	2006-12	7.1-14.5	0.7- 2.6	14.0 -35	9.2-413	800-16000	300-9000
12	Tapi at Nizhar (Gujarat)	5	2006-12	7.1-8.1	1.0-5.5	11-30.3	9.4-191	1400-46000	1100-24000
13	Narmada at Navagam (Gujarat)	8	2006-12	4.8-9.84	0.8-3.5	1.8-21	6.0-136	80-1100	70-500
14	Wainganga at Bapera, Bhandara (Maharashtra)	7	2006-12	5.8-8.2	0.3-6.4	8.0-34	13-124	170-9000	130-5000
15	Damanganga at at Jarry Causeway D/S of CETP discharge (Gujarat)	18	2007-2013	0.3-8.47	1.41-29	4.2-224	446-31262	900-90000	9000-31262
16	Damanganga U/S of CETP discharge GIDC Weir (UT of Daman)	18	2007-2013	6.1-9.1	0.7-4.2	8.6-32	121-242	9000-50000	900-30000
17	Indrawati at Nowrangpur (Orissa)	13	2005-13	6.1-8.0	1.1-3.0	2-23	28-52	408-27000	63-6900
18	Mahanadi at Hirakund (Orissa)	14	2005-13	6.4-8.3	0.0-3.0	5.0-15.0	15-30	816-97000	204-28280
19	Churni at Bijoypur (West Bengal)	17	2005-13	1.0-5.8	2-31	8-121	31-478	1224-146000	204-30600

Table 7: Observed Range of Water Quality Parameters

Sl. No.	River	N	Period of observation	DO (mg/l)	BOD (mg/l)	COD (mg/l)	TDS (mg/l)	TC (MPN/ 100 ml)	FC (MPN/ 100ml)
20	Damodar at Sindri (Jharkhand)	17	2005-13	4.9-8.9	0-3	8-14	40-243	1734-146000	600-146000
21	Damodar at Dishergarh (West Bengal)	17	2005-13	6.1-9.3	0-3.0	6-28	34-208	200-448000	300-83600
22	Subarnrekha Behragora(Jharkhand)	17	2005-13	7-9.7	0-3.0	0-15	15-168	1900-197000	200-109000
23	Subarnrekha at Gopiballavpur (West Bengal)	17	2005-13	6.4-8.7	0-3	0-2	1-157	306-362400	202-30400
24	Subarnrekha at (Lakhnath)	17	2005-13	6.1-9.7	0-2.6	3-12	27-154	510-85300	202-85300
25	Cauvery at Satyagala Bridge, Narsipur (Karnataka)	8	2005-11	6.2-8.6	0-5	3.0-16	222	140	34
26	Thenpennai at Mugalur Bridge, Bangalore (Karnataka)	11	2005-11	1.0-6.0	2.0-19	24.3-104	36-581	350-71600	350-71600
27	Krishna at Deodurg (Karnataka)	10	2005-11	5.5-7.9	0-1.6	2-16	386	21-22000	21-22000
28	Tungabhadra at Hochchelli (Karnataka)	8	2005-11	4.0-9.0	0-7.4	1.5-19	7.4-548	13-16100	13-1100
29	Bhima at Jewargi, Gangapur, (Karnataka)	8	2005-11	6.2-8.0	0.5-10	1.3-28	6-596	2400-18000	2400-18000
30	Pennar at Mothikepli, (Karnataka)	1	2005	5.3	1.1	16	-	-	-
31	Manjira at Janwada (Karnataka)	5	2005-12	6.1-6.6	1.3-3.6	6.0-54	12-272	930-8600	3500
32	Godavari at Basra Kavalguda,(Maharashtra	5	2005-12	4.0-6.8	1-3	8.7-31.4	186-1081	258-5400	800-5400
33	Uttra-Pinkhani at Hindupur (Andhra Pradesh)	5	2005-10	0.8-5.4	0-2	3.8-19	1223-15552	130	130
34	Ganga at at Tarighat, Gazipur (U. P.)	14	2005-12	5.2-8.8	1-6	11-33.6	23-4081	350-220000	240-110000
35	Betwa at Kanjira Bridge , Sagar (M.P.)	15	2005-12	2.8-10.4	0.8-4.0	5-39	157-176	2-2100000	2-2100000
36	Betwa at D/S Dukwan Dam Babina, Birdha Road, Distt. Lalitpur (U.P.)	13	2005-12	5.3-10.8	0.7-6	2.6-44	111-239	1.7-8000	1.8-49000
37	Sone at Chopan (U.P.)	15	2005-12	5.5-10.2	1-3	3.9-44	102-421	170-35000	130-24000
38	Sone at U/S of Deora before Reservoir, Rihand (U.P.)	15	2005-12	5.7-10.5	0.5-2.0	4-44	170-232	130-110000	79-13000
39	Ramganga at D/S Sherkot, Kalagarh (U. P.)	12	2005-12	4.4-8.5	1.0-4.9	7-36	62.4-404	200-220000	50-110000

Table 7: Observed Range of Water Quality Parameters

Sl. No.	River	N	Period of observation	DO (mg/l)	BOD (mg/l)	COD (mg/l)	TDS (mg/l)	TC (MPN/ 100 ml)	FC (MPN/ 100ml)
40	Ramganga at D/S Kalagarh, Dam (Uttrankhand)	12	2005-12	6.2-9.2	1.0-2.6	3-16	158-436	40-160000	20-28000
41	Ganga at Dariganj, Distt. Sonepur, (Bihar)	10	2008-12	5.8-8.7	1.6-4.8	8.0-46	0-213	170-220000	110-110000
42	Satluj at Nangal (H.P.)	16	2006-13	6-9.4	1.0-2.0	2.0-95.0	114-324	25000-16000000	610-1910000
43	Beas at Talwara U/s (Pong Dam), Kangra (H.P.)	18	2005-13	6.0-9.0	1.0-6.0	1.0-472	94-472	4300-6600000	400-1010000
44	River Beas at D/S (Changarwa Village), (Punjab)	17	2006-13	6.1-17.1	1-5	4-180	116-180	6000-2700000	420-1630000
45	Markanda at Kala Amb (H.P.)	19	2005-13	4.4-11.2	1.0-4.0	2.0-22.0	196-294	11000-13000000	0.1-2800000
46	Markanda at Narayan (Haryana)	17	2005-13	1.5-6.7	1.0-85	7-4700	202-6594	12000-1110000000	1260-1070000
47	Ghaggar u/s Parwanoo (H.P.)	14	2006-13	3.8-18	1-27	2-51	156-504	4300-21200000	500-330000
48	Ghaggar at Parwanoo D/S , Amravati, (Haryana)	14	2006-13	3.8-7.5	1-27	2-57	172-504	4300-10900000	360-1010000
49	Ghaggar at Mubarakpur (Punjab)	15	2006-13	1.8-7.4	3-40	17-148	168-514	110000-211000000	2400-1950000
50	Ghaggar at Tiwana village (Punjab)	15	2006-13	0.8-19.8	2-25	18-132	204-1224	2100-13700000	3700-1010000
51	Ghaggar at Sirsa Dabwali Road (Haryana)	13	2006-13	0-2.1	2-31	20-588	198-1228	17000-308000000	200-220000
52	Ghaggar at Chandrapur Siphon (Haryana)	15	2006-13	0-4.5	3-30	11-299	244-984	400-317000000	200-750000
53	Ghaggar at Sirdulgarh (Punjab)	14	2006-13	0-10.2	3-22	20-301	146-1024	10000-2600000	100-22000
54	Ghaggar at Ottu Weir (Haryana)	12	2005-12	0-7	0-28	17-252	1-960	85000-260000000	1300-230000000
55	Ghaggar at Sirsa Hanumangarh Road (Rajasthan)	7	2005-12	10.5-6.3	1-24	10-142	132-1114	1100-2100000	28-111000
56	Ganga at Sultanpur (Uttarakhand)	19	2005-13	8-12	1-3	2-20	90-242	1300-35000000	3600-153000
57	Ganga at Bijnour (U.P.)	16	2005-13	7-9	1-9.5	2-13	18-242	53000-8900000	900-9100000
58	Yamuna at Shergarh, Juhika (U. P.)	25	2005-10	4.1-20.6	1-10	34-107	70-292	9300-9000000	1500-1790000
59	Yamuna at Mohena Palwal Road (Haryana)	18	2005-13	0-12	2-37	34-107	190-1162	33000-113000000	9300-10500000
60	Yamuna at Pontasahib (H. P.)	28	2005-13	6.1-10.7	0-3.6	1.0-30	1.0-304	10-3300000	6-530000
61	Yamuna at Buriya U/S Jagadhari, Mandoli, (Haryana)	17	2005-13	1.0-12.0	1-4	2-22	62-224	4900-300000000	900-3900000

Table 7: Observed Range of Water Quality Parameters

Sl. No.	River	N	Period of observation	DO (mg/l)	BOD (mg/l)	COD (mg/l)	TDS (mg/l)	TC (MPN/ 100 ml)	FC (MPN/ 100ml)
62	Yamuna at Sonipat Baghpat Road (Haryana)	25	2005-13	4.5-11.3	1-8.2	4-74	161-276	700-7200000	800-3900000
63	Yamuna at Palla, Wazirabad (Delhi)	25	2005-12	5.5-10.7	1-4	3-27	124-394	7000-17700000	1900-17700000
64	River Yamuna at Asgarpur village, (U.P.)	17	2005-13	0-4	6-50	28-282	540-958	240000-178000000	43000-2400000
65	River Yamuna at Hasanpur, Mohali (Haryana)	7	2009-13	0-1.35	4-26	23-82	266-820	49000-6100000	7700-1100000
66	River Chambal at Udi (U.P.)	25	2005-13	6.7-11.0	1-4	2-29	20-700	150-400000	70-36000
67	Chambal at Fish farm , Gandhisagar Dam, (M.P)	19	2006-12	6.1-9.8	1.0-26.0	7.0-37.0	2.0-441	19-380	4-360
68	Dhela at Adampur Village, Bhojpur	13	2008-13	0-2.3	6.0-131	62-1044	194-1044	93000-152000000	4300-8800000
69	Kitchha at Pull Bhatta, BareiliRoad, (Uttrakhand)	14	2008-13	2.2-26	0-8	0.8-50	325-450	1700-16000000	700-2200000
70	Kosi at Dadiyal Bridge, (Uttrakhand)	13	2008-13	3.5-10.4	1-4	12-82	168-380	17000-2400000	700-220000
71	Bahela at Badli Village, Tehseel - Tanda (U.P.)	12	2008-13	0.2-1.5	2-77	18-1148	264-2012	18-78000000	18-10100000
72	Pilakhar at Rampur, Bhot (Uttar Pradesh)	7	2009-13	0-7.8	1-2	12-32	278-416	7000-1400000	40-4500
73	River Sarsa at Badhi D/S, (Ghanoli Village) Punjab (B/C to R. Satluj)	5	2009-13	3.0-7.8	1-10	10-49	106-372	1180-175000	1180-192000
74	Sarsa at U/s Saini Mazra , (Punjab)	6	2009-13	10.4-12.8	3-4.21	21-85	330-540	168000-2700000	900-2800
75	River Swan at Dhangla Village, Santoshgarh (Punjab)	8	2009-13	2.4-11.2	1.0-4.0	4.0-22.0	146-312	2300-4600000	400-4600000
76	Ravi at Madhopur U/S , (Punjab)	7	2009-13	7.8-9.2	1-2	3-10	96-370	4300-95000	220-4600000
77	Ravi at Lakhanpur, D/s Madhopur(Jammu)	4	2010-12	7.4-9.8	1-2	5-6	114-130	4300-220000	900-4100
78	Dhansari at U/S Ganesh nagar , Nagaland	16	2005-10	0.3-10.0	0.7-16.5	8-82.32	80-125	17-1600	17
79	Dhansari at U/S, Nagarjan Bridge, Dimarpur Town, Nagalan	16	2005-10	1.0-10	0.1-10.2	7.8-21	90-130	19-540	4
80	Dhansari at D/S	16	2005-10	5.8-	0.3-2.6	3.4-23.9	0.08-	27-1600	17-22

Table 7: Observed Range of Water Quality Parameters									
Sl. No.	**River**	**N**	**Period of observation**	**DO (mg/l)**	**BOD (mg/l)**	**COD (mg/l)**	**TDS (mg/l)**	**TC (MPN/ 100 ml)**	**FC (MPN/ 100ml)**
	Dimarpur Town , Khatkati Gate, Nagaland			10.5			145		
81	Dhansari at Bokajan, Assam	16	2005-10	4.8-9.0	1.6-4.7	6.7-35.2	0.14-150	27-1600	17
82	Dhansari at Nimligarh, Assam	16	2005-10	0.6-15.4	0.6-4.4	12-31	51-103	17-220	17-26
83	Yamuna, Dak Pathar, Uttaranchal	22	2005-2013	6.7-10.2	1-3.8	2-77	74-162	21-1030000	200-39000

Note: **N** denotes to no. of observations made.

5.2 Polluted River Locations Identified on Close Observation of above Tabulated Data**:**

1. Damanganga at Jarry Causeway, D/S of CETP Discharge (Gujarat).
2. Churni at Biyojpur (West Bengal).
3. Thenpennai at Mughalpur Bridge, Bangalore (Karnataka).
4. Markanada, Narayangarh (Haryana).
5. Ghaggar at Mubarakpur (Punjab).
6. Ghaggar at Tiwana Village (Punjab).
7. Ghaggar at Sirsa Dabwali Road (Haryana).
8. Ghaggar at Chandrapur Siphon (Haryana).
9. Ghaggar at Sirdulgarh (Punjab).
10. Ghaggar at Ottu Weir (Haryana).
11. Ghaggar at Sirsa Hanumangarh Road (Rajasthan).
12. Yamuna at Mohena Pawal Road (Haryana).
13. Yamuna at Asgarpur Village (U.P.)
14. Yamuna at Hasanpur, Mohali (Haryana).
15. Dhela at Adampur Village, Bhojpur.
16. Bahela at Badli Village, Tehseel- Tanda (U.P.)

CHAPTER 6: ASSESSMENT OF WATER QUALITY AT INTERSTATES POINTS

6.1 Water quality of rivers monitored at various identified locations covered under IRBM Network is assessed based on the primary water quality criteria of the 04 parameters - DO, BOD, TDS and TC as depicted in Table 7. Locations showing any deviation from prescribed range are considered as polluted and are summarized in section 6.2.

Table 7: Prescribed Standards for BOD, DO, TDS and TC

Parameter	Prescribed Criteria
BOD	<= 3 mg/l
DO	>= 5 mg/l
TDS	500 mg/l
TC	500 MPN/100 ml

Source: Primary Water Quality Criteria for Bathing Water as per the notification at serial no. 93 under Environment (Protection) Rules, 1986.

6.2 Percentage Wise Variation in BOD Values:

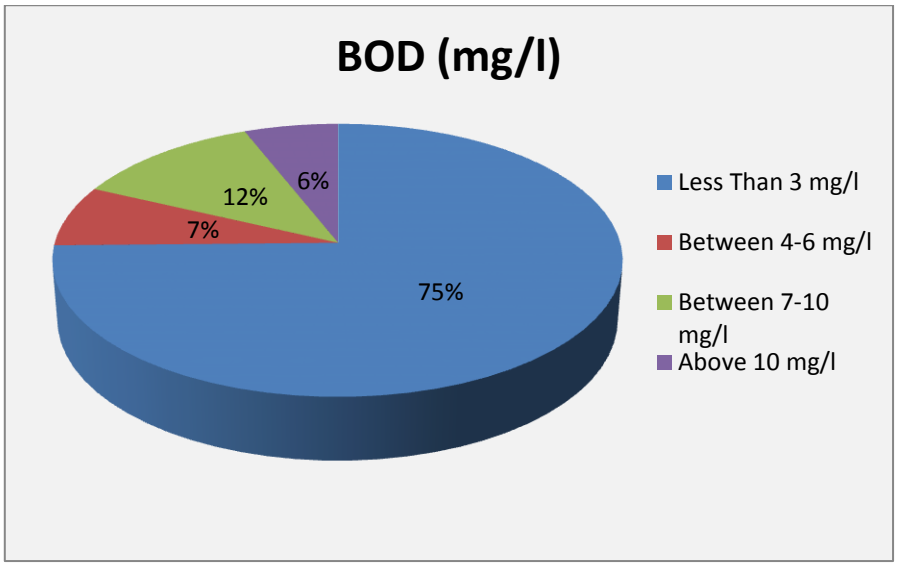


Figure 1: Pie Chart indicating BOD distribution

The close scrutiny of the Figure 1 shows that:

- 75% locations having BOD concentration in the range of 3 mg/ml indicate the water quality is meeting the prescribed norms.
- 7% of the locations have BOD concentration between 4 to 6 mg/l whereas 12% locations have BOD concentration between 7 to 10 mg/l and exceeding from the prescribed standards .
- 6% locations having BOD concentration more than 10 mg/l indicate that water quality is deteriorated .

6.3 Percentage Wise Variation in DO Values:

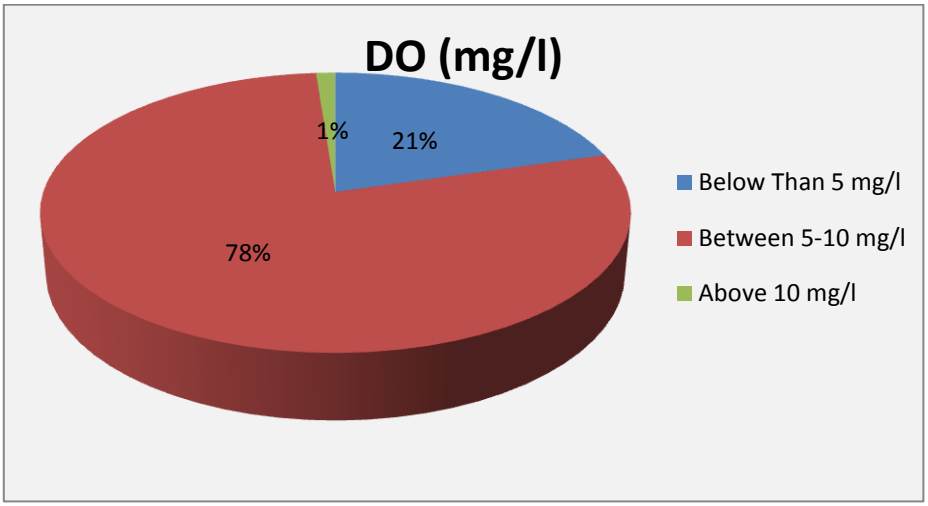


Figure 2: Pie Chart indicating DO distribution

The close scrutiny of the Figure 2 shows that:

- 78% of the locations have DO concentration in the range of 5 to 10 mg/l and meeting the prescribed standard.
- 21% locations have DO concentration below 5mg/l and are not meeting the prescribed standard.
- 1% of the locations show that DO concentration is above 10 mg/l.

6.4 Percentage Wise Variation in TDS Values:

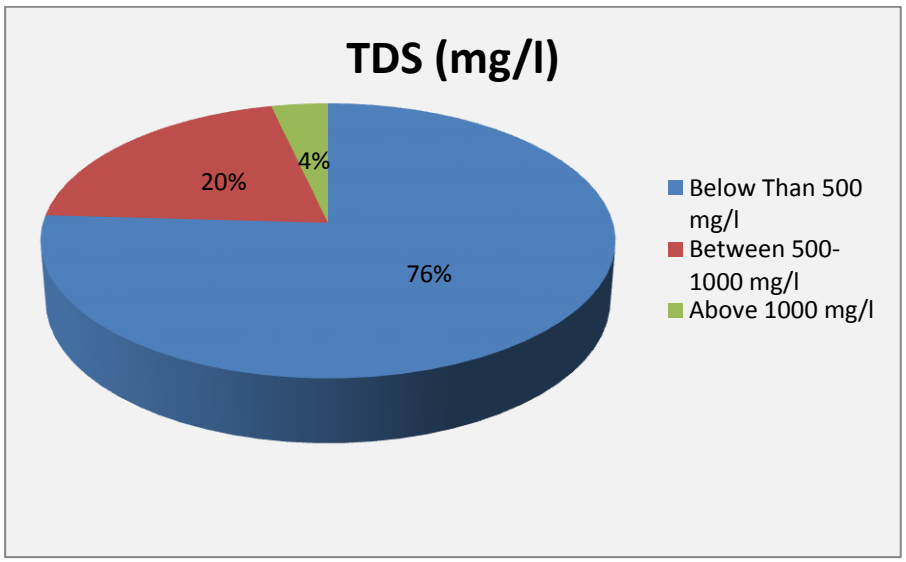


Figure 3: Pie Chart indicating TDS distribution

The close scrutiny of the Figure 3 shows that:

- 76% of the locations i.e. 63 locations contain TDS within the prescribed limit of 500 mg/l.
- 20% of the locations contain TDS more than 500 mg/l but less than 1000 mg/l.
- 4% of the locations have TDS more than 1000 mg/l.

6.5 Percentage Wise Variation in TC Values:

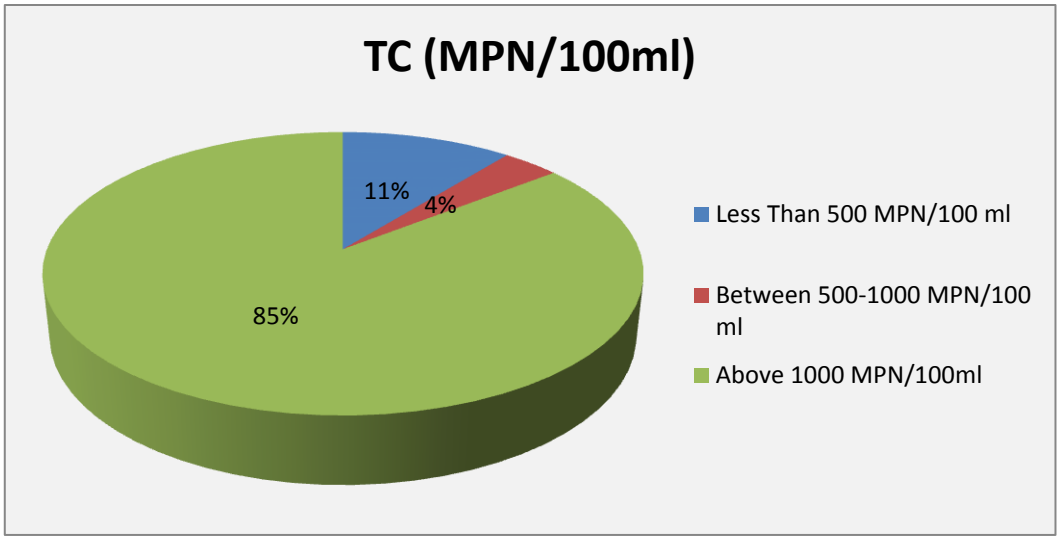


Figure 4: Pie Chart indicating TC distribution

The close scrutiny of the Figure 4 shows that:

:

- 11% of the locations indicate the TC range within the prescribed limit .
- 4% of the locations have TC range between 500-1000 MPN/100 ml.
- 85% of the locations have TC above 1000 MPN/100 ml and not meeting to the prescribed standards.

Table 8: Profile of Water Quality for Last Four Years

River	Location	BOD (mg/l)				Remarks	DO (mg/l)				Remarks
		2010	2011	2012	2013		2010	2011	2012	2013	
Yamuna	Ponta Sahib (H.P.)	1	1	1.3	-	Within Prescribed Limits	8.6	7.8	7.2	-	Within Prescribed Limits
	Sonipat Baghpat Road (Haryana)	1.5	2.3	1	2	Within Prescribed Limits	9.1	7.6	9	-	Within Prescribed Limits
	Palla (Delhi)	1	2	2	-	Within Prescribed Limits	21.4	8.2	6.5	-	Within Prescribed Limits
	Asgarpur Village (U.P.)	10.3	9	5	6	Not Within Prescribed Limits	-	-	-	-	-
	Buriya U/S Jagadhari (Haryana)	1	-	1.5	3	Within Prescribed Limits	9	-	8.3	8.5	Within Prescribed Limits
	Mohena Palwal Road (Haryana)	14.3	-	-	5	Not Within Prescribed Limits	1.2	3.3	-	-	Not Within Prescribed Limits
	Shergarh (U.P.)	9.85	-	-	-	Not Within Prescribed Limits	4	-	-	3	Not Within Prescribed Limits
	Dak Pathar (Uttarakhand)	2	26	1.4	-	Within Prescribed Limits	8.4	7.8	11	-	Within Prescribed Limits

Table 8: Profile of Water Quality for Last Four Years

River	Location	BOD (mg/l)				Remarks	DO (mg/l)				Remarks
		2010	2011	2012	2013		2010	2011	2012	2013	
	Hasanpur, Maholi	16	4	6	5	Not Within Prescribed Limits	1	1.35	5	7	Within Prescribed Limits
Ghaggar	Parwanoo (H.P.)	1	1	1	-	Within Prescribed Limits	18	9.2	-	-	Within Prescribed Limits
	Sirsa Dabwali Road (Haryana)	8	11	-	3	Not Within Prescribed Limits	2.4	-	-	-	Not Within Prescribed Limits
	Mubarakpur (Punjab)	38	40	4	6	Not Within Prescribed Limits	5	-	-	-	Within Prescribed Limits
	Tiwana Village (Punjab)	25	50	18	5	Not Within Prescribed Limits	5.2	4.2	-	-	Not Within Prescribed Limits
	Chandrapur Siphon (Haryana)	10	3	6	7	Not Within Prescribed Limits	3.4	-	-	-	Not Within Prescribed Limits
	Sirdulgarh (Punjab)	10	17	8	7	Not Within Prescribed Limits	4.6	-	-	-	Not Within Prescribed Limits
	Parwanoo D/S, Amravati (Haryana)	1	3	1	-	Within Prescribed Limits	7.8	7.2	-	-	Within Prescribed Limits
	Sirsa Hanumangarh Road (Rajasthan)	-	4	24	1	Within Prescribed Limits	-	-	-	-	-
	Ottu Weir (Haryana)	12	9	-	-	Not Within Prescribed Limits	-	-	-	-	-
Ganga	Tarighat, Gazipur (U.P.)	1.5	3.1	2.4	-	Within Prescribed Limits	8.2	8.3	8.1	-	Within Prescribed Limits
	Sultanpur (Uttarakhand)	1	1	1.3	1	Within Prescribed Limits	8.8	-	-	10.4	Within Prescribed Limits
	Bijnor Deoband Road (U.P.)	8.2	0.6	1.3	-	Within Prescribed Limits	8.21	-	8.4	8.2	Within Prescribed Limits
	Dari Ganj, Sonepur (Bihar)	1.8	4.1	1.6	-	Within Prescribed Limits	8.3	8.4	8.3	-	Within Prescribed Limits
Beas	Changwara Village (Punjab)	1	2.5	1	-	Within Prescribed Limits	9	8.8	-	-	Within Prescribed Limits
	Talwara U/S (Pong Dam) Dist.	1	-	-	-	Within Prescribed Limits	8.4	6.2	7.8	-	Within Prescribed Limits
Markanda	Naraingarh (Haryana)	6	4.6	17	7	Not Within Prescribed Limits	5.6	8	0.6	-	Within Prescribed Limits
	Kala Amb U/S (H.P.)	2.5	1	5	2	Within Prescribed Limits	4.7	9.7	-	9.9	Within Prescribed Limits

Table 8: Profile of Water Quality for Last Four Years

River	Location	BOD (mg/l)				Remarks	DO (mg/l)				Remarks
		2010	2011	2012	2013		2010	2011	2012	2013	
Satluj	Nangal (H.P.)	1	1	1	-	Within Prescribed Limits	8.6	7.8	-	-	Within Prescribed Limits
Dhela	Kashipur-Muradabad Road, Adampur Village (U.P.)	105	6	105	35	Not Within Prescribed Limits	-	-	-	-	-
Bahela	Badli Village, Tehseel-Tanda (U.P.)	76	70	27	26	Not Within Prescribed Limits	1	1	0.6	-	Not Within Prescribed Limits
Kosi	Dadyal Bridge (U.P.)	1.5	4	8.1	1.5	Within Prescribed Limits	7.6	6.1	8.3	-	Within Prescribed Limits
Kitcha	Pull Bhatta, Bareli Road (Uttarakhand)	9	8	7.3	8	Not Within Prescribed Limits	2.2	4.7	6.2	5.6	Within Prescribed Limits
Sarsa	Badhi D/S (Ghanoli Village) Punjab (B/C to R. Satluj)	7.5	3	-	5	Not Within Prescribed Limits	-	-	-	-	-
	U/S at Saini Mazra, Punjab	30	5	4	-	Not Within Prescribed Limits	-	-	-	-	-
Swan	Dhangla Village, Santoshgarh	2.1	3.5	2.5	-	Within Prescribed Limits	-	-	-	-	-
Pilakhar	Rampur, Bhot (U.P.)	1	4	3.3	3	Within Prescribed Limits	8.4	7.8	11	-	Within Prescribed Limits
Ravi	Madhopur U/S, Punjab	1	1.5	-	-	Within Prescribed Limits	-	-	-	-	-
	Lakhanpur D/S, Madhopur	2	1	1	-	Within Prescribed Limits					
Vardha	Pandhurana Village (M.P.)	3.9	2.3	2.6	-	Within Prescribed Limits	6.8	6	5.8	-	Within Prescribed Limits
Mahi	Bajna R., Ratlam (M.P.)	4.1	2	3.5	-	Within Prescribed Limits	6.3	6.4	5.8	-	Within Prescribed Limits
	Bajaj Sagar, near Bansawara (Rajasthan)	3.7	2.4	2.5	-	Within Prescribed Limits	6.5	6.6	6.6	-	Within Prescribed Limits
Chambal	Fish Farm, Gandhisagar Dam (M.P.)	2.9	2	5	-	Within Prescribed Limits	6.8	6.4	5.8	-	Within Prescribed Limits
	Udi (U.P.)	2	2	-	-	Within Prescribed Limits	9.6	-	-	-	Within Prescribed Limits
Churni	Biyojpur (W.B.)	15	10.5	21	7.5	Not Within Prescribed Limits	0.9	0.9	0.9	-	Not Within Prescribed Limits
Betwa	D/S Dukwan	1.3	1.1	4.6	-	Within	7.8	8	-	-	Within

Table 8: Profile of Water Quality for Last Four Years

River	Location	BOD (mg/l)				Remarks	DO (mg/l)				Remarks
		2010	2011	2012	2013		2010	2011	2012	2013	
	Dam at Babina, Birdha Road, Dist. Lalitpur, (U.P.)					Prescribed Limits					Prescribed Limits
	Kanjira Bridge Sagar (M.P.)	1.8	1.7	1	-	Within Prescribed Limits	9	7.8	-	-	Within Prescribed Limits
Thenpennai	Mugalur Bridge (Karnataka)	6.3	19	-	-	Not Within Prescribed Limits	3.7	5.6	-	-	Within Prescribed Limits
Sone	Chopan, (D/S before Reservoir Rihand) (U.P.)	2	1.3	2	-	Within Prescribed Limits	8.7	7.4	8.6	-	Within Prescribed Limits
	Deora (U/S before Reservoir Rihand) (M.P.)	1.5	1	-	-	Within Prescribed Limits	8.2	7.9	8.7	-	Within Prescribed Limits
Tapi	Prakasha (Maharashtra)	-	6.3	5.7	-	Not Within Prescribed Limits	-	9.7	9	-	Within Prescribed Limits
	Nizhar (Gujarat)	-	-	2.4	-	Within Prescribed Limits	-	-	5.6	-	Within Prescribed Limits
	Ajnad (Maharashtra)	-	12.6	3.4	-	Not Within Prescribed Limits	-	13	11	-	Within Prescribed Limits
Bhima	Takli, Solapur (Maharashtra)	2	3.4	-	-	Within Prescribed Limits	-	7.1	-	-	Within Prescribed Limits
	Jewargi (Gangapur) (Karnataka)	10	6	-	-	Not Within Prescribed Limits	6.9	7.9	-	-	Within Prescribed Limits
Krishna	Khurundward, Kolhapur (Maharashtra)	1.1	1.3	-	-	Within Prescribed Limits	6	8.6	-	-	Within Prescribed Limits
	Deodurg (Karnataka)	-	-	-	-	-	5.5	7.8	-	-	Within Prescribed Limits
Damanganga	Jerry Causeways, D/S of CETP (Gujarat)	23	7.3	24	-	Not Within Prescribed Limits	2.3	3.9	3.8	-	Not Within Prescribed Limits
	U/S of CETP discharge GIDC Weir	1.7	3	2.3	-	Within Prescribed Limits	8.1	8	8.4	-	Within Prescribed Limits
Dhansari	Bokajan (Assam)	5.5	-	-	-	Not Within Prescribed Limits	6.7	-	-	-	Within Prescribed Limits
	Ganeshnagar (Nagaland)	1.2	-	-	-	Within Prescribed Limits	6.9	-	-	-	Within Prescribed Limits
	Nagarjan Bridge	1.3	-	-	-	Within Prescribed	7.1	-	-	-	Within Prescribed

Table 8: Profile of Water Quality for Last Four Years

River	Location	BOD (mg/l)				Remarks	DO (mg/l)				Remarks
		2010	2011	2012	2013		2010	2011	2012	2013	
	(Nagaland)					Limits					Limits
	Khatkati Gate (Nagaland)	2	-	-	-	Within Prescribed Limits	7.2	-	-	-	Within Prescribed Limits
	Numaligarh (Assam)	4.4	-	-	-	Within Prescribed Limits	7.4	-	-	-	Within Prescribed Limits
Damodar	Sindri (Jharkhand)	-	-	2.5	2	Within Prescribed Limits	7	7.9	7.1	8.9	Within Prescribed Limits
	Dishergarh (W.B.)	-	2.3	-	2	Within Prescribed Limits	7.4	7.7	7.7	8.5	Within Prescribed Limits
Cauvery	Satyagala Bridge, Narsipur, Karnataka	-	-	-	-	-	6.5	6.2	-	-	Within Prescribed Limits
Indrawati	Nowrangpur (Orissa)	2.6	2	2	2	Within Prescribed Limits	6.6	7.4	7.1	7.6	Within Prescribed Limits
Tungabhadra	Hochchelli (Karnataka)	-	-	-	-	-	8	8	-	-	Within Prescribed Limits
Godavari	Basra Kavalguda (Maharashtra)	9	-	19	-	Not Within Prescribed Limits	6	-	-	-	Within Prescribed Limits
Ramganga	D/S Sherkot, Kalagarh (U.P.)	3	2.7	-	-	Within Prescribed Limits	6.9	8.4	8	-	Within Prescribed Limits
	D/S Kalagarh Dam (Uttarakhand)	2.6	1	-	-	Within Prescribed Limits	6.6	9.2	7		Within Prescribed Limits
Mahanadi	Hirakund (Orissa)	2	-	2	-	Within Prescribed Limits	7.7	7.3	7.4	7.7	Within Prescribed Limits
Narmada	Navagam (Gujarat)	-	3.3	3.5	-	Within Prescribed Limits	-	9.8	7.6	-	Within Prescribed Limits
Wainganga	Bapera, Bhandara (Maharashtra)	-	-	0.92	-	Within Prescribed Limits	-	-	6.4	-	Within Prescribed Limits
Subarnrekha	Bheragora (Jharkhand)	3	-	3	-	Within Prescribed Limits	7.4	8.5	8	7.8	Within Prescribed Limits
	Gopiballavpur (W.B.)	-	-	3	-	Within Prescribed Limits	7.5	7.7	7.7	7.6	Within Prescribed Limits
Uttra Pikhani	Hindupur (A.P.)	-	-	-	-	-	3	-	-	-	Within Prescribed Limits

CHAPTER 7: WATER QUALITY TREND

7.1 Water Quality of River Satluj

River Satluj originates from beyond Indian borders in the Southern lopes of the Kailash mountain near Mansarover lake from Rakas lake, It enters Himachal at Shipki and flows in the South-Westerly direction through Kinnaur, Shimla, Kullu, Solan, Mandi and Bilaspur districts. Its corse in Himachal Pradesh is 320 km. Water quality of river Satluj is monitored at Nangal (H.P.), interstate boundary for H.P. and Punjab.

Water Quality of River Satluj at Nangal (H.P.)

The water Quality of river Satluj is monitored for year 2006-13 having 16 number of observations.

Summary of Observations:

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	4	1	2	1	1	16

Water Quality of River Satluj at Nangal (H.P.) during 2006-2013 is depicted in figures (1-6) :

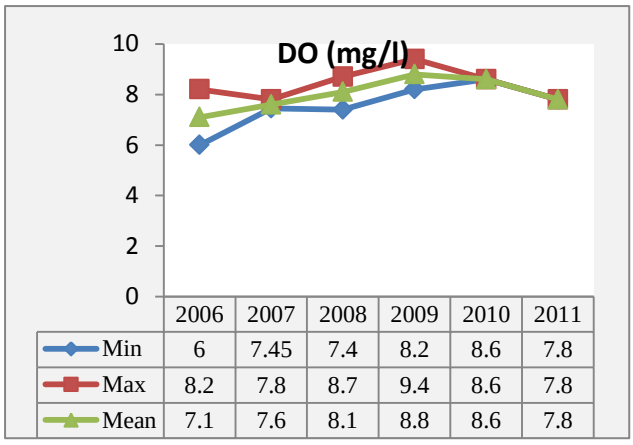


Figure 1

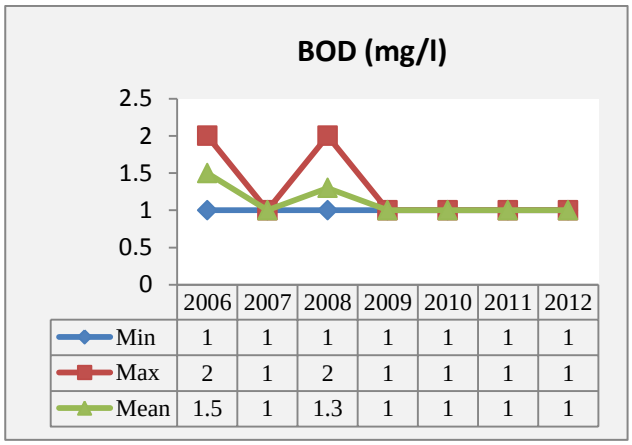


Figure 2

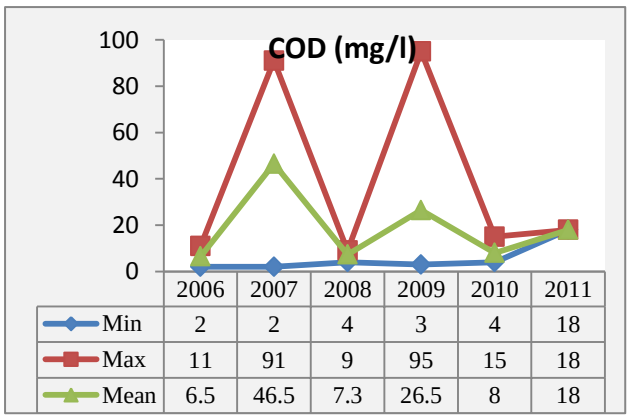


Figure 3

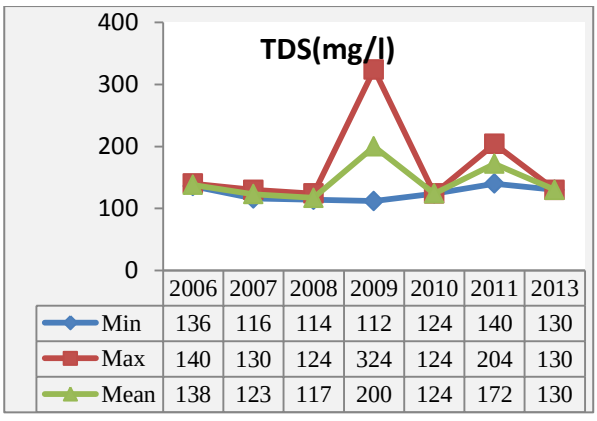


Figure 4

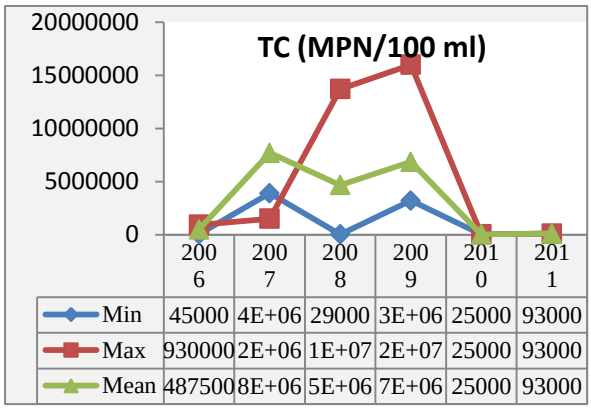


Figure 5

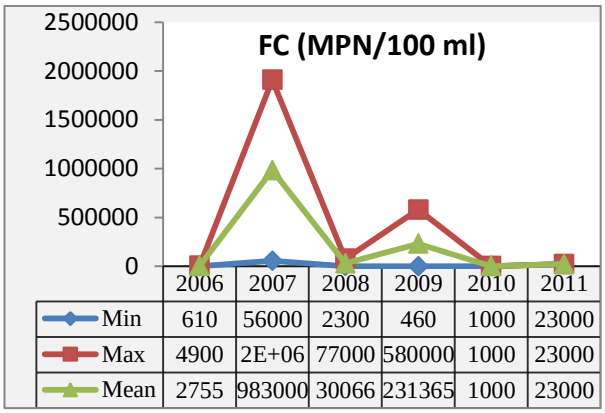


Figure 6

Close examination of figures 1 to 6 reveals following observations:

DO concentration is meeting to the minimum limit of 5.0 mg/l during 2006-2011 and ranges between 6mg/l in 2006 and 9.4 mg/l in 2009 respectively. BOD concentration is within the prescribed limit of 3.0 mg/l and ranges between 1.0 mg/l and 2.0 mg/l during 2006 and 2008 respectively . COD concentration ranges between 2.0 mg/l and 95.0 mg/l. TDS concentration ranges between 114 mg/l and 324 mg/l during year 2008 and 2009 respectively. TC count ranges between 25,000 MPN/100ml and 16,000,000 MPN/100ml during 2010 and 2009 respectively. FC count ranges between 460(MPN/100ml) and 19, 10,000(MPN/100ml) during 2009 and 2007 respectively.

7.2 Water Quality of River Beas:

Beas River flows in the northern part of India. The river rises in the Himalayas in central Himachal Pradesh, and flows for some 470 km (290 miles) to the Sutlej River in the Indian state of Punjab. Its total length is 460 kilometres (290 mi) and its drainage basin is 20,303 square kilometres (7,839 sq m) large. Water quality of river Beas is monitored at two locations : (i) Talwara U/s (Pong Dam), Kangra (H.P.) and (ii) D/S (Changarwa Village), (Punjab) , interstate boundaries for H.P. and Punjab

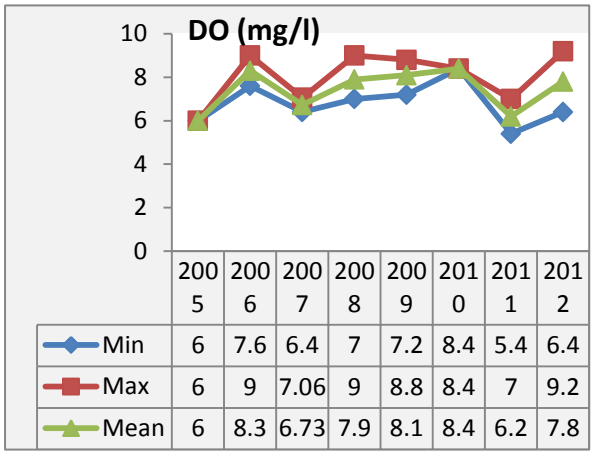
7.2.1 Water Quality of River Beas at Talwara U/s (Pong Dam), Kangra (H.P.)

The water Quality of river Beas at Talwara U/s (Pong Dam), Kangra (H.P.) is monitored for year 2006-13 having 18 number of observations.

Summary of observations:

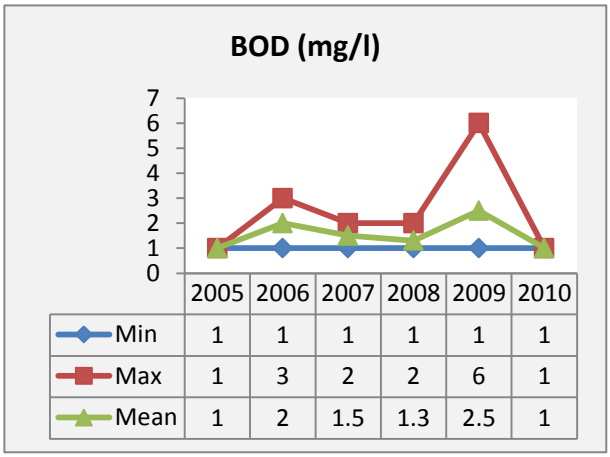
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	3	4	1	2	2	1	18

Water Quality of River Beas at Talwara U/s (Pong Dam), Kangra (H.P.) during 2005-2013 is depicted in graphs (from figures 7 - 12):



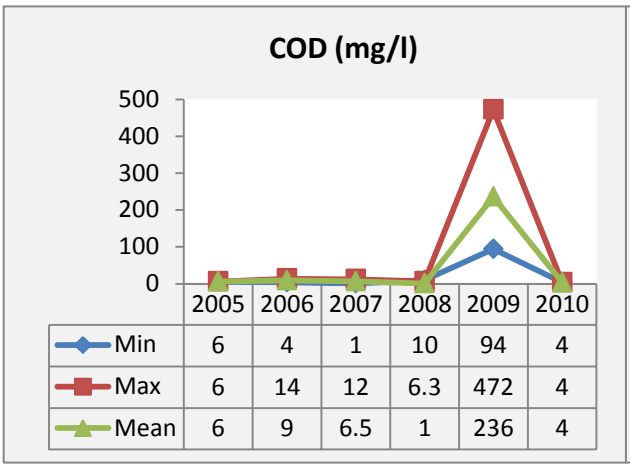
	2005	2006	2007	2008	2009	2010	2011	2012
Min	6	7.6	6.4	7	7.2	8.4	5.4	6.4
Max	6	9	7.06	9	8.8	8.4	7	9.2
Mean	6	8.3	6.73	7.9	8.1	8.4	6.2	7.8

Figure 7



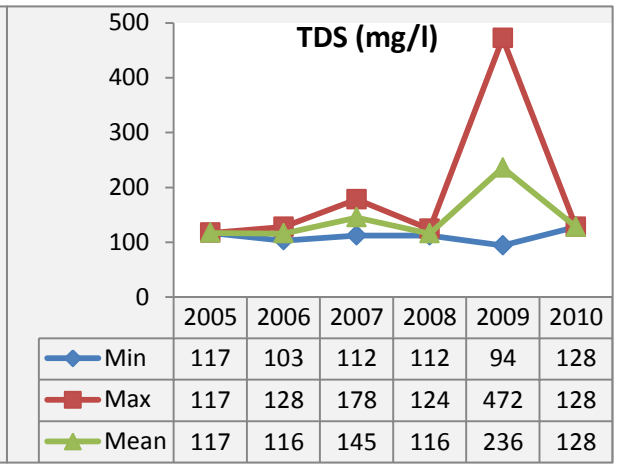
	2005	2006	2007	2008	2009	2010
Min	1	1	1	1	1	1
Max	1	3	2	2	6	1
Mean	1	2	1.5	1.3	2.5	1

Figure 8



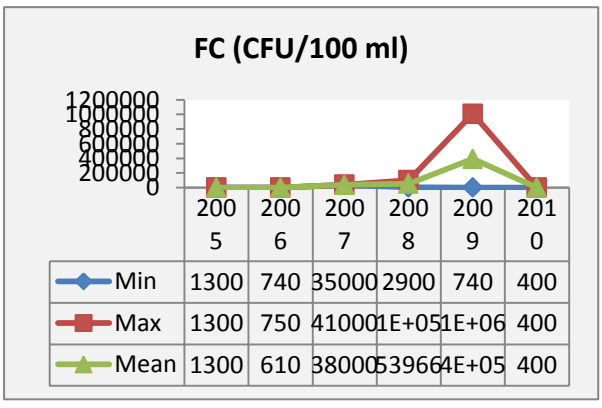
	2005	2006	2007	2008	2009	2010
Min	6	4	1	10	94	4
Max	6	14	12	6.3	472	4
Mean	6	9	6.5	1	236	4

Figure 9



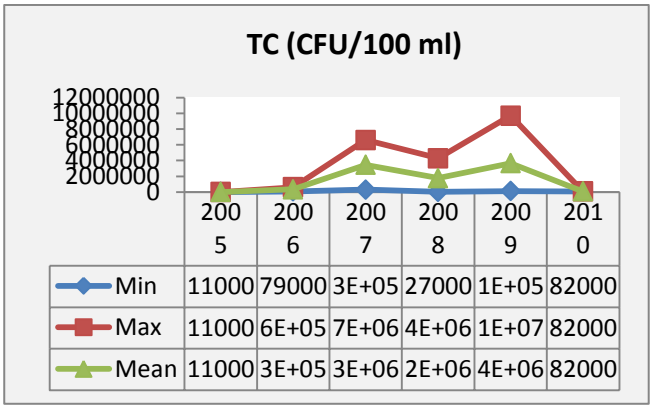
	2005	2006	2007	2008	2009	2010
Min	117	103	112	112	94	128
Max	117	128	178	124	472	128
Mean	117	116	145	116	236	128

Figure 10



	2005	2006	2007	2008	2009	2010
Min	1300	740	35000	2900	740	400
Max	1300	750	41000	1E+05	1E+06	400
Mean	1300	610	38000	53966	4E+05	400

Figure 11



	2005	2006	2007	2008	2009	2010
Min	11000	79000	3E+05	27000	1E+05	82000
Max	11000	6E+05	7E+06	4E+06	1E+07	82000
Mean	11000	3E+05	3E+06	2E+06	4E+06	82000

Figure 12

Close examination of figures 7 to 12 shows that:

DO concentration is well above the minimum limit of 5.0 mg/l during 2005-2012. DO concentration ranges between 5.4 mg/l and 9.0 mg/l during 2011 and 2008 respectively. BOD concentration ranges from 1.0 mg/l to 6 mg/l during 2005-2010. COD concentration ranges from 1.0 mg/l to 472 mg/l during 2005-2010. TDS concentration ranges between 94 mg/l and 472 mg/l in year 2009 only. TC count ranges between 11000MPN/100ml and 9700000 MPN/100ml during 2005 and 2009. FC count ranges between 400 MPN/100ml and 1010000 MPN/100ml during 2010 and 2009.

7.2.2 Water Quality of River Beas at D/S Changarwa Village, (Punjab)

The water Quality of river Beas at D/S Changarwa Village, (Punjab) is monitored for year 2006-13 having 17 number of observations.

Summary of Observations :

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	4	1	2	2	1	17

Water Quality of River Beas at D/S (Changarwa Village), (Punjab) during 2005-2013is depicted in graphs (from figures 13 - 18) below:

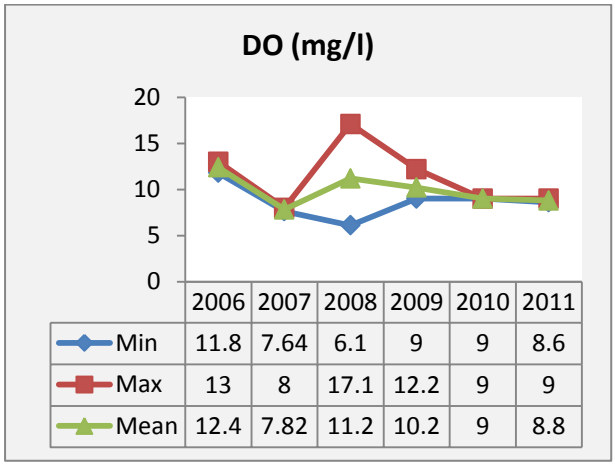


Figure 13

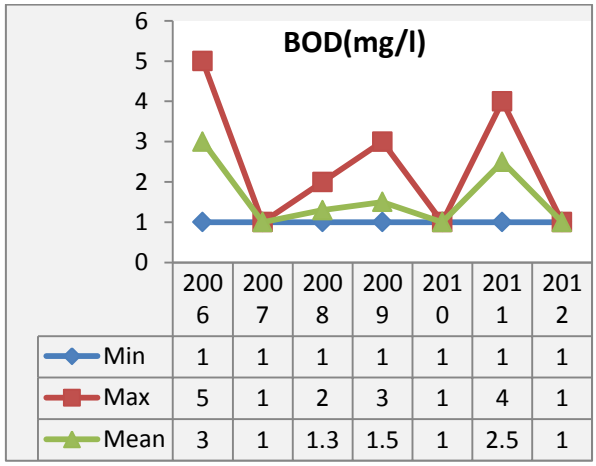


Figure 14

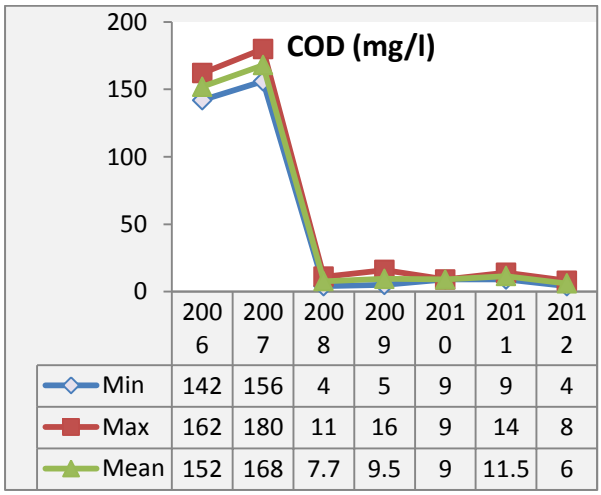


Figure 15

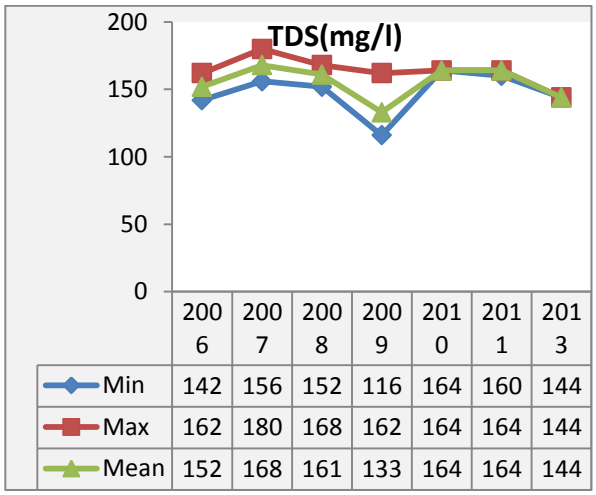


Figure 16

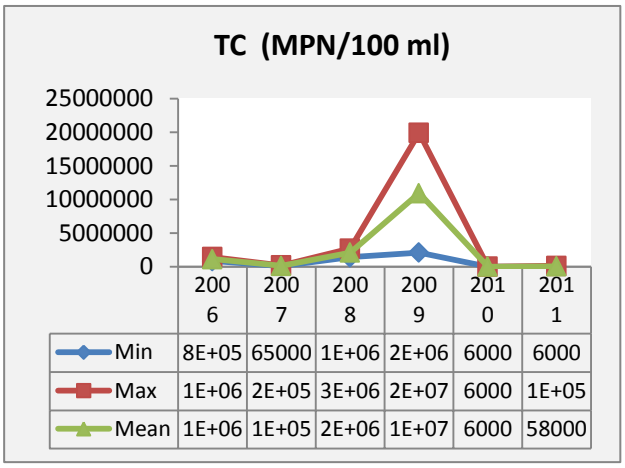


Figure 17

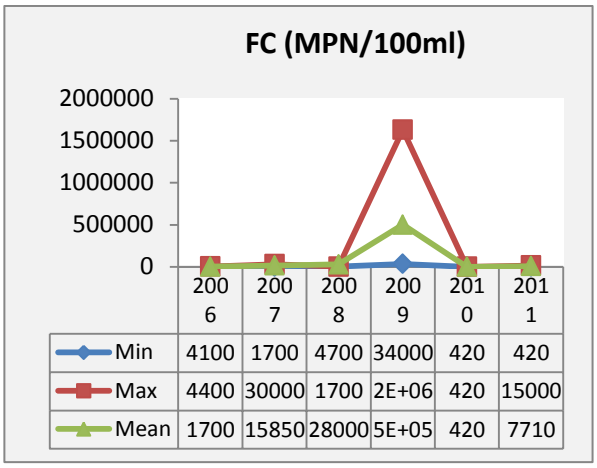


Figure 18

Close examination of figure 13 to 18 shows that:

DO concentration is meeting the minimum prescribed limit of 5.0 mg/l during 2006-2011. DO concentration ranges between 6.1 mg/l and 17.1mg/l during same year i.e. 2008. BOD concentration ranges between 1.0 mg/l and 5.0 mg/l during 2006 and 2012. COD concentration ranges between 4 mg/l and 180 mg/l during 2008/2012 and 2007 respectively. TDS concentration ranges between 116 mg/l and 180 mg/l during 2008 & 2007 respectively. TC count ranges between 6000 MPN/100 ml and 19900000 MPN/100 ml during 2010 and 2009 respectively. FC count ranges between 420 MPN/100ml and 1630000 MPN/100ml during 2010/ 2011 and 2009 respectively.

7.3.1 River Sarsa at U/s Saini Mazra , (Punjab)

Water quality of river Sarsa is monitored at two locations : (i) U/s Saini Mazra , (Punjab) and (ii) Badhi D/S, (Ghanoli Village), (B/C to R. Satluj) Punjab, interstate boundaries for H.P. and Punjab

The water Quality of river Sarsa at U/s Saini Mazra , (Punjab) is monitored for year 2009-13 having 06 numbers of observations.

Summary of Observations :

Year	2009	2010	2011	2012	2013	Total
Observations	1	1	1	2	1	6

.

Water Quality of River Sarsa at U/s Saini Mazra , (Punjab) during 2009-2013 is depicted in graphs (from figures 19-23):

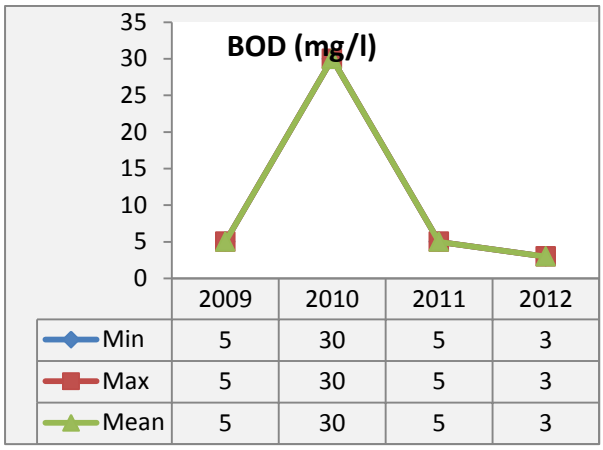


Figure 19

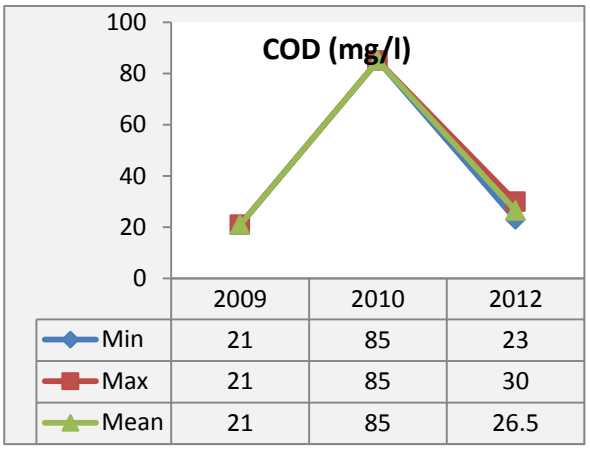


Figure 20

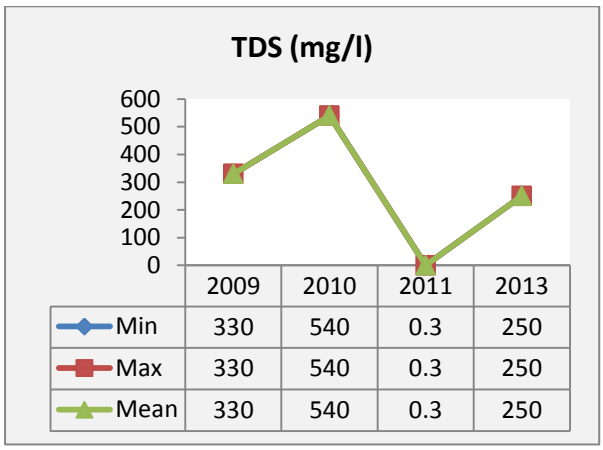


Figure 21

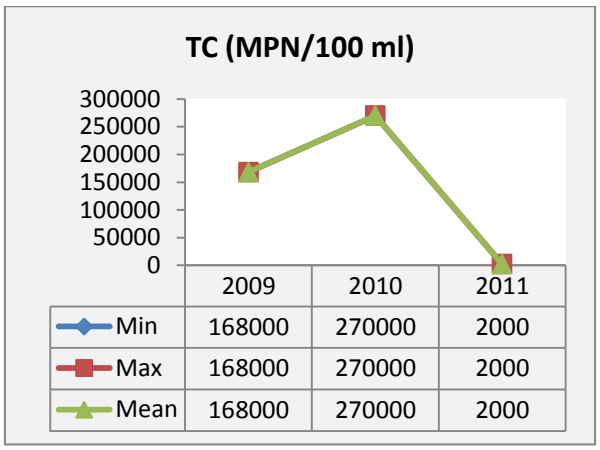


Figure 22

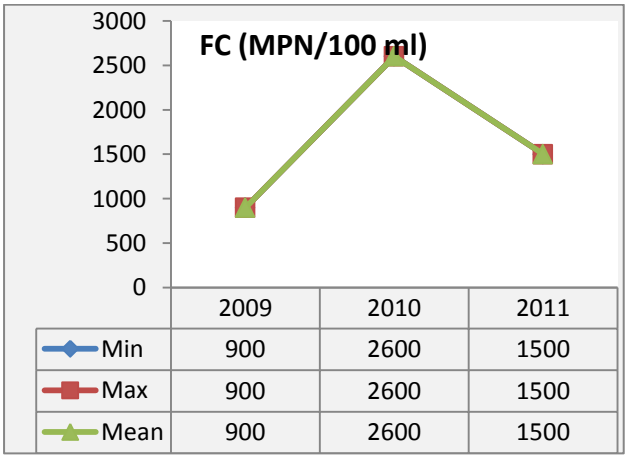


Figure 23

Close examination of figures 19 to 23 shows that:

BOD concentration is not within the prescribed limit of 3.0 mg/l except in 2012. BOD concentration ranges between 3 mg/l and 30mg/l during year 2012 and 2010 respectively. COD concentration ranges between 21 mg/l and 85 mg/l during year 2009 and 2010 respectively. TDS concentration ranges between 0.3 mg/l and 540 mg/l during year 2011 and 2010 respectively. TC count ranges between 2000 MPN/100mland 270000 MPN/100ml during 2011 and 2010. FC concentration ranges between 900 MPN/100ml and 2600 MPN/100ml during 2009 and 2010.

7.3.2 River Sarsa at Badhi D/S, (Ghanoli Village), (B/C to R. Satluj), Punjab

The water Quality of river Sarsa at Badhi D/S, (Ghanoli Village), (B/C to R. Satluj) Punjab is monitored for year 2009-13 having 05 numbers of observations.

Summary of Observations:

Year	2009	2010	2012	2013	Total
Observations	1	2	1	1	5

Water Quality of River Sarsa at Badhi D/S, (Ghanoli Village) Punjab (B/C to R. Satluj) during 2009-2013 is depicted in graphs (from figures 24-26):

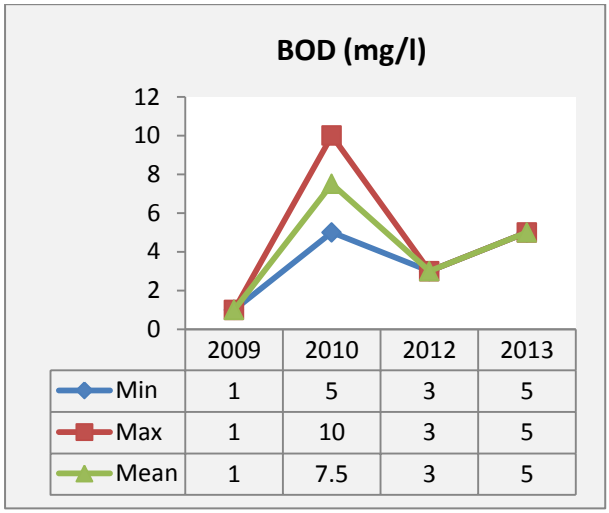


Figure 24

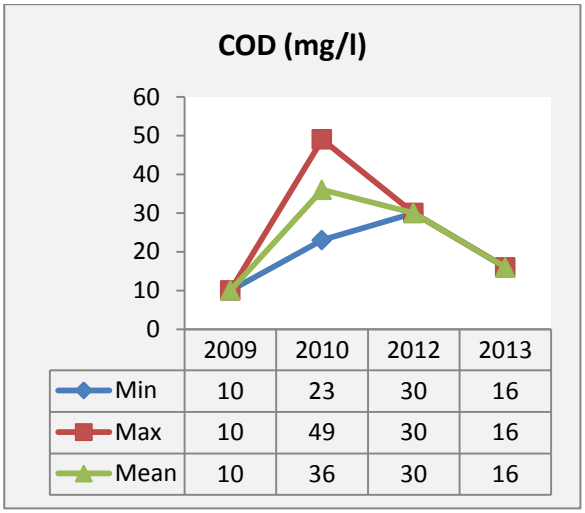


Figure 25

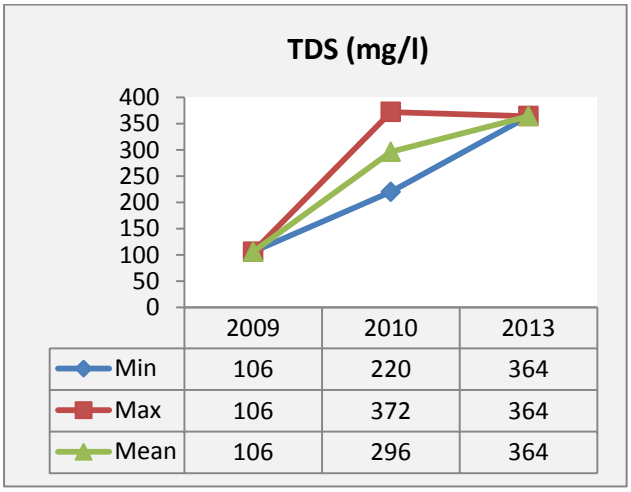


Figure 26

Close examination of figures 24 to 26 shows that:

BOD concentration is not meeting to the prescribed limit of 3.0 mg/l in year 2009. BOD concentration ranges between is 1 mg/l in year 2009 whereas maximum BOD concentration is 10 mg/l in year 2010. Minimum COD concentration is 10 mg/l in year 2009 whereas maximum COD concentration is 49 mg/l in year 2010. Minimum TDS concentration is 106 mg/l in year 2009. Whereas maximum TDS concentration is 372 mg/l in year 2010.

7.4 River Swan at Dhangla Village, Santoshgarh (Punjab)

The water Quality of river Swan at Dhangla Village, Santoshgarh (Punjab) is monitored for year 2009-13 having 08 numbers of observations.

Summary of observations:

Year	2009	2010	2011	2012	2013	Total
Observations	2	1	2	2	1	8

River Swan at Dhangla Village, Santoshgarh (Punjab) during 2009-2013 is depicted in graphs (from figures 27 to 31):

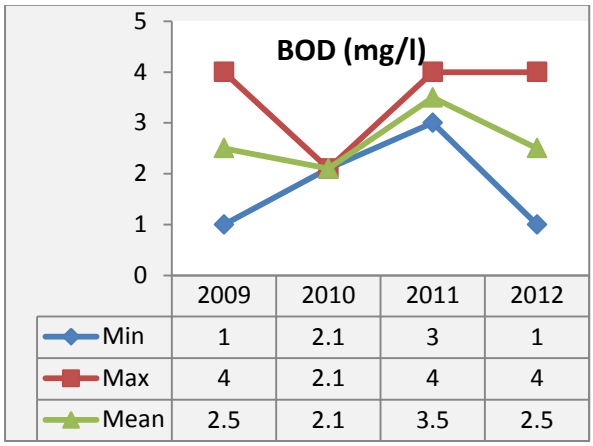


Figure 27

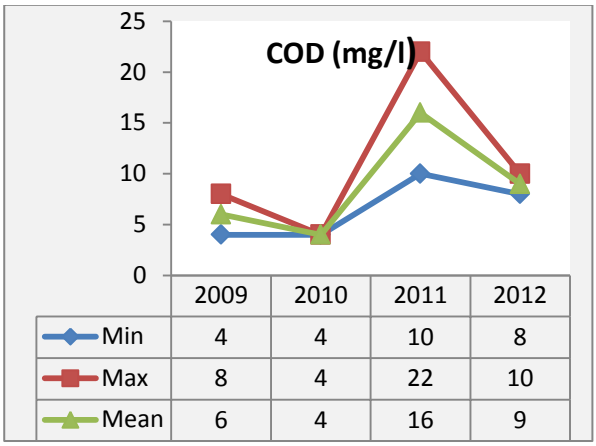


Figure 28

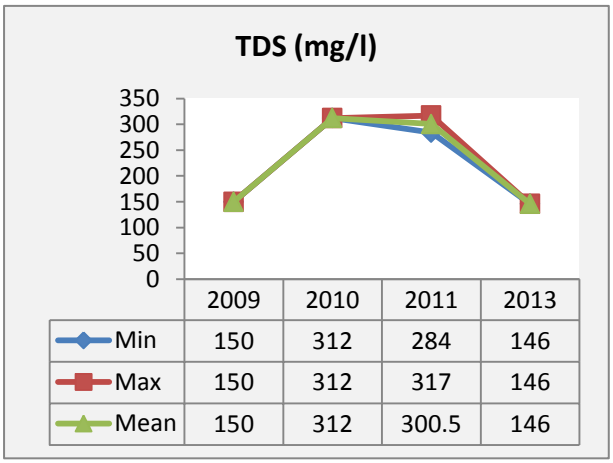


Figure 29

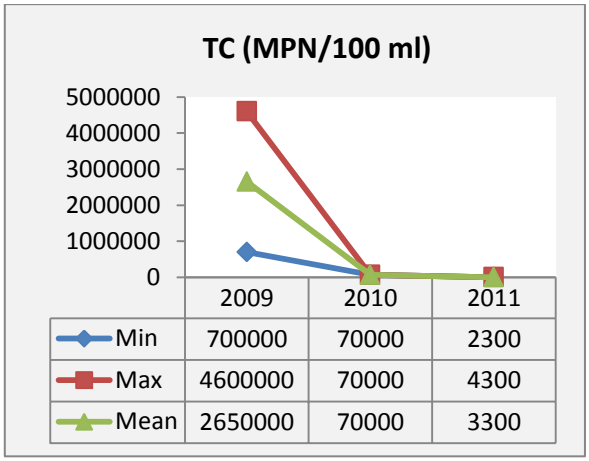


Figure 30

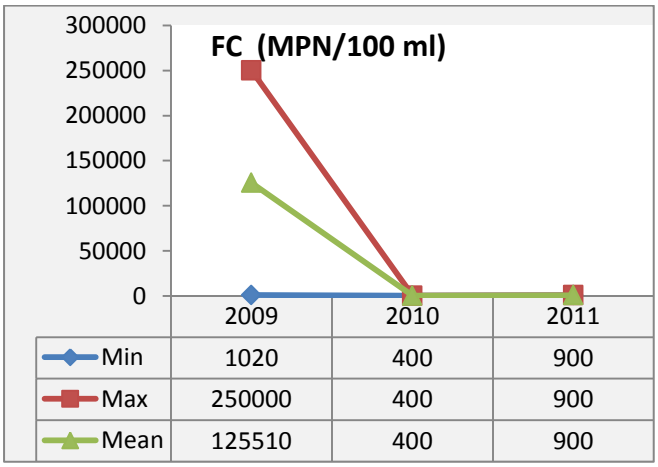


Figure 31

Close examination of figures 194 to 198 shows that:

BOD concentration is meeting the prescribed limit of 3.0 mg/l in year 2010. BOD concentration ranges between 1.0 mg/l and 4.0 mg/l during year 2012 and 2009 respectively. COD concentration ranges between 4.0 mg/l and 22 mg/l during year 2009/2010 and 2011. TDS concentration ranges between 146 mg/l and 317 mg/l during in year 2013 and 2011. TC count ranges between 2300MPN/100ml and 4600000MPN/100ml during in year 2011 and 2009. FC count ranges between 400 MPN/100ml and 250000 MPN/100ml during year 2010 and 2009.

7.5 Water Quality of River Markanda:

River Markanda is a tributary of the River Ghaggar. It originates from the southern face of the lower Himalayas on the western extremity in the Paonta Valley. This rain-fed river has very low flow in the winters and summers, but during monsoon the water level rises abruptly. Water quality of river Markanda is monitored at two locations : (i) **Kala Amb (H.P.)** (ii) Naraingarh at interstate boundaries for H.P. and Haryana

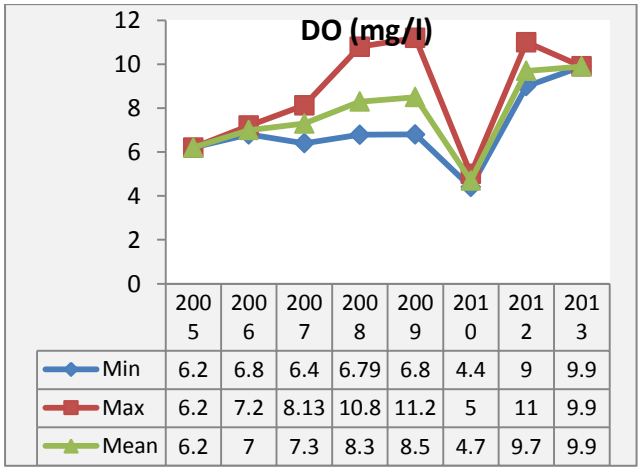
7.5.1 River Markanda at Kala Amb (H.P.)

The water Quality of river Markanda at Kala Amb (H.P.) is monitored for year 2005-13 having 19 numbers of observations.

Summary of observations:

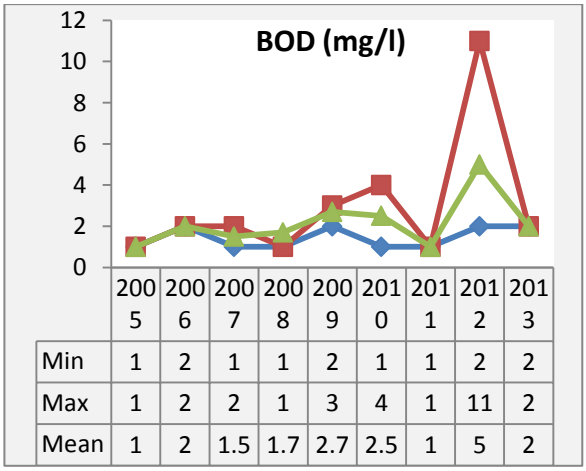
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	3	4	1	1	3	2	19

Water Quality of River Markanda at Kala Amb (H.P.) during 2005-2013 is depicted in graphs (from figures 32-27):



	2005	2006	2007	2008	2009	2010	2012	2013
Min	6.2	6.8	6.4	6.79	6.8	4.4	9	9.9
Max	6.2	7.2	8.13	10.8	11.2	5	11	9.9
Mean	6.2	7	7.3	8.3	8.5	4.7	9.7	9.9

Figure 32



	2005	2006	2007	2008	2009	2010	2011	2012	2013
Min	1	2	1	1	2	1	1	2	2
Max	1	2	2	1	3	4	1	11	2
Mean	1	2	1.5	1.7	2.7	2.5	1	5	2

Figure 33

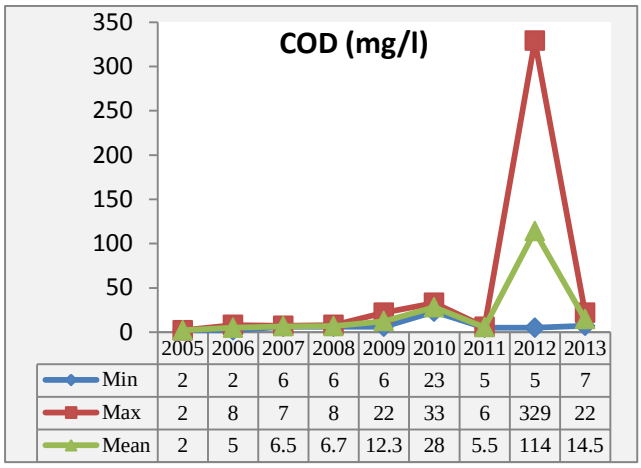


Figure 34

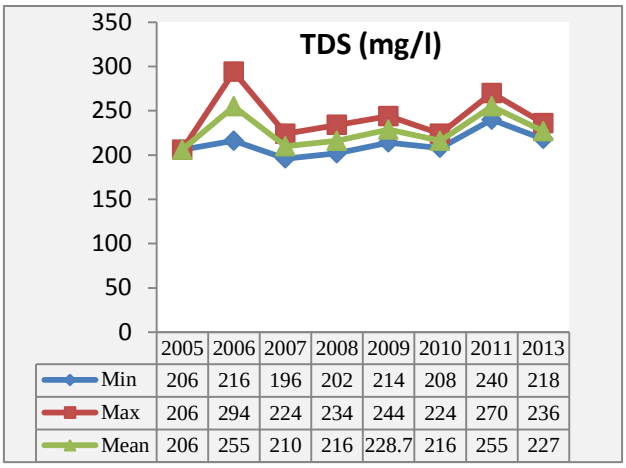


Figure 35

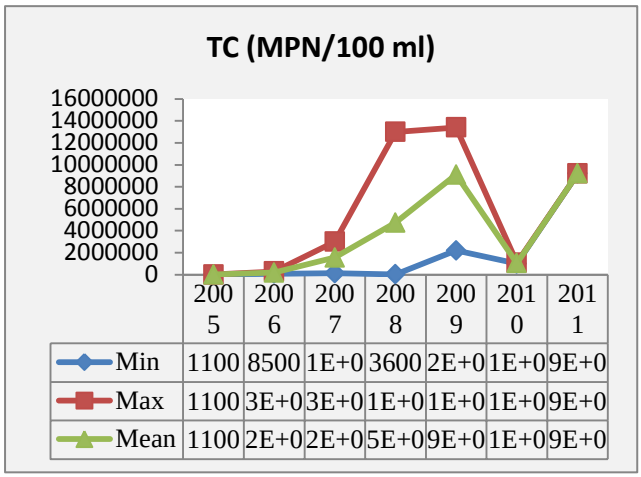


Figure 36

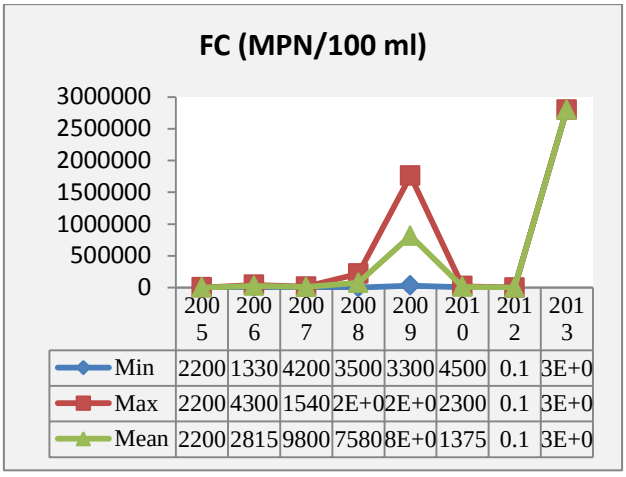


Figure 37

Close examination of figure 32 to 37 shows that:

Dissolved Oxygen is well above the minimum limit of 5.0 mg/l except in year 2010. DO concentration ranges 4.4 mg/l and 11.2 mg/l during year 2010 and year 2009. BOD concentration is within the minimum limit of 3.0 mg/l except in year 2010 and 2012 .BOD concentration ranges between 1 mg/l to 11 mg/l. COD concentration ranges between 2 mg/l and 329 mg/l during year 2005/2006 and 2012. TDS concentration ranges between 196 mg/l and 294 mg/l during year 2007 and 2006. TC count ranges between 11000 MPN/100 ml and 134000000 MPN/100 ml during 2005 and year 2009 respectively. FC count ranges between 0.1 MPN/100ml and 2800000MPN/100ml during year 2012 and year 2013.

7.5.2 River Markanda at Narayangarh (Haryana)

The water Quality of River Markanda at Narayangarh (Haryana) is monitored for year 2005-13 having 17 numbers of observations.

Summary of Observation made during 2005-13:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	3	4	1	1	2	1	17

Water Quality of River Markanda at Narayangarh (Haryana) during 2005-2013 is depicted in graphs (from figures 38-43) below:

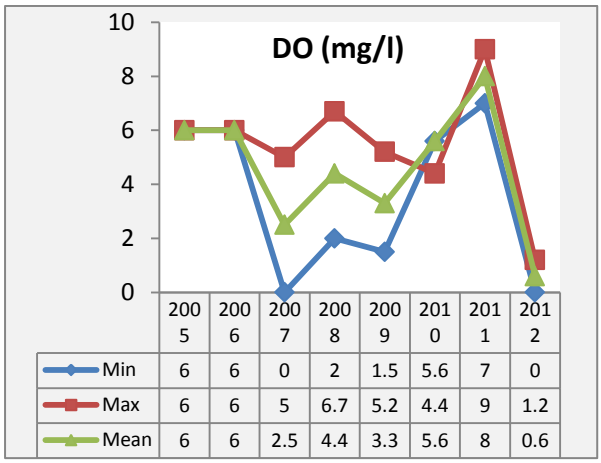


Figure 38

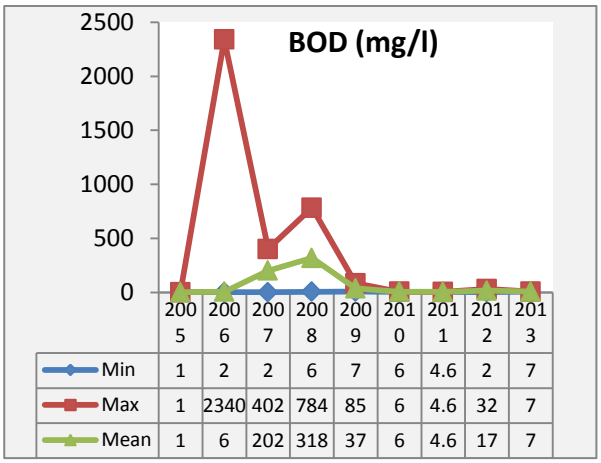


Figure 39

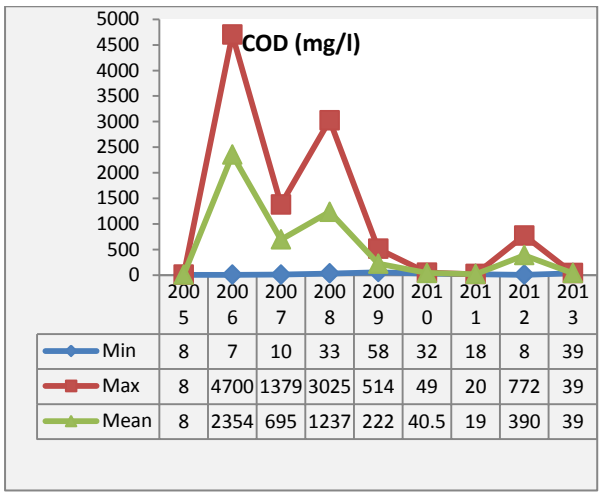


Figure 40

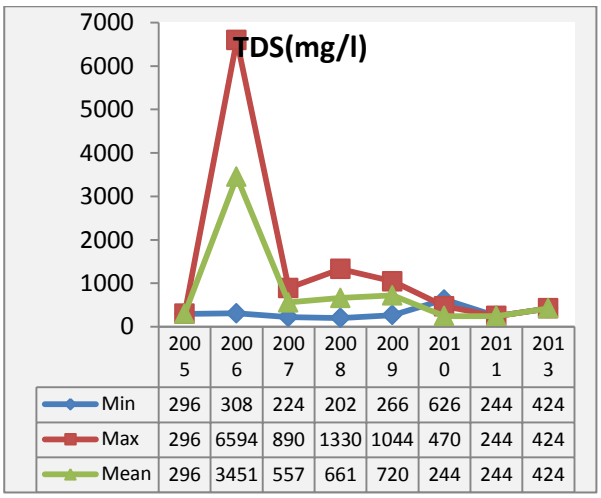


Figure 41

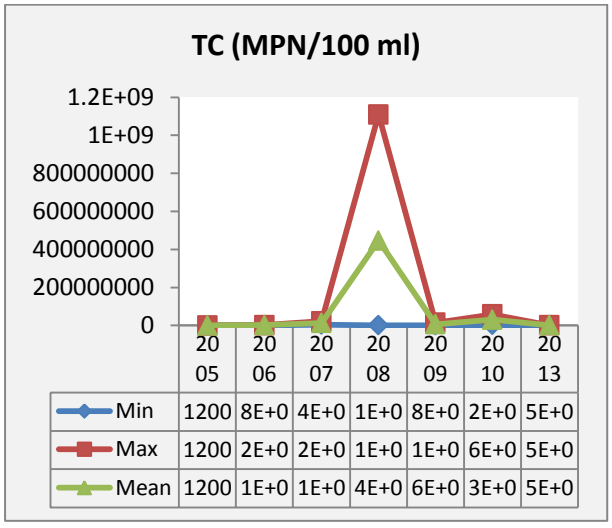


Figure 42

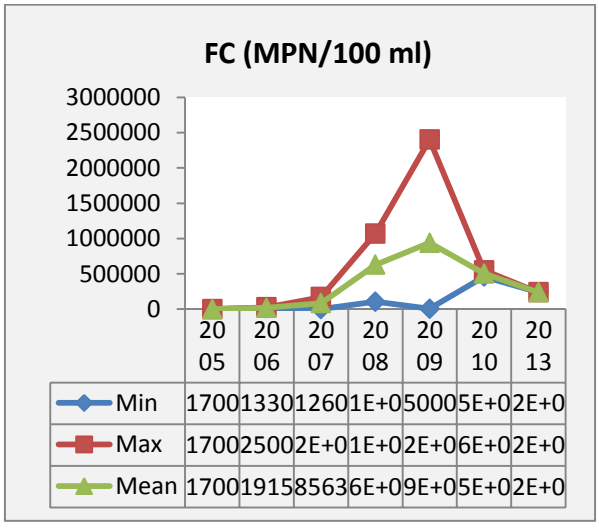


Figure 43

Close examination of figure 38 to 43 shows that:

DO concentration is not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2005, 2006 and 2011. Minimum and maximum concentration of DO observed is 0 mg/l in year 2007 & 2012 and 9 mg/l in year 2011 respectively. BOD concentration ranges between 1mg/l to 2340 mg/l.Minimum BOD concentration observed is 1 mg/l in year 2005 whereas maximum concentration of BOD observed is 2340 mg/l in year 2006. Minimum COD concentration observed is 7 mg/l in year 2006 whereas maximum concentration of COD observed is 4700 mg/l

in year 2006. Minimum concentration of TDS observed is 202 mg/l in year 2008 whereas maximum concentration of TDS observed is 6594 mg/l in year 2006. Minimum count of TC observed is 12000 MPN/100ml in year 2005 whereas maximum count of TC observed is 1110000000 MPN/100ml in year 2008. Minimum count of FC observed is 1260 MPN/100ml in year 2007 whereas maximum count of FC observed is 2400000 MPN/100ml in year 2009.

7.6 Water Quality of River Ghaggar

The Ghaggar is an intermittent river in India, flowing during the monsoon season. It originates in the Shivalik Hills of Himachal Pradesh and flows through Punjab, Haryana and Rajasthan. The Ghaggar originates in the Shivalik Range, northwestern Himachal Pradesh , and flows about 200 miles (320 km) southwest through Pinjore in the state of Haryana. It originates in the outer Himalayas between the Yamuna and the Sutluj and enters Haryana near Pinjore. Passing through Ambala and Hissar it reaches Bikaner in Rajasthan and runs a course of 290 miles before finally disintegrating in the deserts of Rajasthan.

It eventually loses itself in the sands of the Thar Desert . Just Southwest of Sirsa, it feeds two irrigation canals that extend into Rajasthan . Its seasonal flow is dependent on monsoon rainfall.

7.6.1 River Ghaggar at U/S Parwanoo (H.P.)

The water Quality of River Ghaggar at U/S Parwanoo (H.P.) is monitored for year 2005-13 having 14 numbers of observations at the interstate boundary of Himachal Pradesh and Haryana.

Summary of observations:

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	3	3	3	1	1	1	1	14

Water Quality of River Ghaggar at U/S Parwanoo (H.P.) during 2006-2013 is depicted in graphs (from figures 44-49):

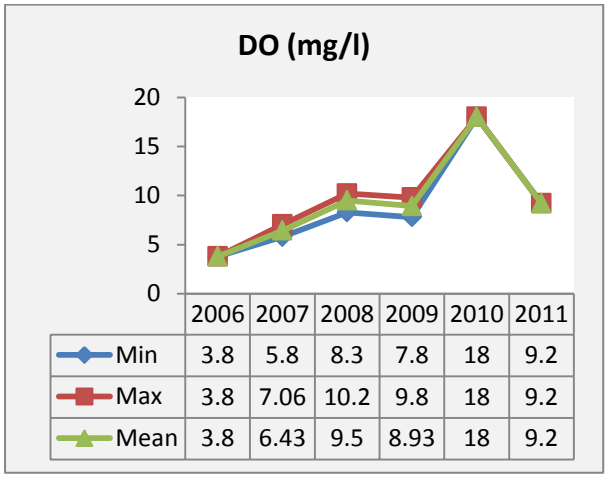


Figure 44

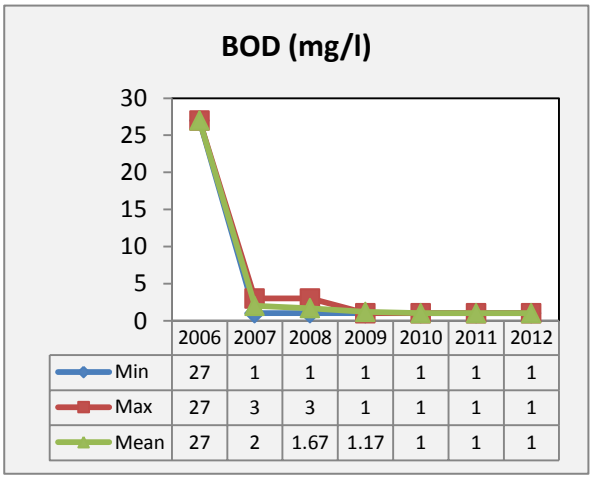


Figure 45

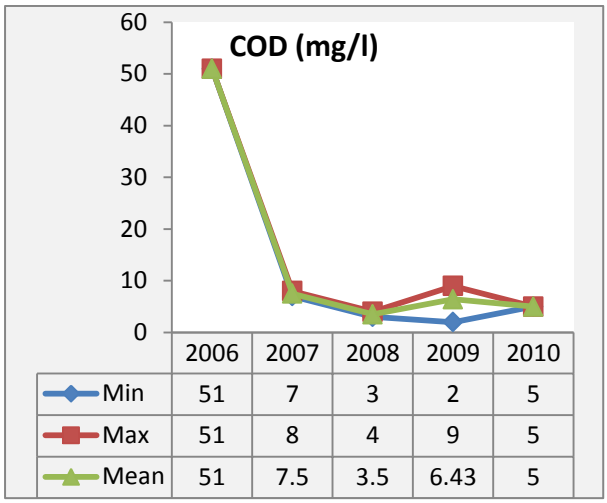


Figure 46

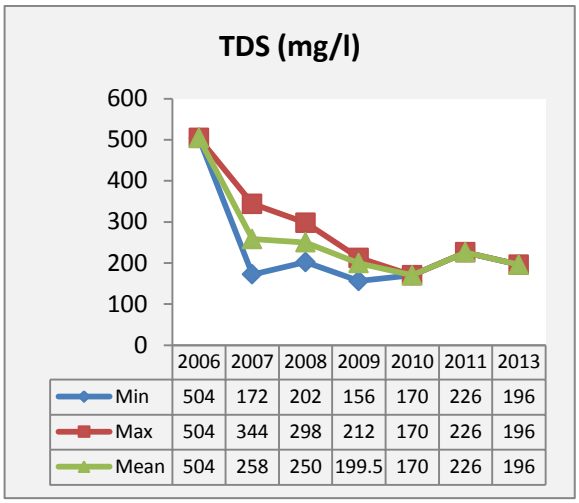


Figure 47

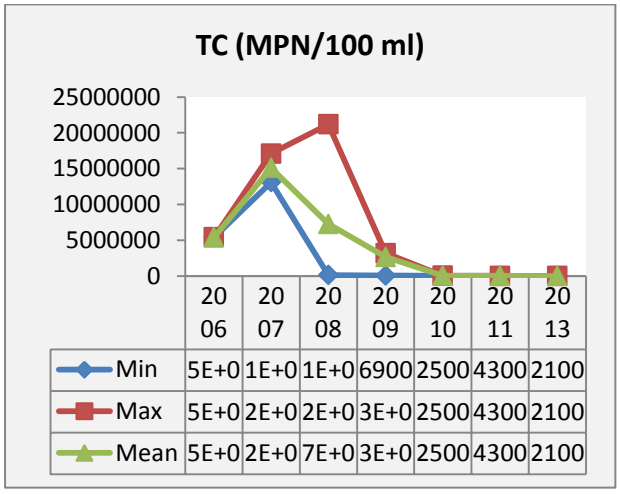


Figure 48

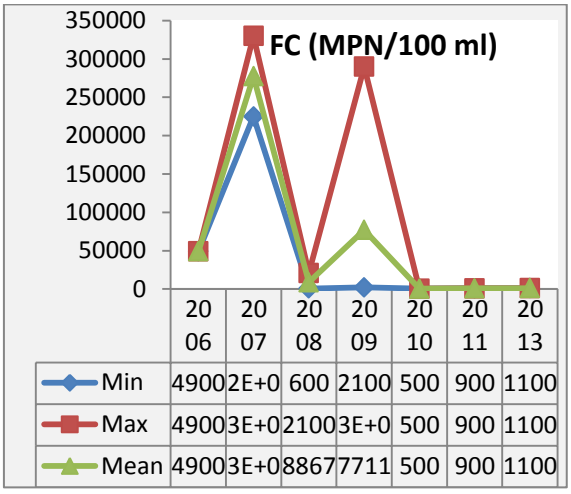


Figure 49

Close examination of figure 44 to 49 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l except in year 2006 which is 3.8 mg/l. DO concentration ranges between 3.8 & 18 mg/l during 2006 & 2010. BOD concentration ranges between 1 mg/l and 27 mg/l in during same year i.e. 2006. COD ranges between 2 mg/l and 51 mg/l during year 2009 and year 2006 respectively. TDS ranges between 156 mg/l & 504 mg/l during year 2009 & year 2006 respectively. TC count ranges between 2100 MPN/100ml and 21200000 MPN/100ml during 2013 and 2008. Minimum count of FC observed is 500 MPN/100ml in year 2010. Maximum count of FC observed is 330000 MPN/100ml in year 2007.

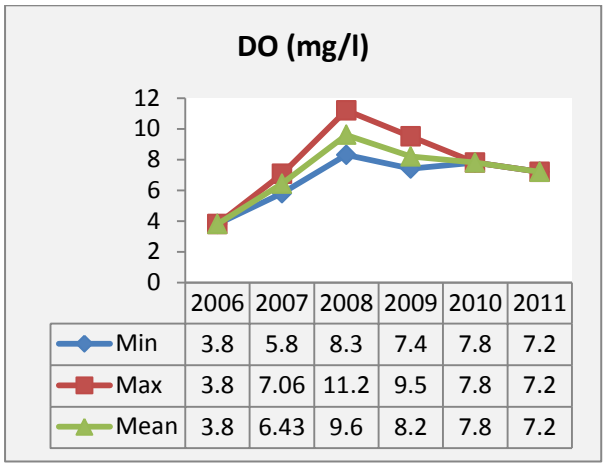
7.6.2 River Ghaggar at Parwanoo D/S, Amravati, (Haryana)

The water Quality of River Ghaggar at Parwanoo D/S, Amravati, (Haryana) is monitored for year 2005-13 having 14 numbers of observations at the interstate boundary of Haryana and Himachal Pradesh.

Summary of observations:

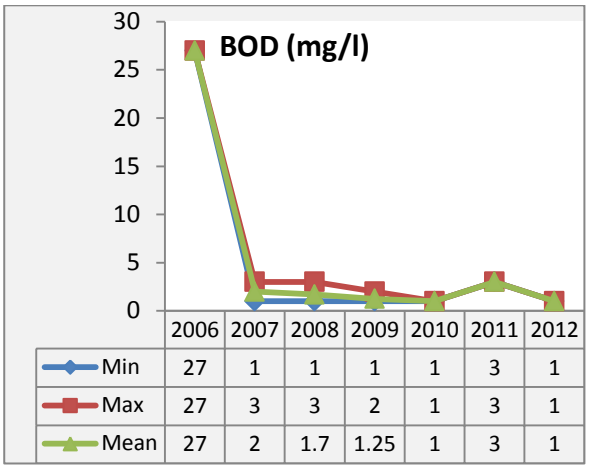
Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	3	4	1	1	1	1	14

Water Quality of River Ghaggar at Parwanoo D/S , Amravati, (Haryana)during 2005-2013 is depicted in graphs (from figures 50-55) below:



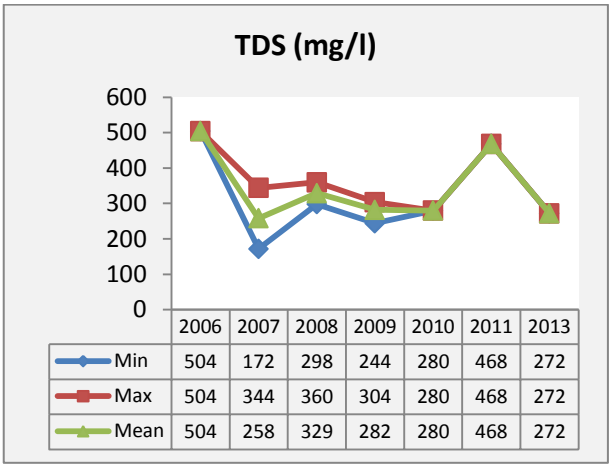
	2006	2007	2008	2009	2010	2011
Min	3.8	5.8	8.3	7.4	7.8	7.2
Max	3.8	7.06	11.2	9.5	7.8	7.2
Mean	3.8	6.43	9.6	8.2	7.8	7.2

Figure 50



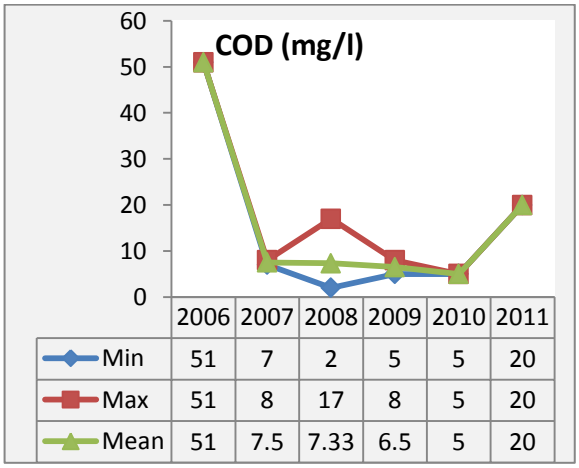
	2006	2007	2008	2009	2010	2011	2012
Min	27	1	1	1	1	3	1
Max	27	3	3	2	1	3	1
Mean	27	2	1.7	1.25	1	3	1

Figure 51



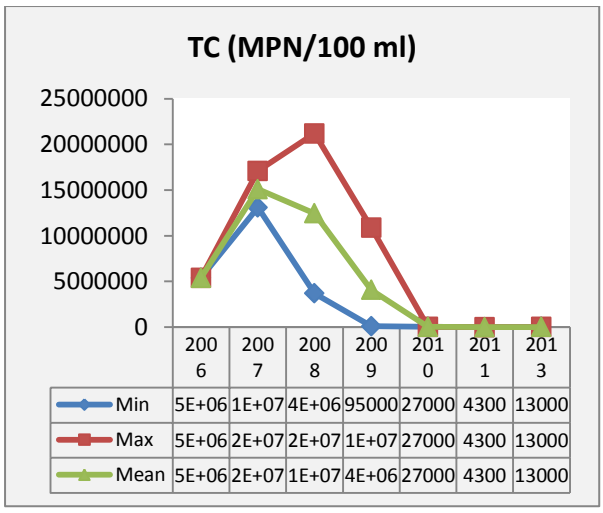
	2006	2007	2008	2009	2010	2011	2013
Min	504	172	298	244	280	468	272
Max	504	344	360	304	280	468	272
Mean	504	258	329	282	280	468	272

Figure 52



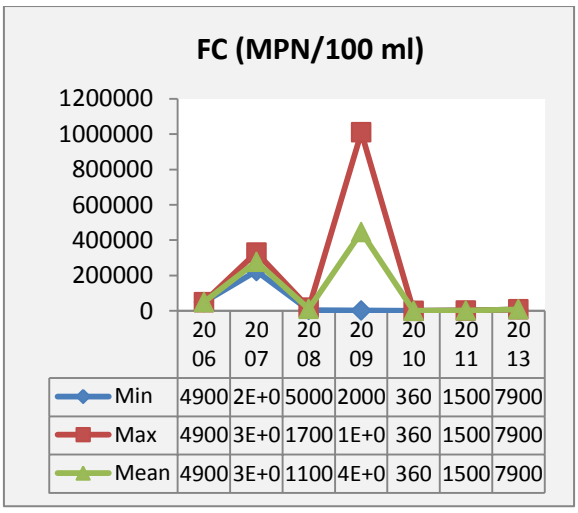
	2006	2007	2008	2009	2010	2011
Min	51	7	2	5	5	20
Max	51	8	17	8	5	20
Mean	51	7.5	7.33	6.5	5	20

Figure 53



	2006	2007	2008	2009	2010	2011	2013
Min	5E+06	1E+07	4E+06	95000	27000	4300	13000
Max	5E+06	2E+07	2E+07	1E+07	27000	4300	13000
Mean	5E+06	2E+07	1E+07	4E+06	27000	4300	13000

Figure 54



	2006	2007	2008	2009	2010	2011	2013
Min	4900	2E+0	5000	2000	360	1500	7900
Max	4900	3E+0	1700	1E+0	360	1500	7900
Mean	4900	3E+0	1100	4E+0	360	1500	7900

Figure 55

Close examination of figure 50-55 shows that:

DO concentration is above the minimum prescribed limit of 5.0 mg/l except in year 2006 which is 3.8 mg/l. DO concentration ranges between 3.8 mg/l and 11.2 mg/l during year 2006 & 2008. BOD ranges between 1 mg/l and 27 mg/l during year 2006 and 2007 respectively. COD concentration ranges between 2 mg/l and 51 mg/l during year 2008 & 2006 respectively. TDS ranges between 72 mg/l and 504 mg/l in year 2007 and 2006 respectively. TC count ranges

between 4300MPN/100ml and 10900000 MPN/100 ml during year 2011 and 2009 respectively. FC count ranges between 360 MPN/100ml and 1010000 MPN/100 ml during year 2010 and 2009.

7.6.3 River Ghaggar at Mubarakpur (Punjab)

The water Quality of River Ghaggar at Mubarakpur (Punjab) is monitored for year 2006-13 having 15 numbers of observations at the interstate boundary of Punjab and Haryana.

Summary of Observations:

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	4	1	1	1	1	15

Water Quality of River Ghaggar at Mubarakpur (Punjab) during 2005-2013 is depicted in graphs (from figures 56-61) below:

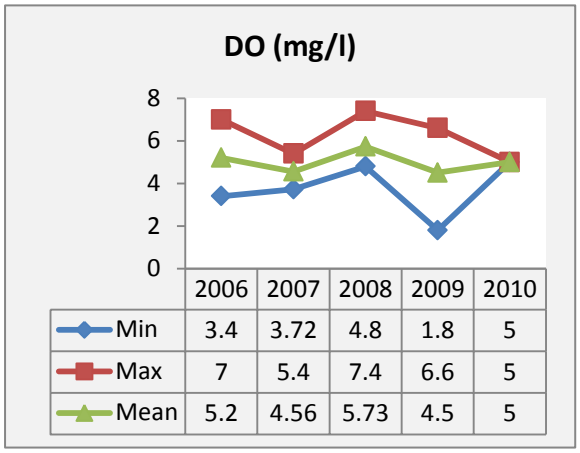


Figure 56

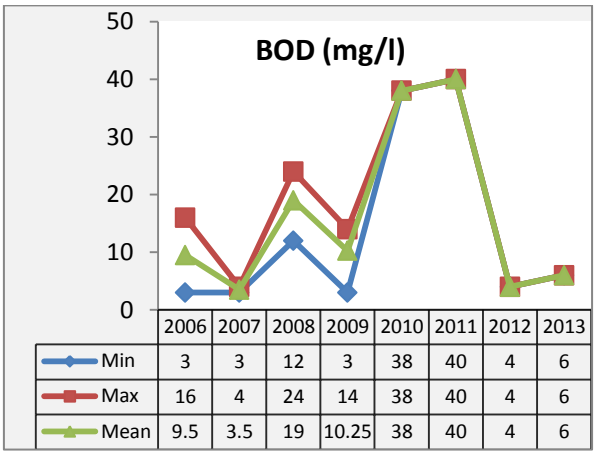


Figure 57

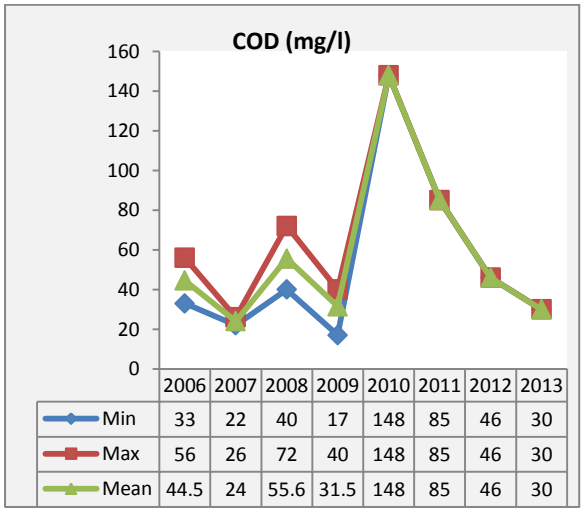


Figure 58

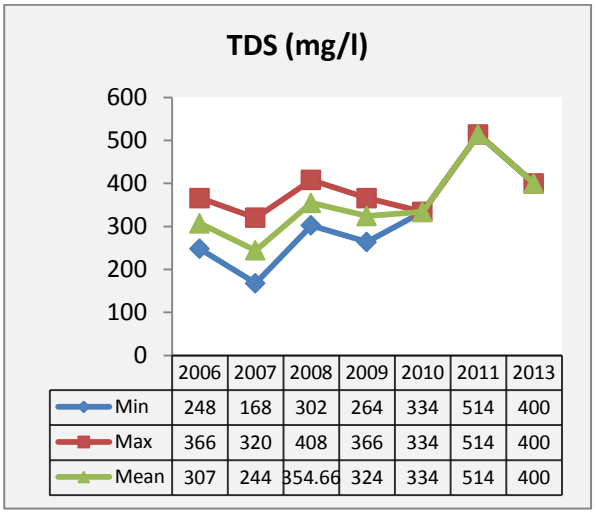


Figure 59

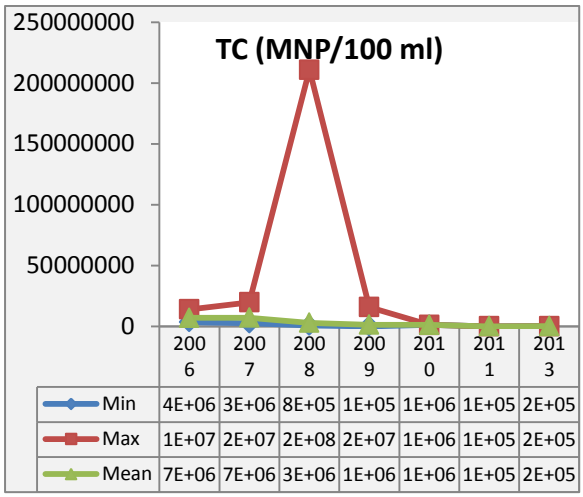


Figure 60

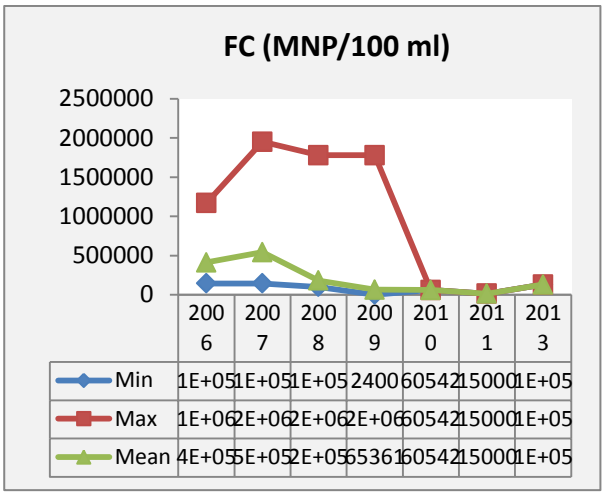


Figure 61

Close examination of figure 56 to 61 shows that:

DO concentration is not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2010. DO concentration ranges between 1.8 mg/l and 7.4 mg/l during year 2009 and 2008 respectively. BOD concentration ranges between 3 mg/l and 40 mg/l during year 2006/ 2007/2009 and 2011. COD concentration ranges between 17 mg/l and 148 mg/l during year 2009 and 2010. TDS observed is 168 mg/l in year 2007whereas maximum value of TDS observed is 514 mg/l in year 2011. Minimum count of TC observed is 11000MPN/100ml in year 2011 whereas maximum count of TC observed is 211000000MPN/100ml in year 2008. Minimum count of FC observed is 2400 MPN/100mlyear 2009 and maximum count of FC observed is 1950000 MPN/100mlin year 2008.

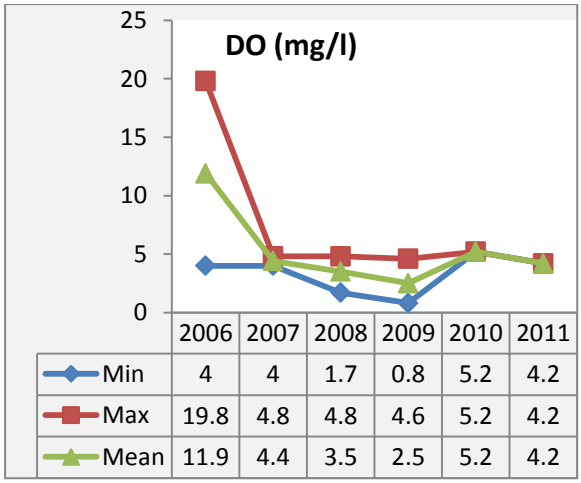
7.6.4 River Ghaggar at Tiwana village (Punjab)

The water Quality of River Ghaggar at Mubarakpur (Punjab) is monitored for year 2006-13 having 15 numbers of observations at the interstate boundary of Punjab and Haryana.

Summary of observations:

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	4	1	1	1	1	15

Water Quality of River Ghaggar at Tiwana village (Punjab) during 2006-2013 is depicted in graphs (from figures 62-67) below:



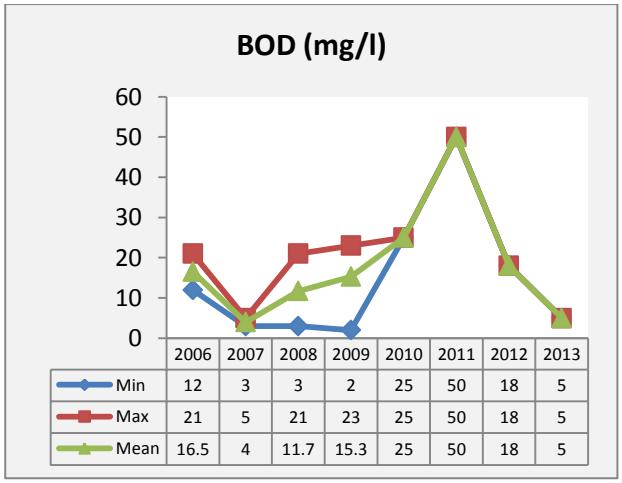


Figure 62

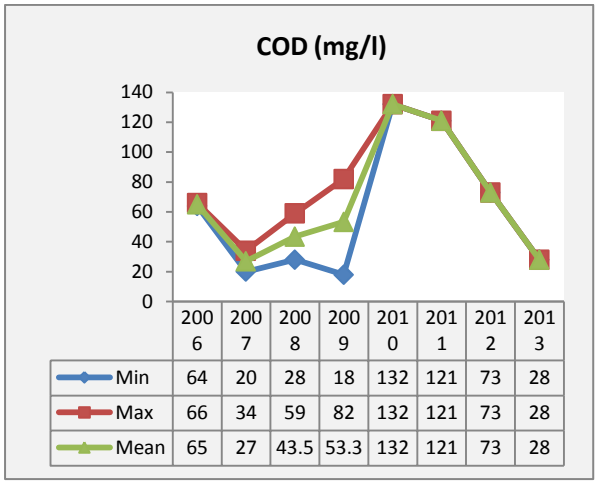


Figure 63

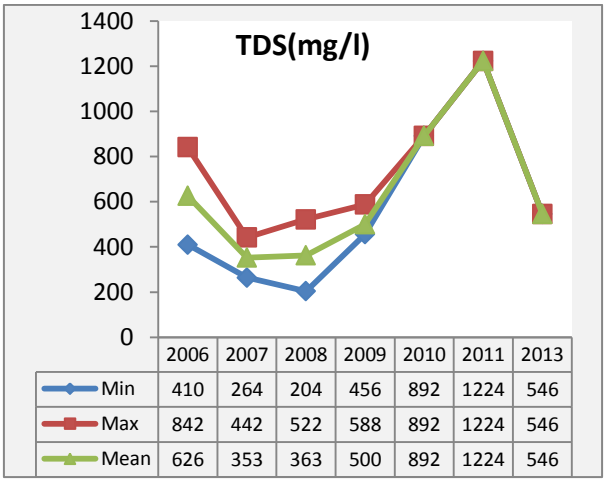


Figure 64

Figure 65

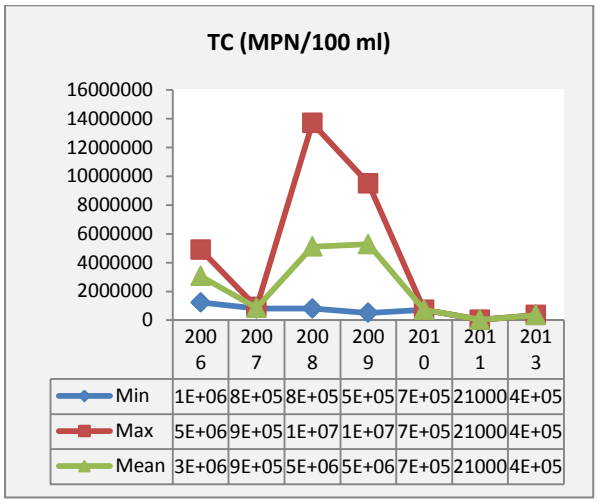


Figure 66

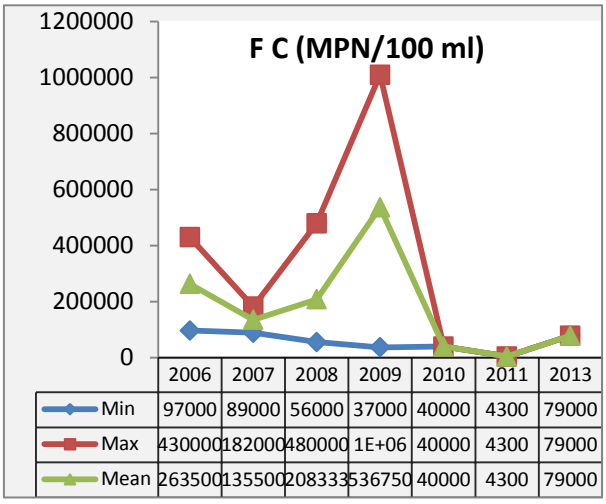


Figure 67

Close examination of figure 62 to 67 shows that:

Minimum concentration ranges between 0.8 mg/l and 19.8 mg/l during year 2009 and 2006 respectively. BOD Concentration ranges between 2 mg/l and 50 mg/l during year 2009 and 2011 respectively. COD ranges between 18 mg/l and 132 mg/l during year 2009 and 2010 respectively. TDS ranges between 204 mg/l and 1224 mg/l during year 2009 and 2011 respectively. TC count ranges between 21000 MPN/100ml and 13700000 MPN/100ml during year 2008 respectively. FC ranges between 4300 MPN/100ml and 1010000 MPN/100ml during year 2011 and 2009 respectively.

7.6.5 River Ghaggar at Sirsa Dabwali Road (Haryana)

The water Quality of River Ghaggar at Sirsa Dabwali Road (Haryana) is monitored for year 2006-13 having 13 numbers of observations at the interstate boundary of Haryana and Punjab.

Summary of observations:

Year	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	2	3	4	1	1	1	13

Water Quality of River Ghaggar at Sirsa Dabwali Road (Haryana) during 2006-2013 is depicted in graphs (from figures 68-73) below:

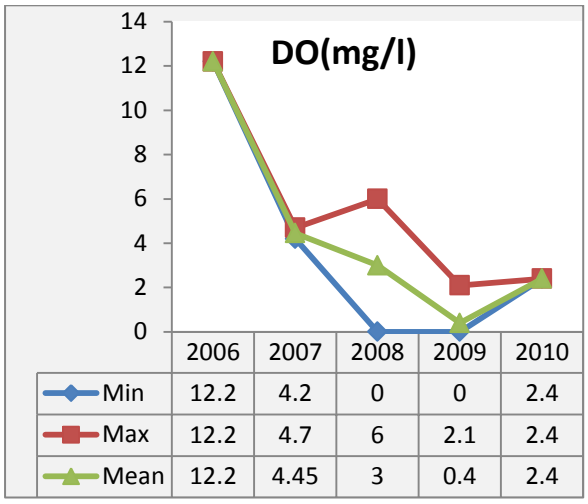


Figure 68

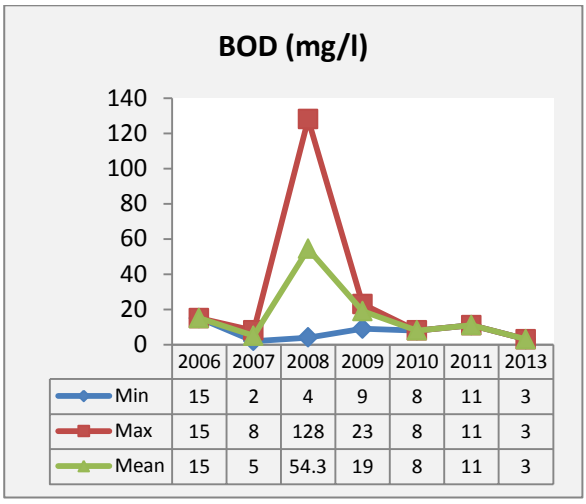


Figure 69

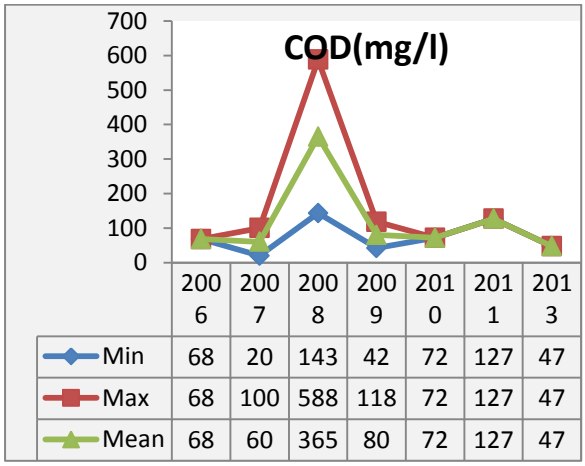


Figure 70

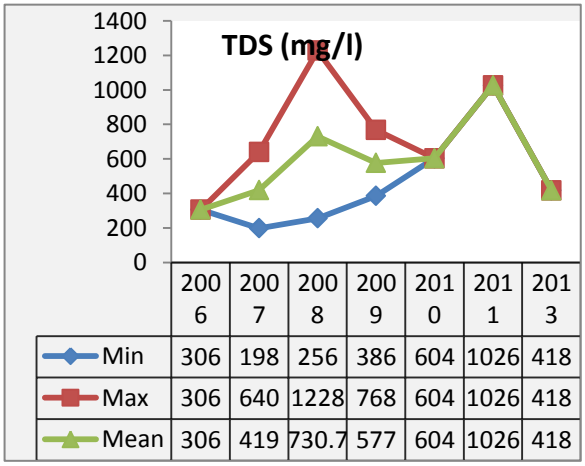


Figure 71

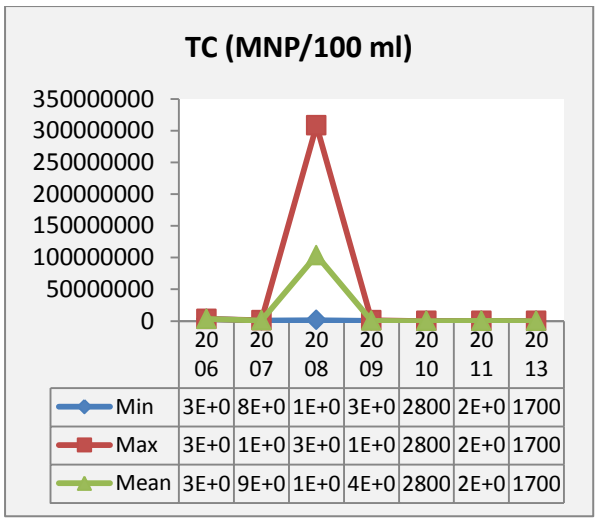


Figure 72

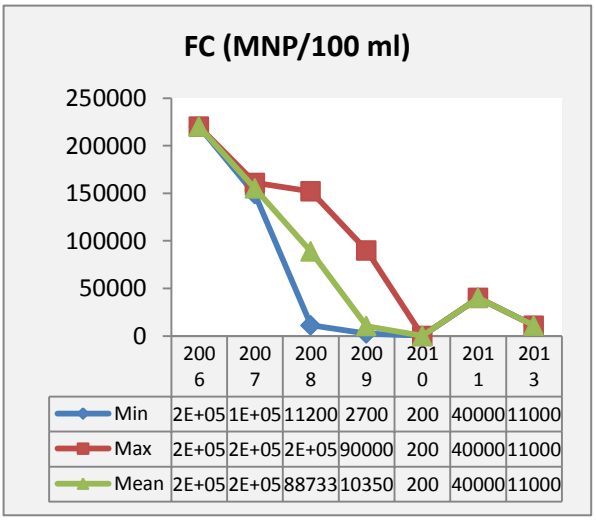


Figure 73

Close examination of figure 68 to 73 shows that:

DO concentration is not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2006. Minimum concentration of DO observed is 0 mg/l in year 2008 and 2009 whereas maximum concentration of DO observed is 12.2 mg/l in year 2006. Concentration of BOD is not meeting to the maximum prescribed limit of 3.0 mg/l except in year 2013. Minimum concentration of BOD

observed is 2 mg/l in year 2007 whereas maximum concentration of BOD observed is 128 mg/l in year 2008. Minimum concentration of COD observed is 20 mg/l in year 2007. Maximum concentration of COD observed is 588 mg/l in year 2008. Minimum concentration of TDS observed is 198 mg/l in year 2007 whereas maximum concentration of TDS observed is 1228 mg/l in year 2008. Minimum count of TC observed is 17000MPN/100ml in year 2013 whereas maximum count of TC observed is 308000000MPN/100mlin year 2008. Minimum count of FC observed is 200MPN/100ml in year 2010 whereas maximum count of FC observed is 220000MPN/100ml in year 2006.

7.6.6 Ghaggar at Chandrapur Siphon (Haryana)

The water Quality of River Ghaggar at Chandrapur Siphon (Haryana) is monitored for year 2006-13 having 15 numbers of observations at the interstate boundary of Haryana and Punjab.

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	4	1	1	1	1	15

Water Quality of River Ghaggar at Chandrapur Siphon (Haryana) during 2005-2013 is depicted in graphs (from figures 74-79):

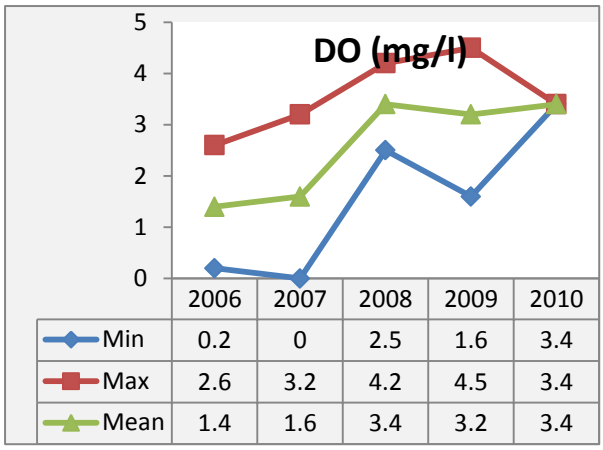


Figure 74

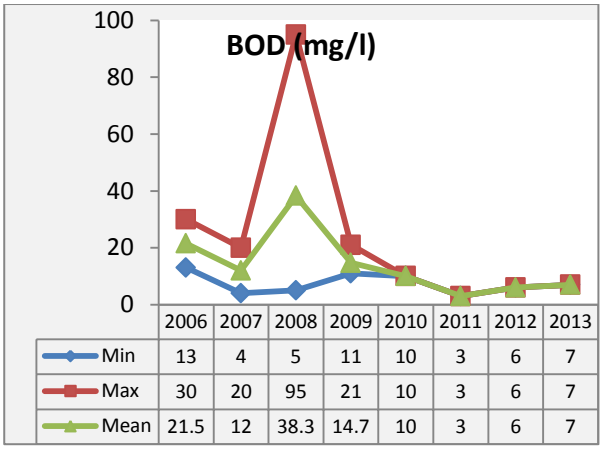


Figure 75

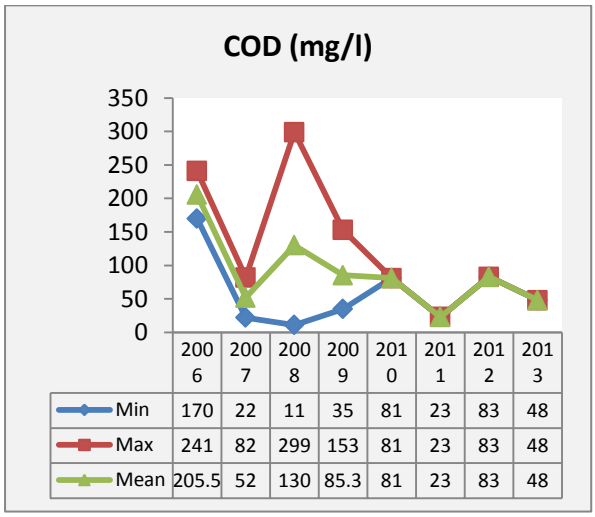


Figure 76

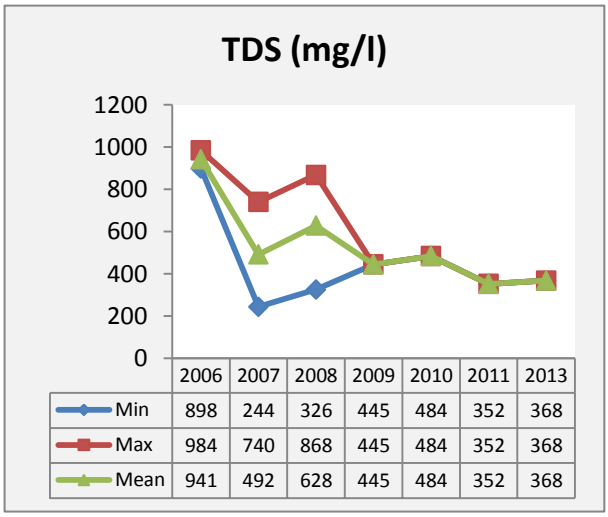


Figure 77

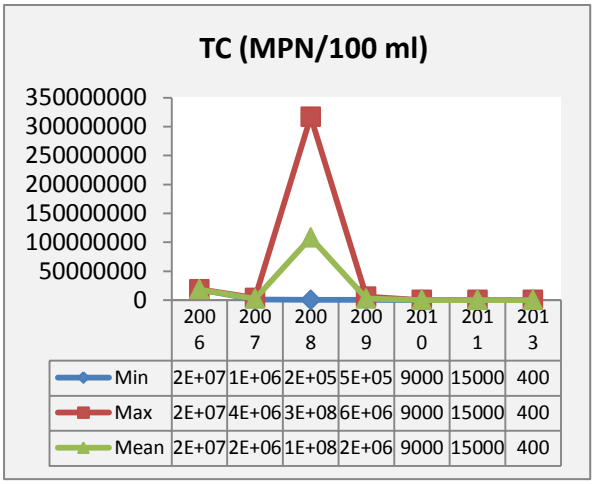


Figure 78

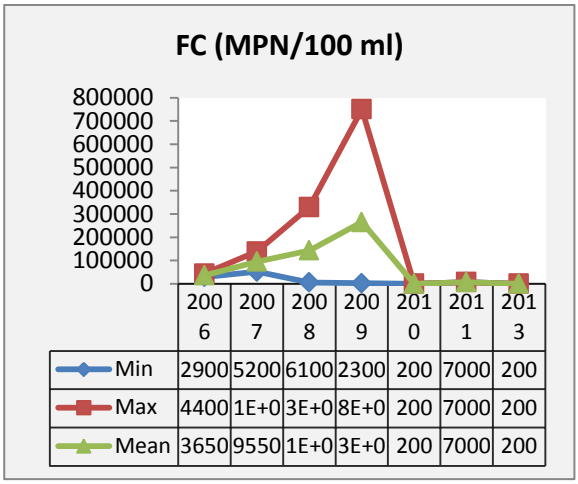


Figure 79

Close examination of figure 74 to 79 shows that:

DO concentration is not meeting to the minimum prescribed limit of 5.0mg/l. concentration of DO ranges between 0 mg/l and 4.5 mg/l during year 2007 and year 2009 respectively. BOD concentrations is not meeting to the maximum prescribed limit of 3.0 mg/l except in year 2011and ranges between 3mg/l and 95 mg/l during year 2008 and year 2011 respectively. COD concentration ranges between 11 mg/l and 299 mg/l in the same year i.e. year 2008. TDS concentration ranges between 244 mg/l and 984 mg/l during year 2007 and year 2006 respectively. TC count ranges between 400MPN/100ml and 317000000MPN/100ml during year 2013 and year 2008 respectively. FC count ranges between is 200 MPN/100ml and 750000 MPN/100ml during year 2013 and year 2008.

7.6.7 River Ghaggar at Sirdulgarh (Punjab)

The water Quality of River Ghaggar at Sirdulgarh (Punjab) is monitored for year 2006-13 having 14 numbers of observations at the interstate boundary of Haryana and Punjab.

Summary of observations:

Year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	2	3	3	1	1	1	1	14

Water Quality of River Ghaggar at Sirdulgarh (Punjab) during 2005-2013 is depicted in graphs (from figures 80-85):

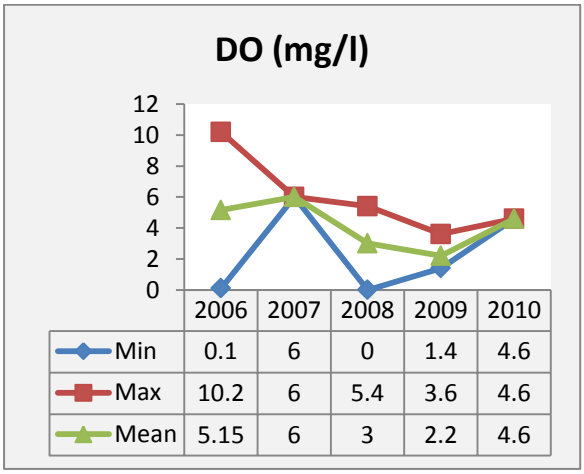


Figure 80

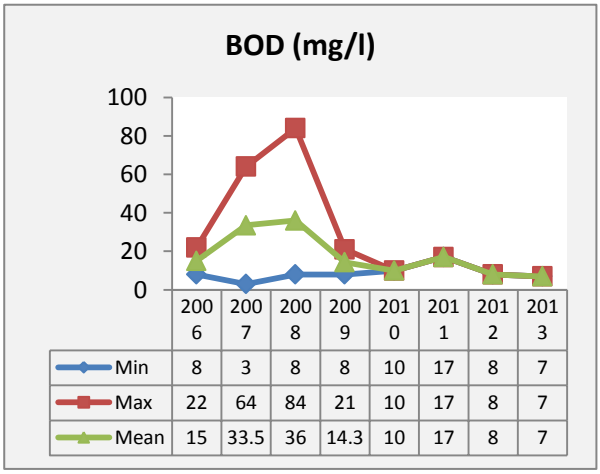


Figure 81

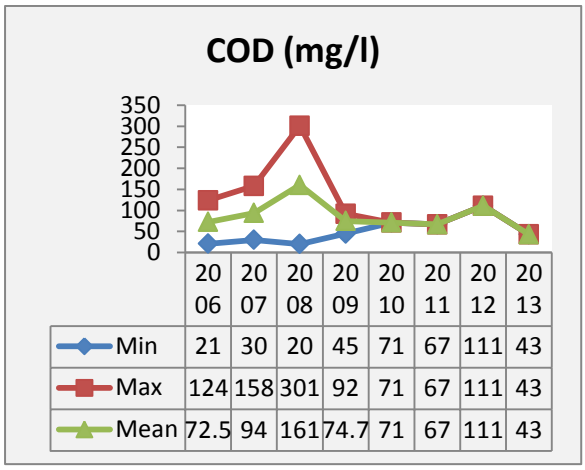


Figure 82

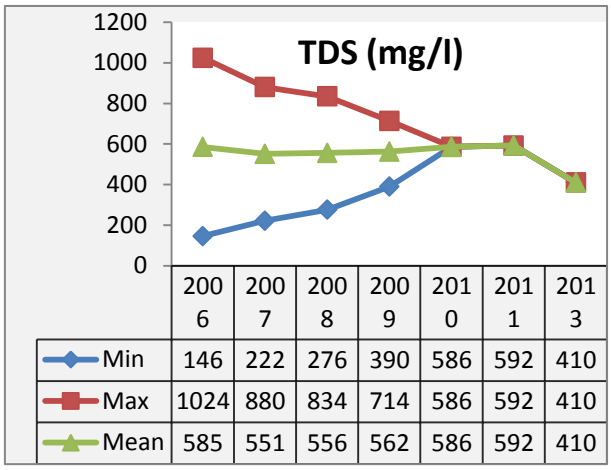


Figure 83

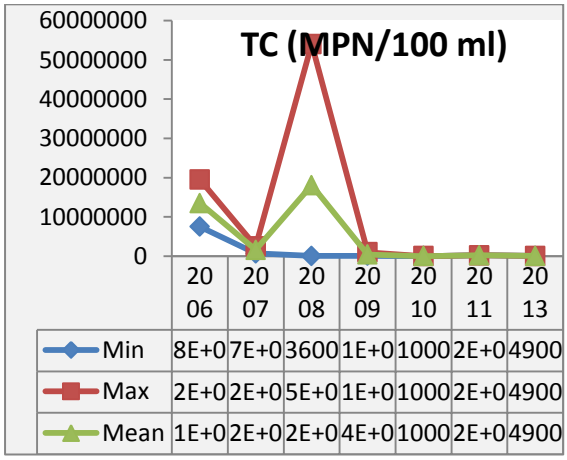


Figure 84

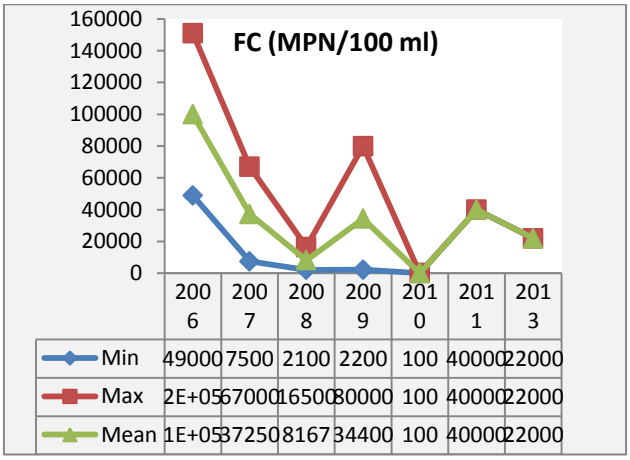


Figure 85

Close examination of figure 80 to 85 shows that:

DO concentration are not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2007. DO concentration ranges between 0 mg/l and 10.2 mg/l during year 2008 and 2006 respectively. BOD concentration is exceeding to the maximum prescribed limit and ranges between 3 mg/l and 84mg/l during year 2008 and year 2007 respectively. COD concentration ranges between 20 mg/l and 301 mg/l during same year i.e. 2008. TDS concentration ranges between 146mg/l and 1024 mg/l in the same year i.e. 2006. TC count ranges between 10000 MPN/100ml in and 19500000 MPN/100ml during 2010 and 2006 respectively. FC count ranges between 100 MPN/100ml in and 151000 MPN/100ml during 2010 and 2006 respectively.

7.6.8 River Ghaggar at Ottu Weir (Haryana)

The water Quality of River Ghaggar at Ottu Weir (Haryana) is monitored for year 2005-13 having 12 numbers of observations at the interstate boundary of Haryana and Rajasthan.

Summary of observations:

Year	2005	2006	2007	2008	2009	2011	2012	Total
Observations	1	2	2	3	2	1	1	12

Water Quality of River Ghaggar at Ottu Weir (Haryana) during 2005-2013 is depicted in graphs (from figures 86-91)below:

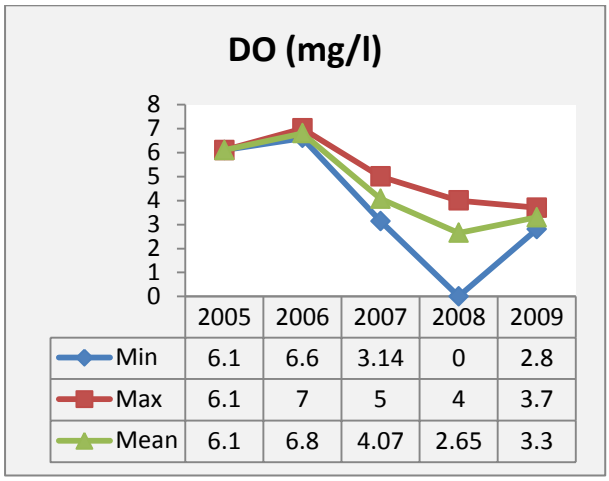


Figure 86

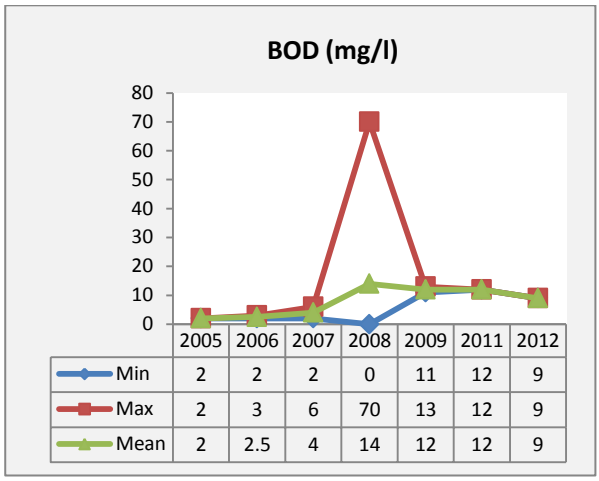


Figure 87

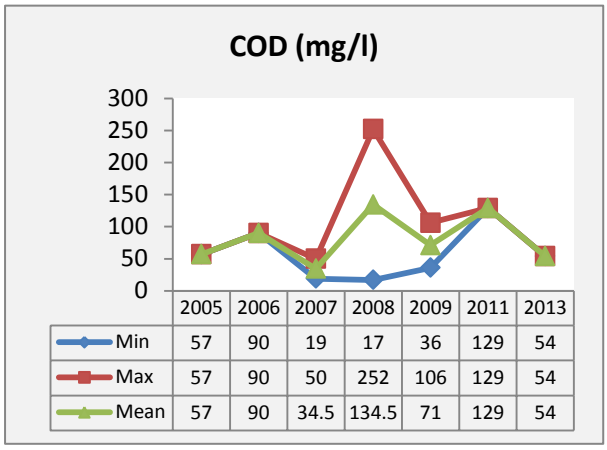


Figure 88

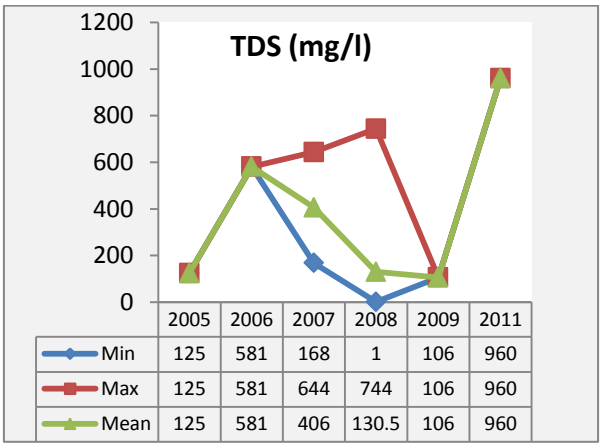


Figure 89

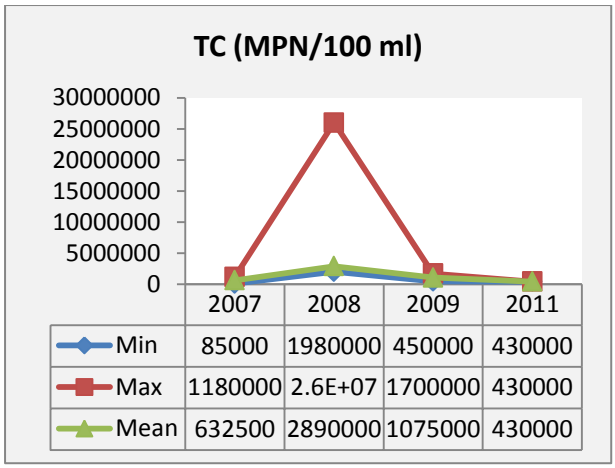


Figure 90

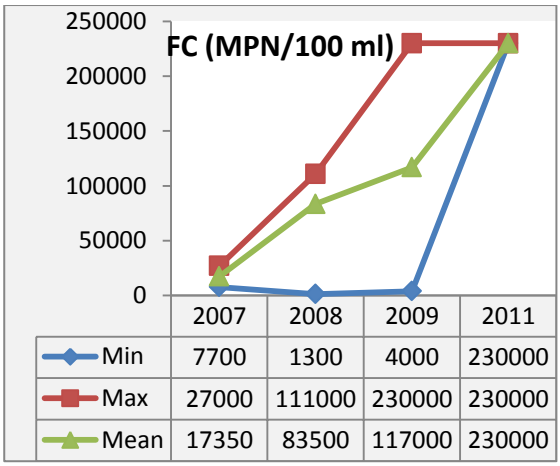


Figure 91

Close examination of figure 86 to 91 shows:

DO concentration is not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2005 and 2006. DO Concentration ranges between 0 mg/l and 7 mg/l during year 2008 and 2006 respectively. BOD concentration ranges between 0 mg/l and 70 mg/l in the same year i.e. 2008. BOD concentration ranges between 17 mg/l and 252 mg/l in the same year 2008. TDS ranges between 1 mg/l and 960 mg/l during year 2008 and 2011 respectively. TC count ranges between 85000 MPN/100ml and 26000000MPN/100ml during year 2007 and 2008 respectively. FC

count ranges between 1300MPN/100ml and 23000000MPN/100ml during year 2008 and 2009/ 2011 respectively.

7.6.9 River Ghaggar at Sirsa Hanumangarh Road (Rajasthan)

The water Quality of River Ghaggar at at Sirsa Hanumangarh Road (Rajasthan) is monitored for year 2005-13 having 7 numbers of observations at the interstate boundary of Haryana and Rajasthan. During monitoring in summer season, the river is found often dry.

Summary of observations:

Year	2005	2007	2008	2011	2012	2013	Total
Observations	1	2	1	1	1	1	7

Water Quality of River Ghaggar at Sirsa Hanumangarh Road (Rajasthan) during 2005-2013 is depicted in graphs (from figures 92-97):

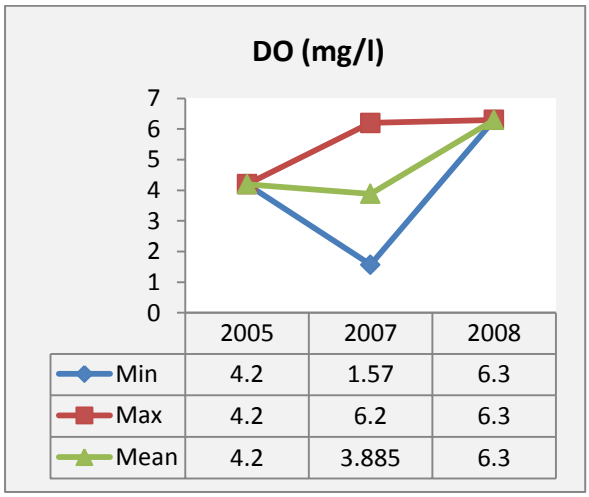


Figure 92

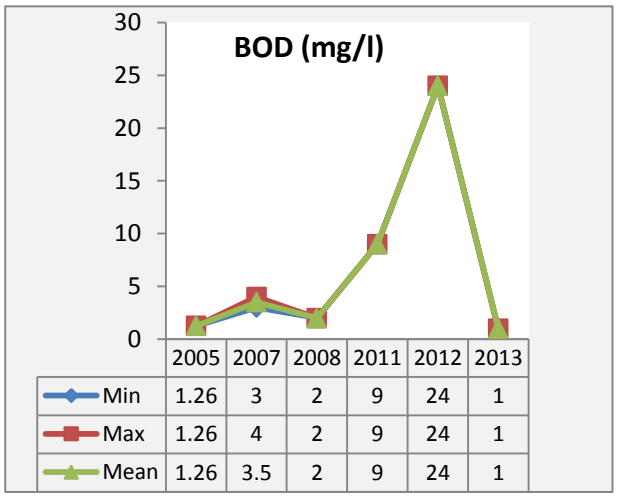


Figure 93

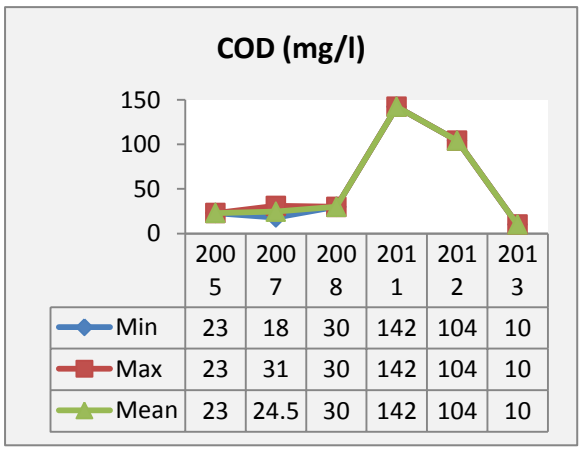


Figure 94

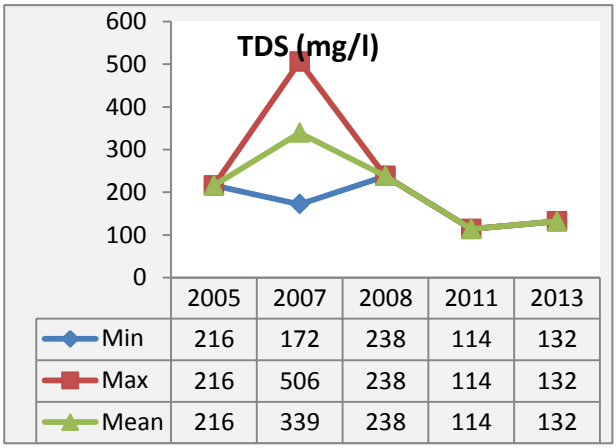


Figure 95

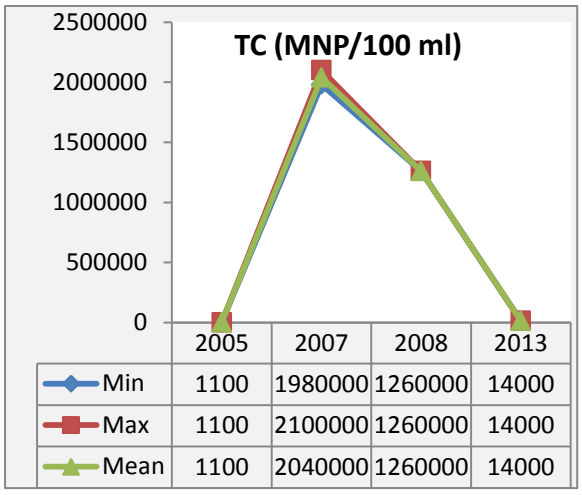


Figure 96

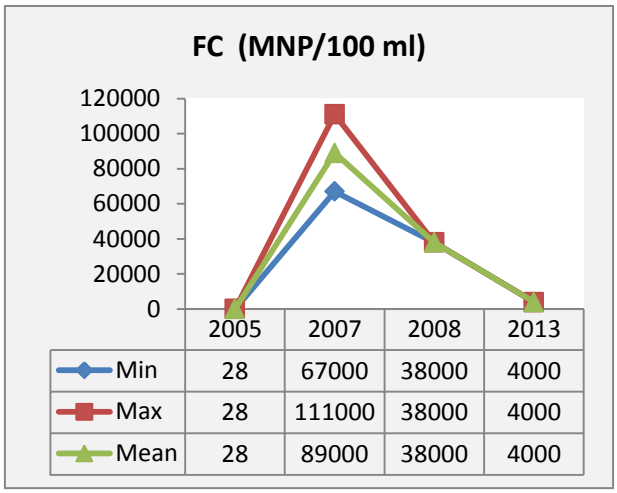


Figure 97

Close examination of figure 92 to 97 shows that:

DO concentration are not meeting to the minimum prescribed limit of 5.0 mg/l except in year 2008. DO concentration ranges between 1.57 mg/l and 6.3 mg/l in the same year i.e. 2008. BOD concentration ranges between 1 mg/l and 24 mg/l during year 2013 and 2012. COD concentration ranges between 10 mg/l and 142 mg/l during year 2013 and 2011 respectively. TDS ranges between 114 mg/l and 506 mg/l during year 2011 and 2007 respectively. TC count ranges between 1100 MPN/100ml and 2100000MPN/100 ml in year 2005 and 2007. FC count ranges between 28 MPN/100ml and 111000 MPN/100ml during year 2005 and 2007 respectively.

7.7 Water Quality of River Ganga

River Bhagirathi and river Alaknanda originate in Garhwal Himalayas and join at Devprayag to form River Ganga. River Ganga traverses through Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal and thereafter enters Bangladesh. The important tributaries of Ganga are the Yamuna, the Kali, the Ramganga, the Ghaghra, the Gandak, the Kosi, and the Sone.

7.7.1 River Ganga at Sultanpur (Uttrakhand)

The water Quality of River Ganga at Sultanpur (Uttrakhand) is monitored for year 2005-13 having 22 Numbers of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	3	4	2	1	3	4	22

Water Quality of River Ganga at Sultanpur (Uttrakhand) during 2005-2013 is depicted in graphs (from figures 98-103):

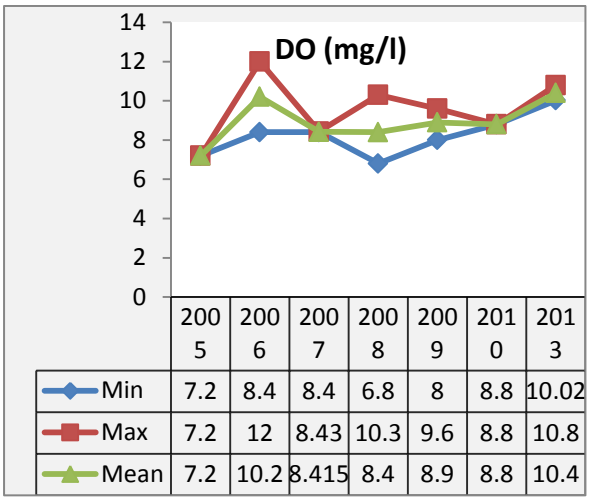


Figure 98

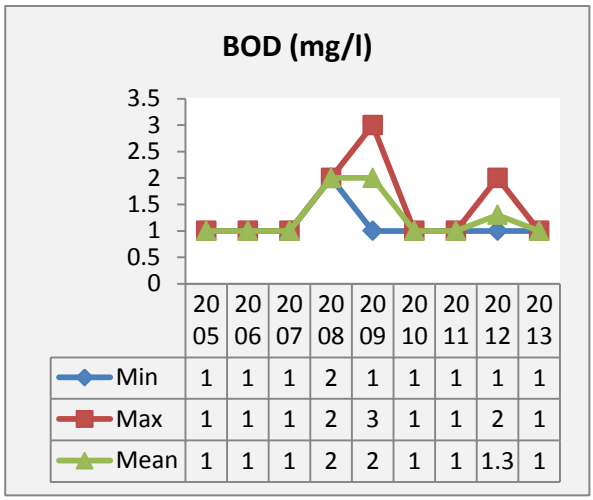


Figure 99

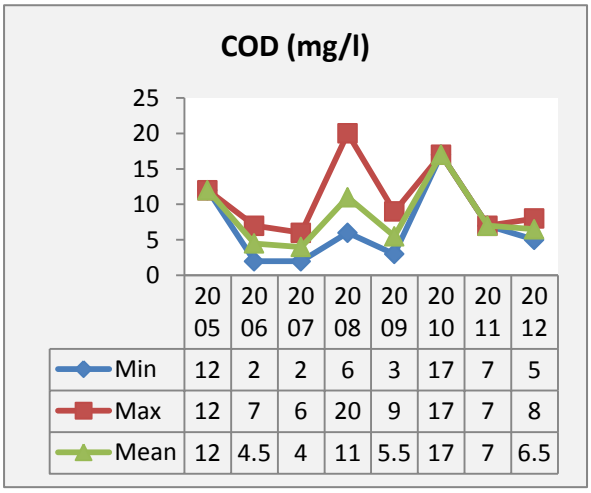


Figure 100

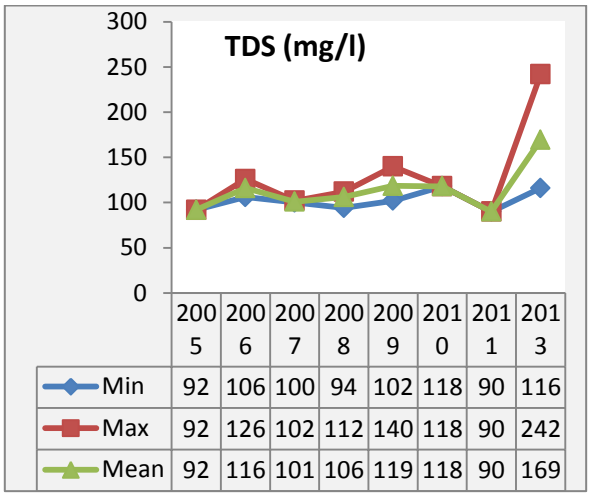


Figure 101

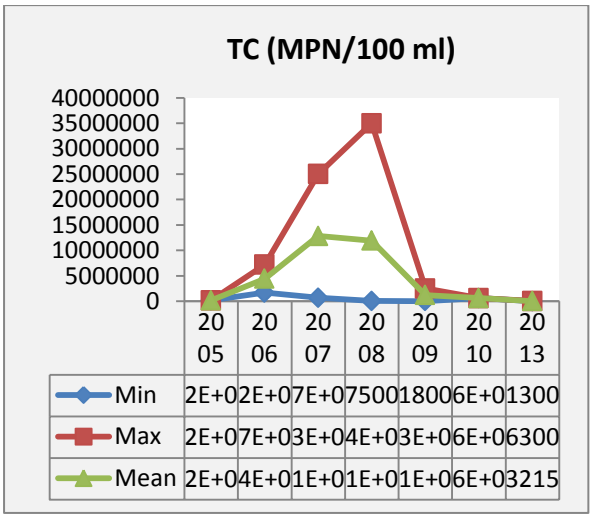


Figure 102

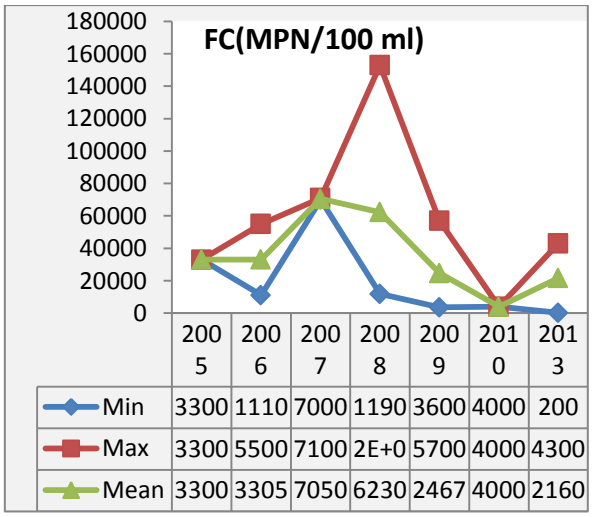


Figure 103

Close examination of figure 98 to 103 shows that:

DO concentration ranges between 6.8 mg/l and 12.0 mg/l during year 2008 and 2006 respectively. BOD concentration ranges between 1 mg/l and 3.0 mg/l during year 2005-13. COD concentration ranges between 2 mg/l and 20 mg/l during year 2006/2007 and 2008 respectively. TDS ranges between 90 mg/l and 242 mg/l during year 2011 and 2013. TC count ranges between 1300

MPN/100ml and 35000000 MPN/100ml during year 2013 and 2008 respectively. FC count ranges between 200MPN/100ml and 153000 MPN/100ml during year 2013 and 2008 respectively.

7.7.2 River Ganga at Bijnour (U.P.)

The water Quality of River Ganga at at Bijnour (U.P.) is monitored for year 2005-13 having 16 numbers of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	1	2	1	4	1	1	3	2	16

Water Quality of River Ganga at Bijnour (U.P.) during 2005-2013 is depicted in graphs (from figures 104-109):

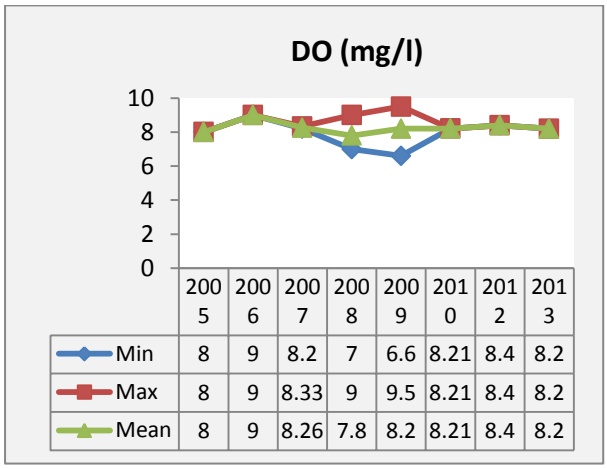


Figure 104

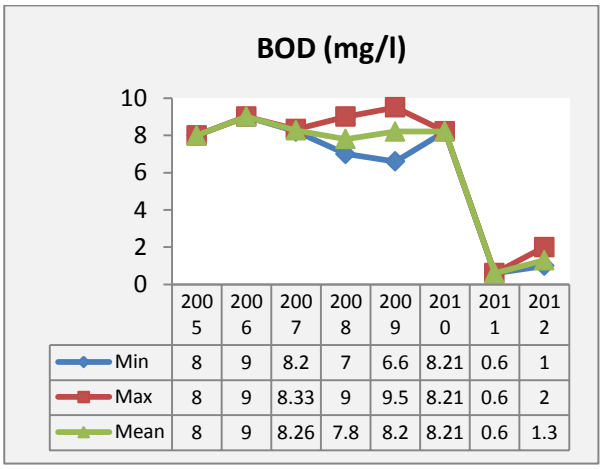


Figure 105

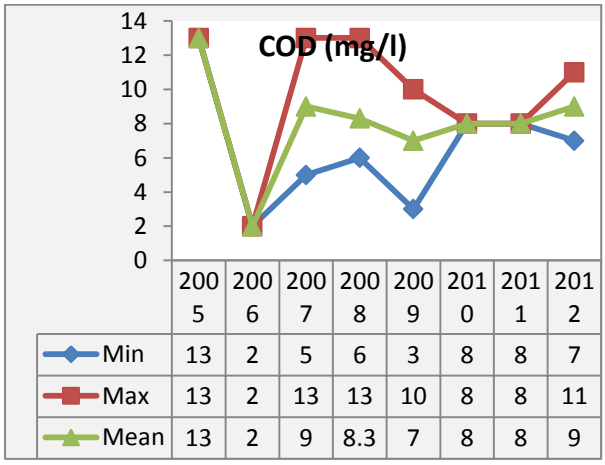


Figure 106

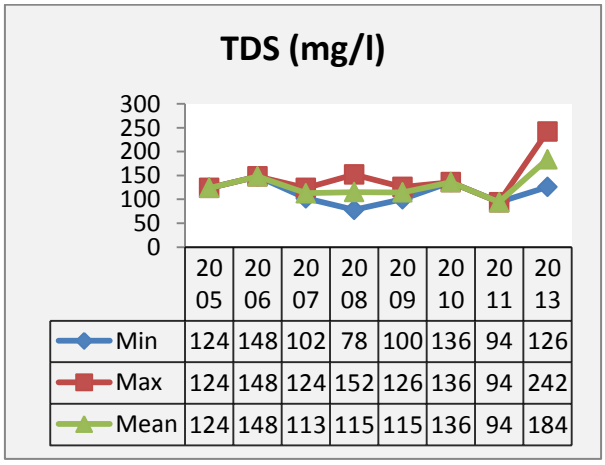


Figure 107

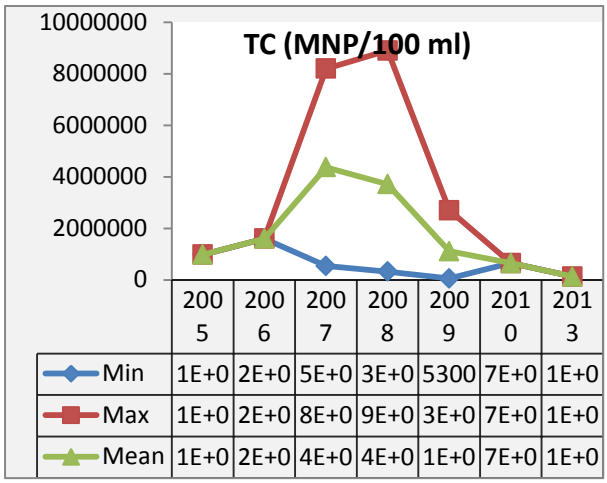


Figure 108

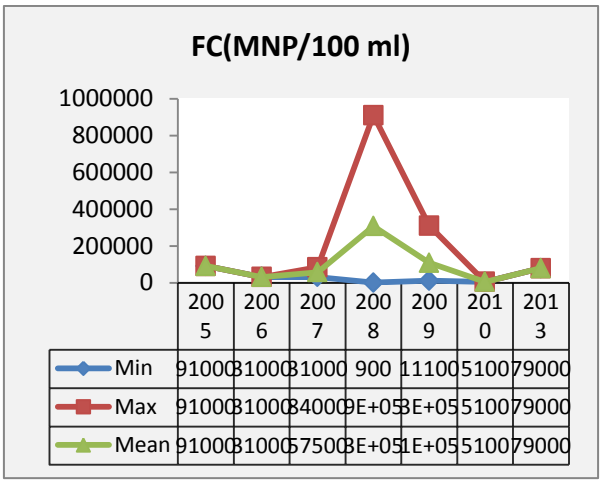


Figure 109

Close examination of figure 104 to 109 shows that:

DO concentration ranges between 6.6 mg/l and 9.5 mg/l in year 2009 only. BOD concentration ranges between 0.6 mg/l and 9.5 mg/l during year 2011 and 2009 respectively. COD concentration ranges between 2 mg/l and 13 mg/l during year 2006 and 2005,2008 respectively. TDS ranges between 78 mg/l and 242 mg/l during 2008 and 2013 respectively. TC count ranges between 53000 MPN/100ml and 8900000 MPN/100ml during year 2009 and 2008 respectively. FC count ranges between 900 MPN/100ml and 91000000 MPN/100ml during year 2008 and 2010 respectively.

7.8 River Dhela at Adampur Village, Bhojpur

The water Quality of River Dhela at Adampur Village, Bhojpur is monitored for year 2005-13 having 13 Numbers of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2008	2009	2010	2011	2012	2013	Total
Observations	2	3	1	2	3	2	13

Water Quality of River Dhela at Adampur Village, Bhojpur during 2005-2013 is depicted in graphs (from figures 110-114):

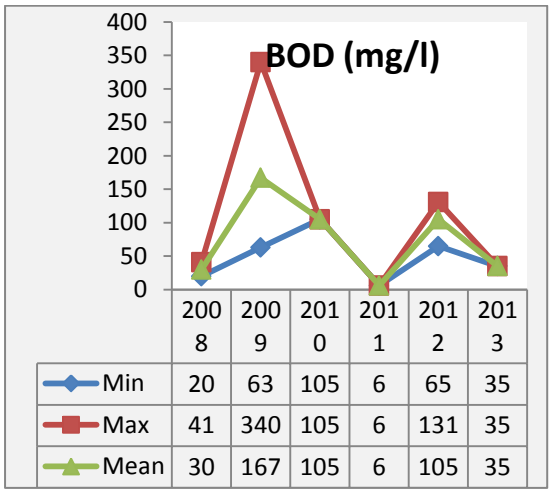


Figure 110

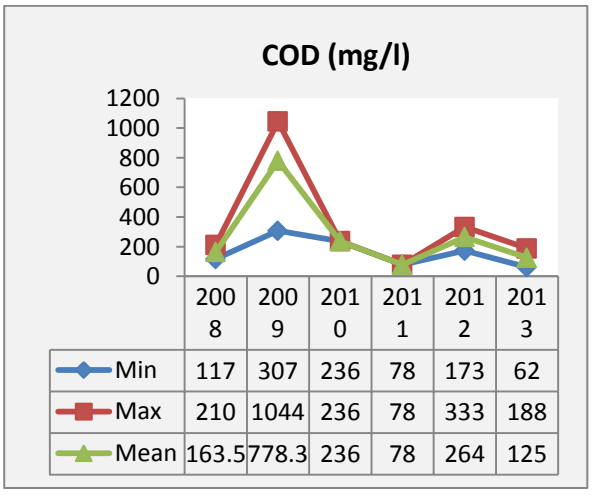


Figure 111

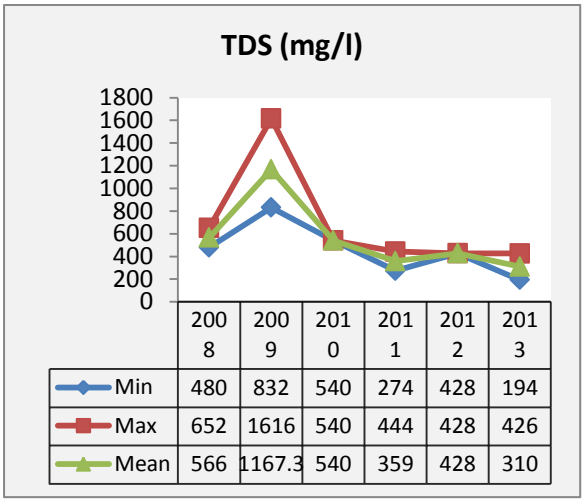


Figure 112

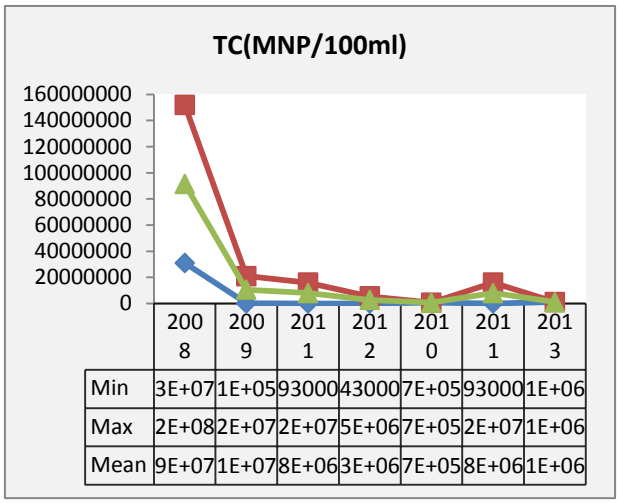


Figure 113

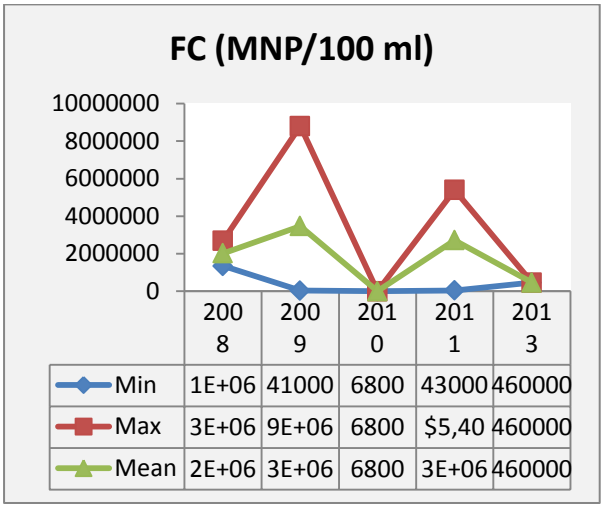


Figure 114

Close examination of figure 110 to 114 shows that:

BOD concentration ranges between 6.0 mg/l and 340 mg/l during year 2011 and 2009 respectively. COD concentration ranges between 62 mg/l and 1044 mg/l during year 2013 and 2009 respectively. TDS concentration ranges between 194 mg/l and 1616 during year 2013 and 2009 respectively. TC count ranges between 43000 MPN/100ml and 152000000 MPN/100 ml during year 2010 and 2008 respectively. FC count ranges between 6800 MPN/100ml and 8800000MPN/100ml during year 2011 and 2009 respectively.

7.9 River Bahela at Badli Village, Tehseel - Tanda (U.P.)

The water Quality of River Bahela at Badli Village, Tehseel - Tanda (U.P.) is monitored for year 2005-13 having 12 Numbers of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	0	0	0	2	3	1	2	3	1	12

Water Quality of River Bahela at Badli Village, Tehseel - Tanda (U.P.) during 2005-2013 is depicted in graphs (from figures 115-120):

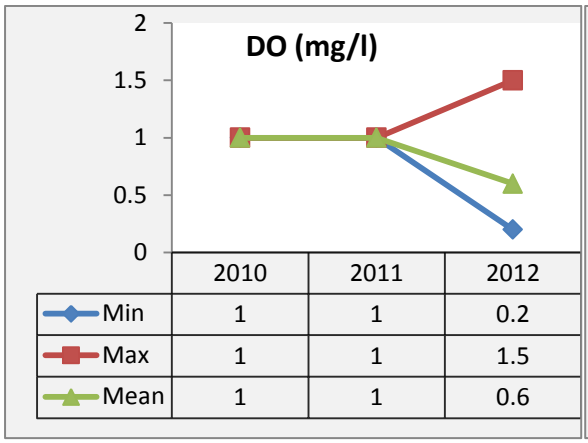


Figure 115

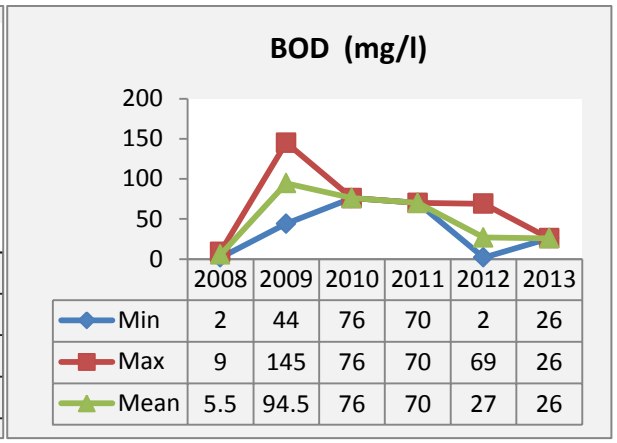


Figure 116

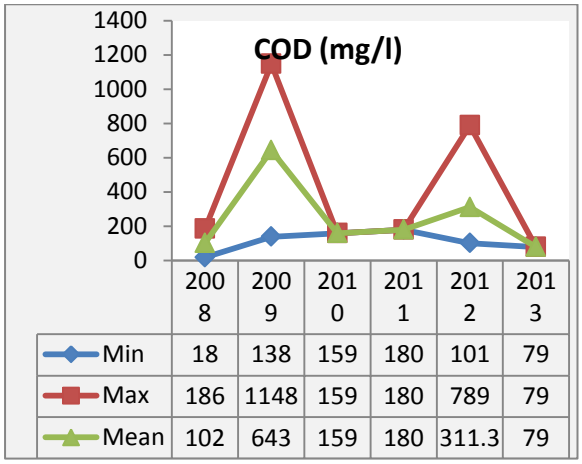


Figure 117

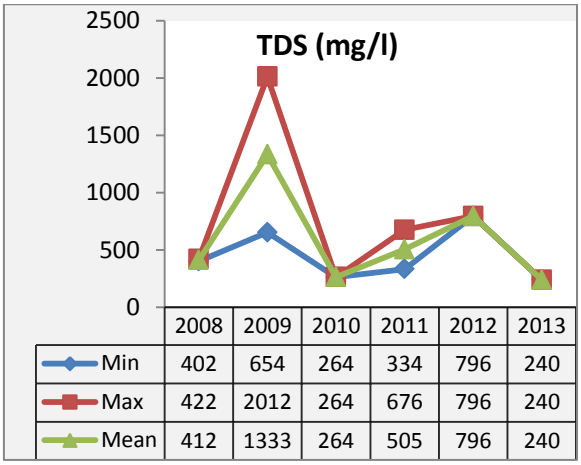


Figure 118

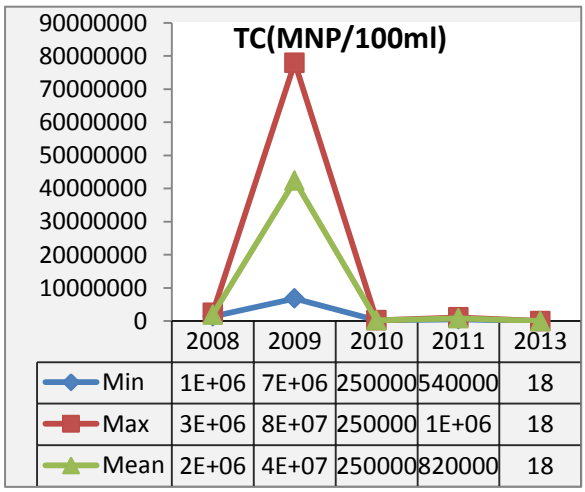


Figure 119

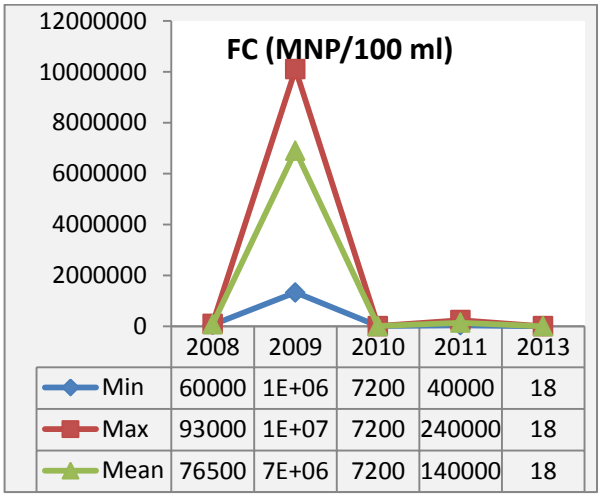


Figure 120

Close examination of figure 115 to 120 shows that:

DO concentration ranges between 0.2 mg/l and 1.0 mg/l in the same year 2012. BOD concentration ranges between 2 mg/l and 145 mg/l during year 2008 and 2009 respectively. COD concentration ranges between 18 mg/l and 1148 mg/l during year 2008 and 2009 respectively. TDS ranges between 264 mg/l and 2012 mg/l during year 2010 and 2009 respectively. TC ranges between 18 MPN/100ml and 78000000MPN/100ml during year 2013 and 2009 respectively. FC ranges between 18MPN/100ml and 10100000 MPN/100ml during year 2013 and 2009.

7.10 River Kitchha at Pull Bhatta, Bareili Road, (Uttrakhand)

The water Quality of River Kitchha at Pull Bhatta, Bareili Road, (Uttrakhand) is monitored for year 2008-13 having 14 Numbers of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2008	2009	2010	2011	2012	2013	Total
Observations	2	3	1	2	4	2	14

Water Quality of River Kitchha at Pull Bhatta, Bareili Road, (Uttrakhand) during 2005-2013 is depicted in graphs (from figures 121-126):

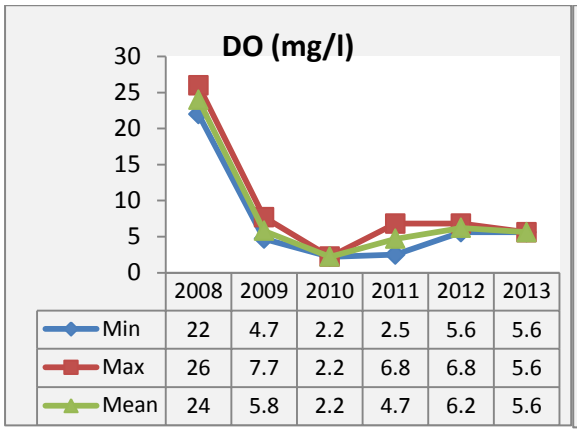


Figure 121

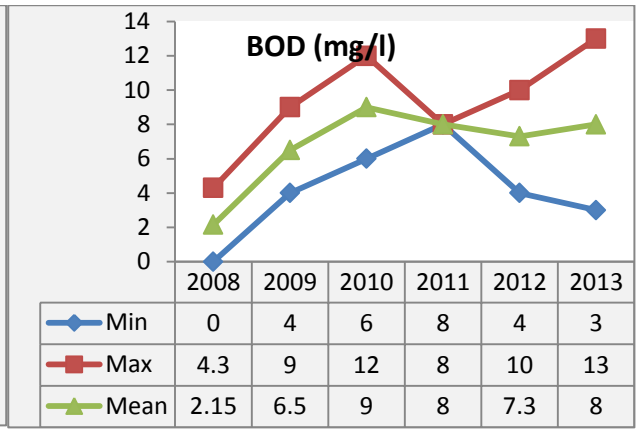


Figure 122

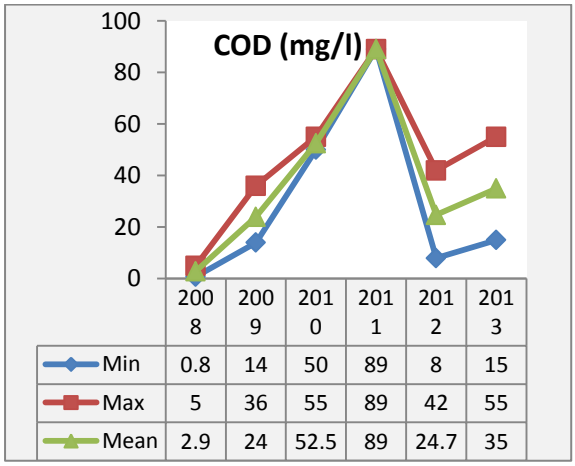


Figure 123

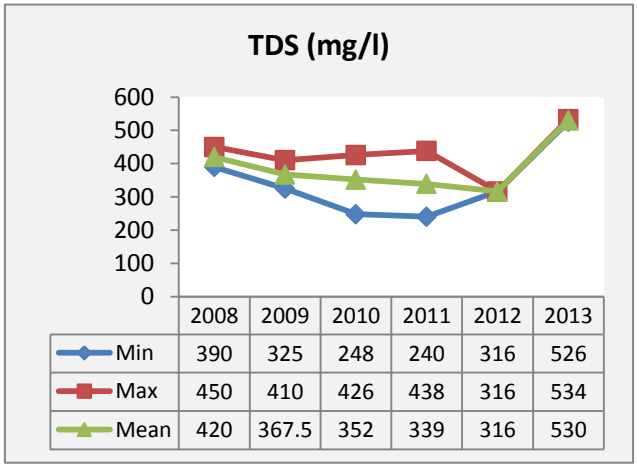


Figure 124

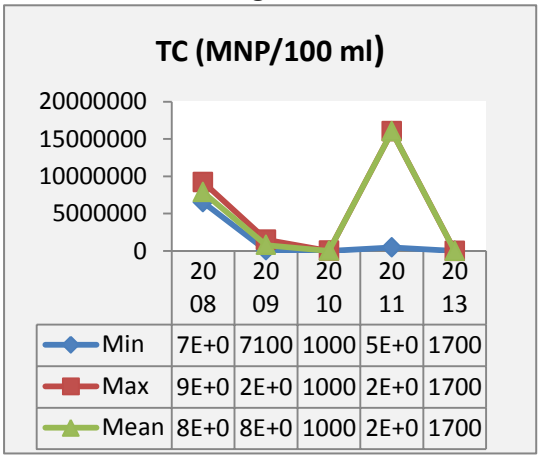


Figure 125

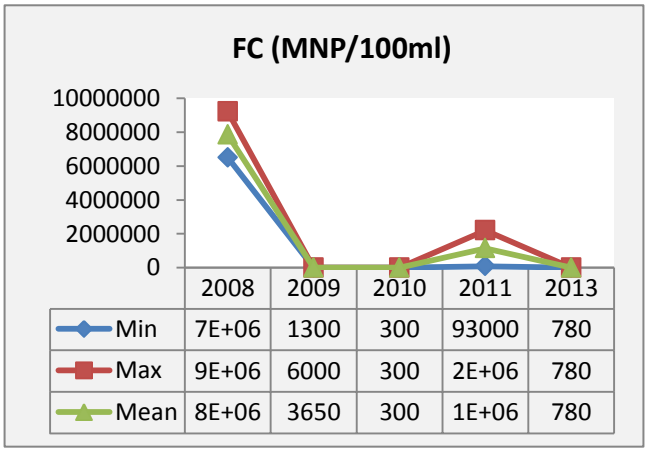


Figure 126

Close examination of figure 121 to 126 shows that:

DO concentration ranges between 2.2 mg/l and 26 mg/l during year 2010 and 2008 respectively. BOD concentration ranges between 0 mg/l and 13 mg/l year 2008 and 2013 respectively. COD concentration ranges between 0.8 mg/l and 89 mg/l during year 2008 and 2011 respectively. TDS ranges between 240 mg/l and 534 mg/l during 2011 and 2013 respectively. TC count ranges between 1700 MPN/100ml and 16000000 MPN/100ml during year 2013 and 2011 respectively. FC count ranges between 300 MPN/100ml and 9200000 MPN/100ml during year 2010 and 2008 respectively .

7.11 River Kosi at Dadiyal Bridge, (Uttrakhand)

The water Quality of River Kosi at Dadiyal Bridge, (Uttrakhand) is monitored for year 2008-13 having 13 Number of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations :

Year	2008	2009	2010	2011	2012	2013	Total
Observations	2	3	1	2	3	2	13

Water Quality of River Kosi at Dadiyal Bridge, (Uttrakhand) during 2005-2013 is depicted in graphs (from figures 127-132):

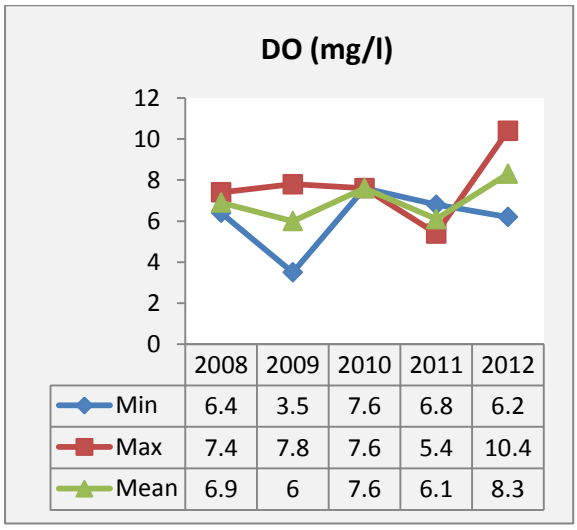


Figure 127

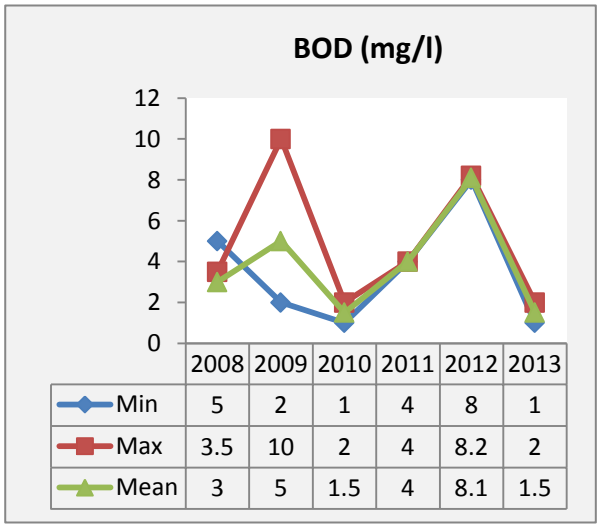
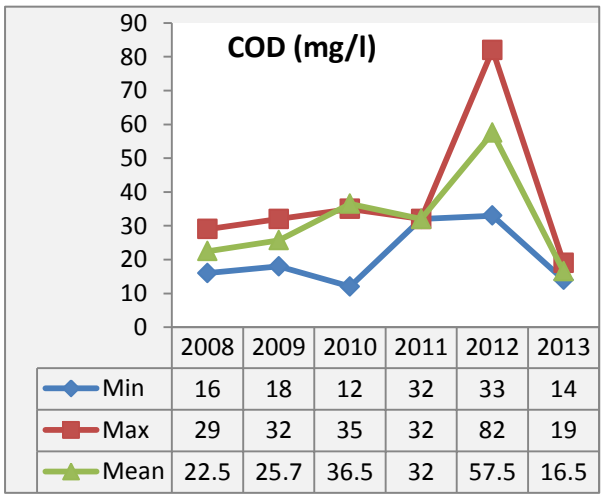


Figure 128



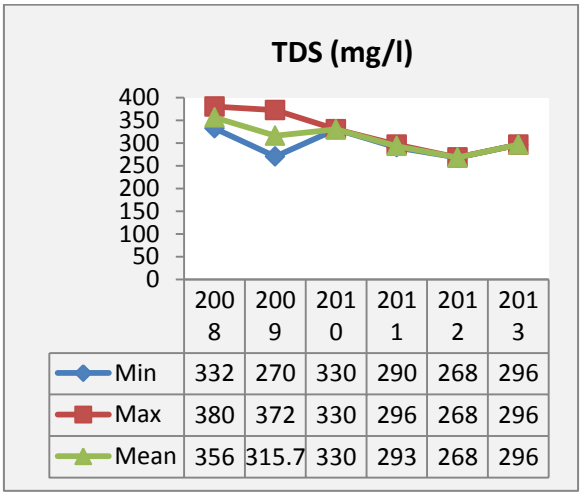


Figure 129

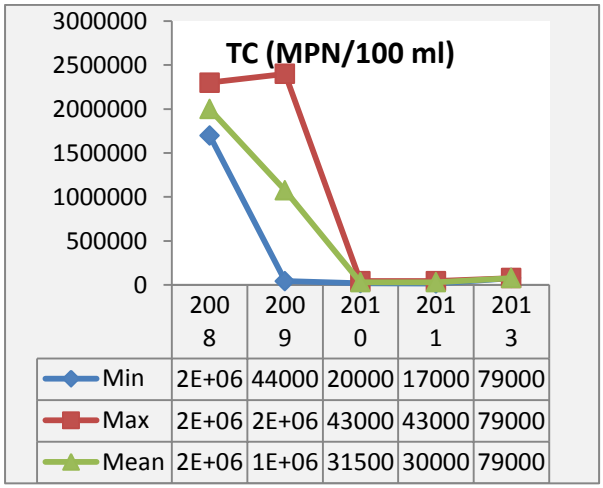


Figure 130

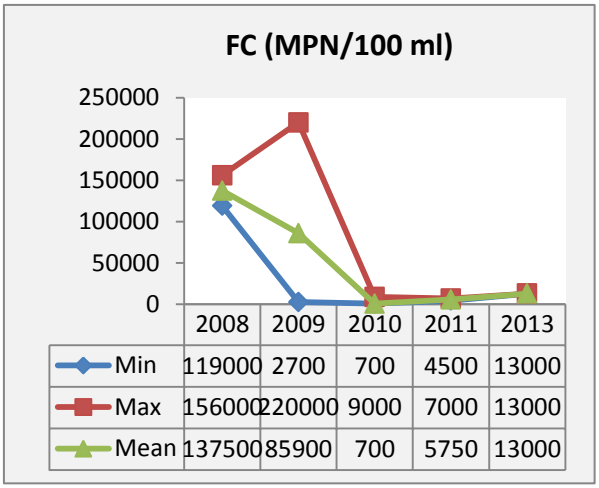


Figure 131

Figure 132

Close examination of figure 127 to 132 shows that:

DO concentration ranges between 3.5 mg/l and 10.4 mg/l during year 2010 and 2012 respectively. BOD concentration ranges between 1 mg/l and 10 mg/l during year 2010/2013 and 2009. COD concentration ranges between 12 mg/l and 82 mg/l during year 2010 and 2012. TDS concentration ranges between observed is 268 mg/l in year 2012 whereas maximum concentration of TDS observed is 380 mg/l in year 2008. Minimum count of TC observed is 17000 MPN/100ml in year 2011. Maximum count of TC observed is 2400000 MPN/100ml in year 200 while minimum count of FC observed is 700 MPN/100ml in year 2010 whereas maximum count of FC observed is 220000 MPN/100ml in year 2009.

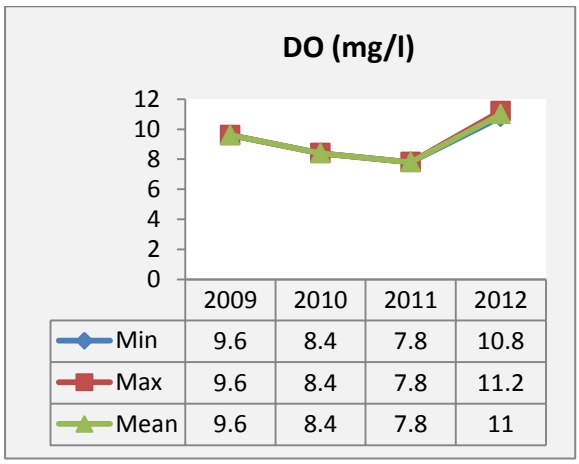
7.12 River Pilakhar at Rampur , Bhot (Uttar Pradesh)

The water Quality of river Pilakhar at Rampur , Bhot (Uttar Pradesh) is monitored for year 2009-13 having 07 Number of observations at the interstate boundary of U.P. and Uttrakhand.

Summary of observations:

Year	2009	2010	2011	2012	2013	Total
Observations	1	1	1	3	1	7

Water Quality of River Pilakhar at Rampur, Bhot (Uttar Pradesh) during 2005-2013 is depicted in graphs (from figures 133-138):



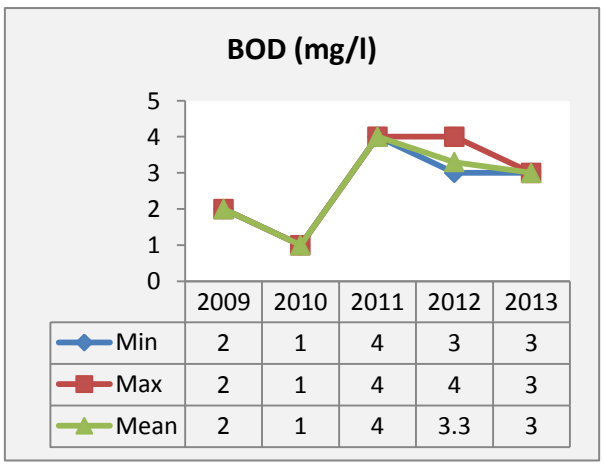


Figure 133

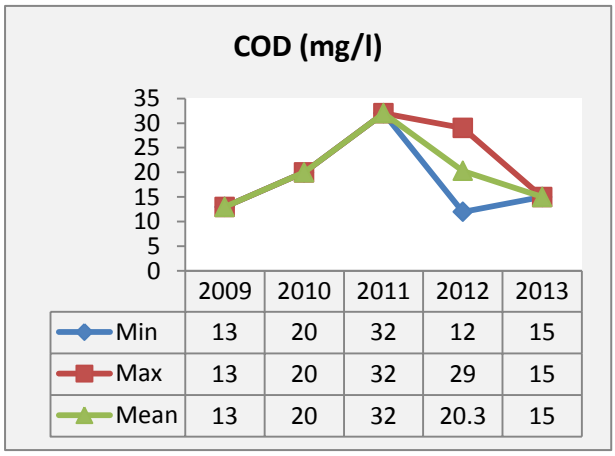


Figure 134

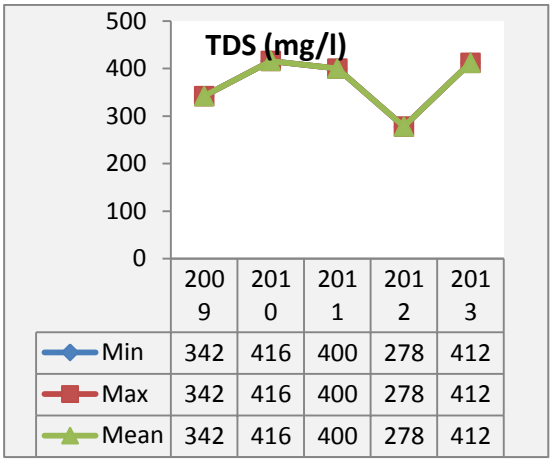
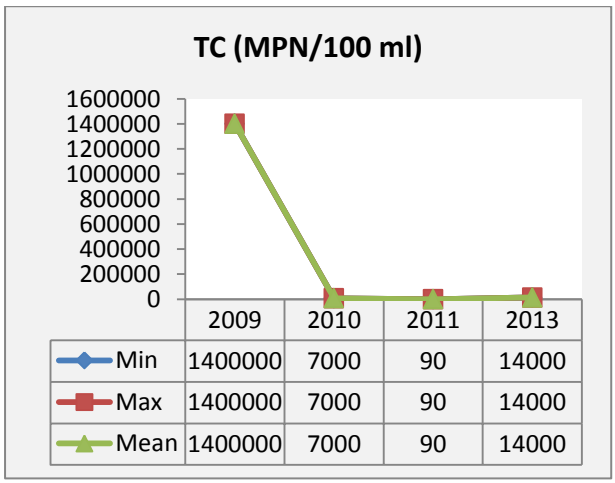


Figure 135

Figure 136



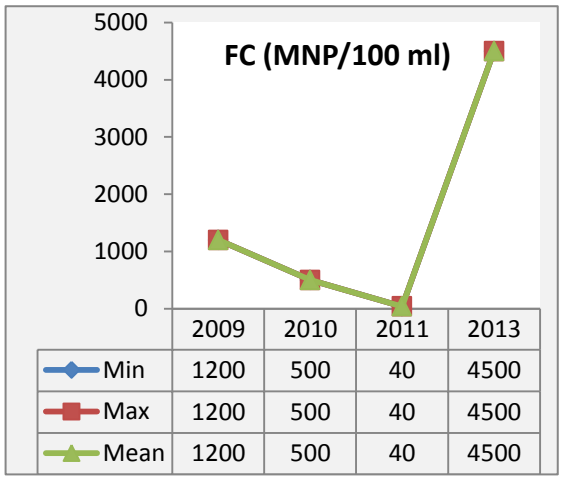


Figure 137

Figure 138

Close examination of figures 133 to 138 shows that:

DO concentration is not meeting to the minimum prescribed limit of 5.0 mg/l. Minimum DO concentration ranges between 7.8 mg/l and 11.2 mg/l during year 2011 and year 2012 respectively. BOD concentration ranges between 1 mg/l and 4 mg/l during year 2010 and 2011 /2012 respectively. COD concentration ranges 12 mg/l and 32 mg/l during year 2012 and year 2011. TDS concentration ranges between 278 mg/l and 416 mg/l during year 2012 and year 2010 respectively. TC count ranges between 90 MPN/100ml and 1400000 MPN/100 ml during year 2011 and 2009. FC count ranges between 40MPN/100ml and 4500 MPN/100ml during year 2011 and 2013 respectively.

7.13 Water Quality of River Ravi

The water Quality of river Ravi is monitored at (i) Madhopur U/S, (Punjab) and (ii) at Lakhanpur, D/s Madhopur (Jammu and Kashmir) at the interstate boundaries of Punjab and Jammu & Kashmir.

7.13.1 River Ravi at Madhopur U/S, (Punjab)

The water Quality of river Ravi at Madhopur U/S, (Punjab) is monitored for year 2009-13 having 07 Number of observations at the interstate boundary of *Punjab* and *Jammu & Kashmir*.

Summary of observations:

Year	2009	2010	2011	2012	2013	Total
Observations	1	1	2	2	1	7

Water Quality of River Ravi at Madhopur U/S, (Punjab) during 2009-2013 is depicted in graphs (from figures 139-142):

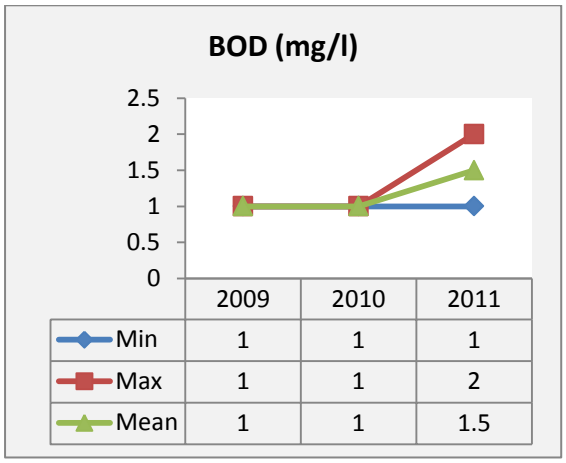


Figure 139

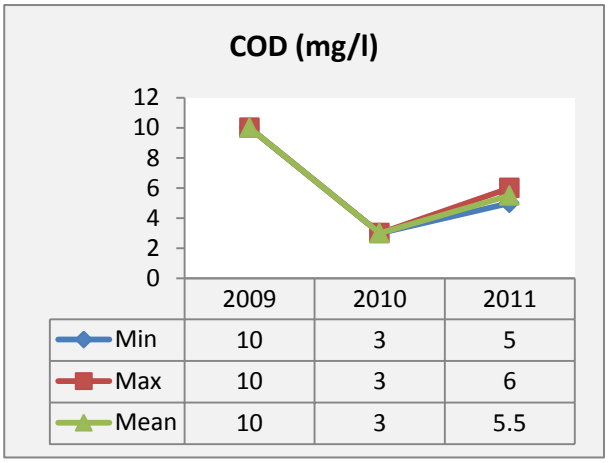


Figure 140

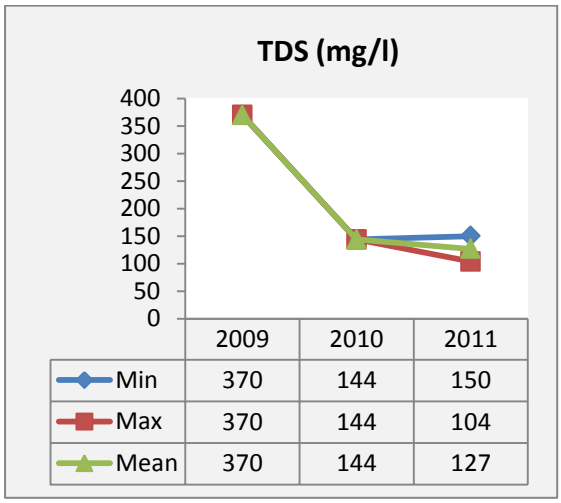


Figure 141

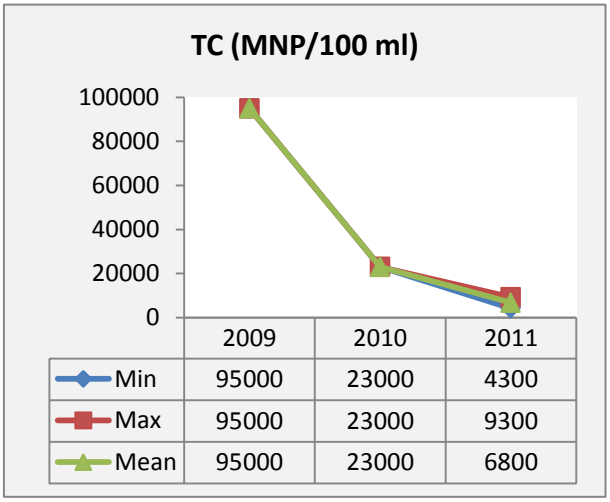


Figure 142

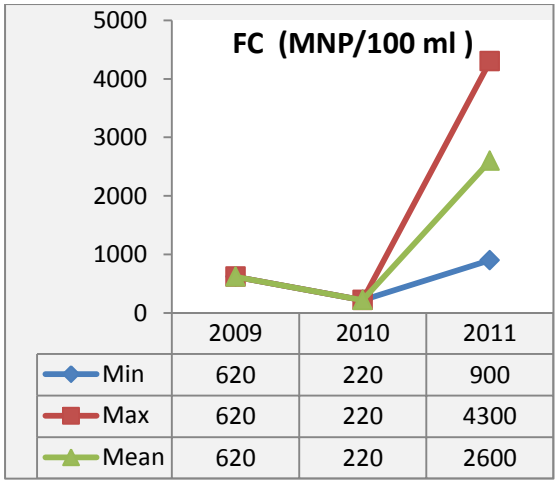


Figure 143

Close examination of figure 139 to 143 shows that:

BOD concentration is well within the maximum prescribed limit of 3.0 mg/l and it was 1 mg/l in each observation made during 2009-10. Minimum concentration of COD observed is 3 mg/l in year 2010 whereas maximum concentration of COD observed is 10 mg/l in year 2009. Minimum concentration of TDS observed is 144mg/l in year 2010 and maximum concentration of TDS observed is 370 mg/l in year 2009. Minimum count of TC observed is 4300MPN/100ml in year 2011. Maximum count of TC observed is 95000 MPN/100ml in year 2009. Minimum count of FC observed is 220MPN/100ml in year 2010. Maximum count of FC observed is 4300 MPN/100ml in year 2011.

7.13.2 River Ravi at Lakhanpur, D/s Madhopur (Jammu and Kashmir)

The water Quality of river Ravi at Lakhanpur, D/s Madhopur (Jammu and Kashmir) is monitored for year 2010-12 having 04 Number of observations at the interstate boundary of *Punjab* and *Jammu & Kashmir*.

Summary of observations:

Year	2010	2011	2012	Total
Observations	1	2	1	4

Water Quality of River Ravi at Lakhanpur, D/s Madhopur (Jammu) during 2010-2012 is depicted in graphs (from figures 144-145):

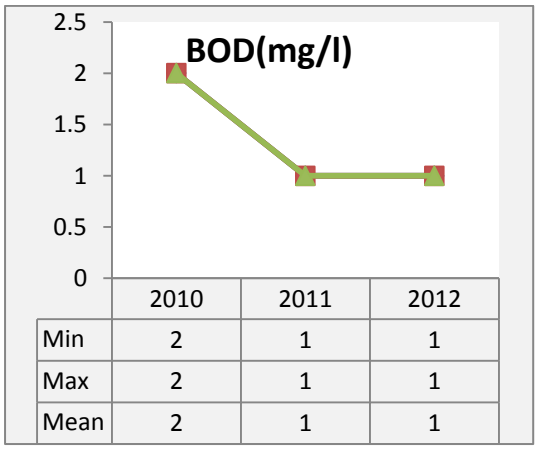


Figure 144

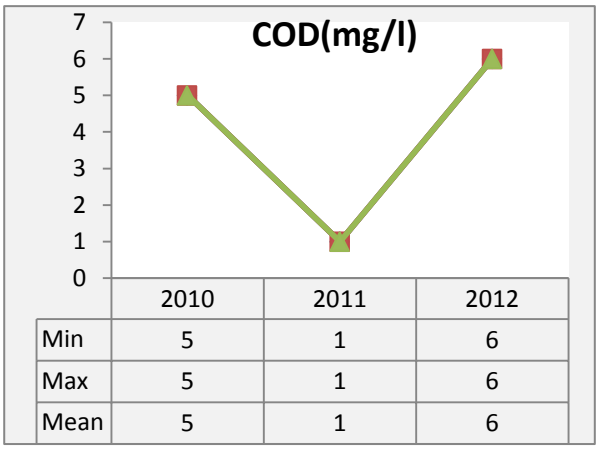


Figure 145

Close examination of figures 144-145 shows that :

BOD concentration is well within the maximum prescribed limit of 3.0 mg/l. Minimum COD concentration observed was 1 mg/l in the year 2011. Maximum COD concentration observed was 6 mg/l in the year 2012.

7.14 Water Quality of River Yamuna

7.14.1 River Yamuna at Dak Pathar (Uttarakhnad)

Water Quality of River Yamuna at Dak Pathar (Uttrakhand) is monitored for 2005-13 having 16 Numbers of observations at the interstate boundaries of Uttrakhand and Himachal Pradesh.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2012	2013	Total
Observations	1	2	4	2	4	4	2	3	22

Water Quality of River Yamuna at Dak Pathar (Uttrakhand) during 2005-2013 is depicted in graphs (from figures 146-151):

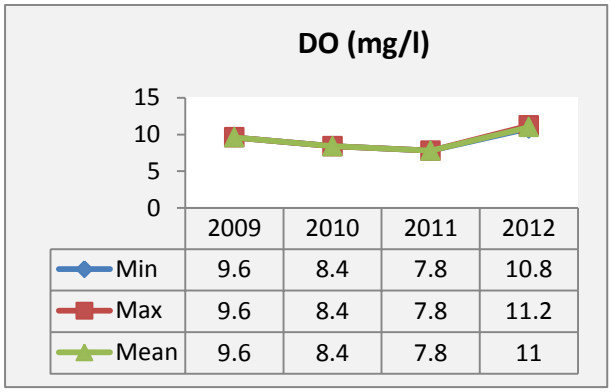


Figure 146

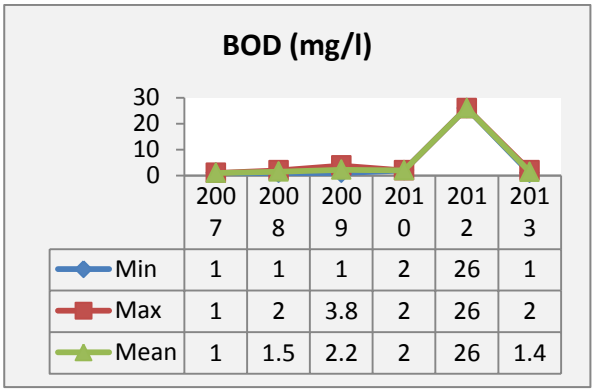


Figure 147

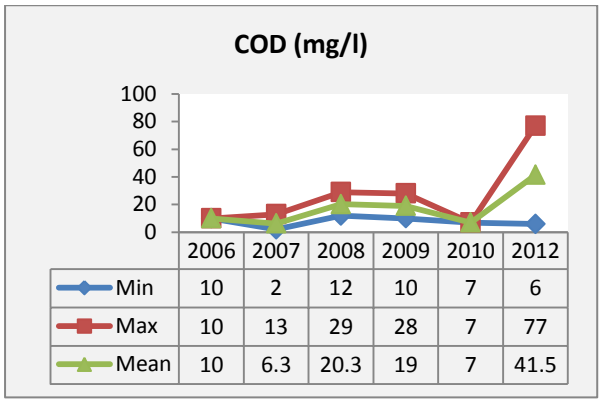


Figure 148

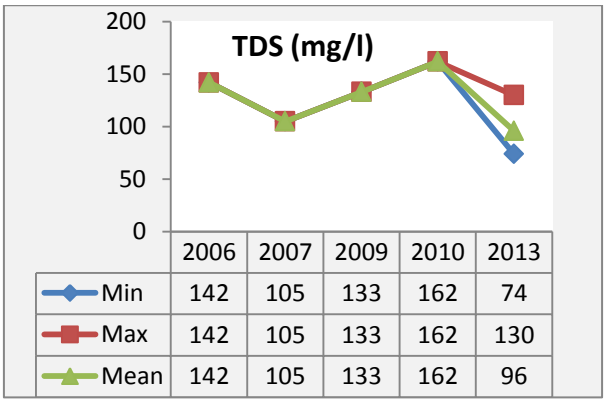


Figure 149

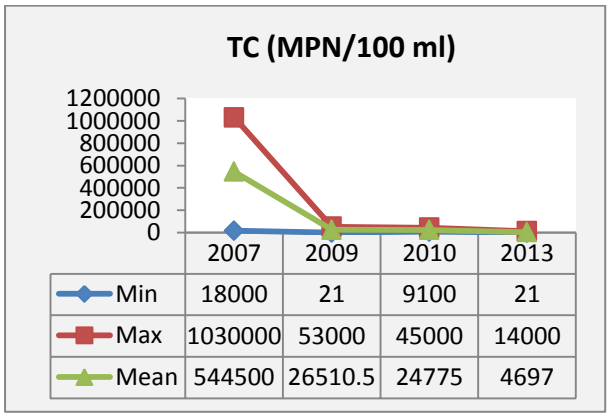


Figure 150

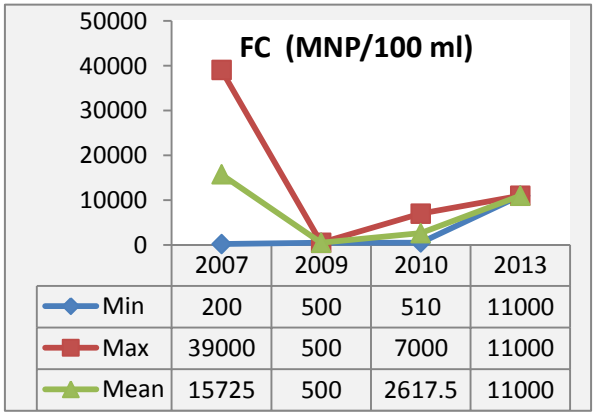


Figure 151

Close examination of figures 146 to 151 shows that:

DO concentration ranges between 6.7 mg/l and 10.2 mg/l during year 2009 and 2007 respectively. BOD concentration ranges between 1 mg/l and 26mg/l during year 2007 and 2011 respectively. COD concentrations ranges between 2 mg/l and 77 mg/l during year 2007 and 2012 respectively. TDS concentration ranges between 74 mg/l and 162 mg/l during year 2013 and 2010 respectively. TC count ranges 21 MPN/100 and 1030000 MPN/100 during year 2009 and 2007 respectively. FC count ranges between 200 MPN/100 ml and 39000 MPN/100 ml during the year 2007.

7.14.2 River Yamuna at Pontasahib (H. P.)

The water Quality of river Ravi Yamuna at Pontasahib (H. P.) is monitored for year 2005-13 having 28 Number of observations at the interstate boundary of *Punjab* and *Jammu & Kashmir*.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	4	4	4	4	4	4	1	28

Water Quality of River Yamuna at Pontasahib (H. P.) during 2005-2013 is depicted in graphs (from figures 152-157):

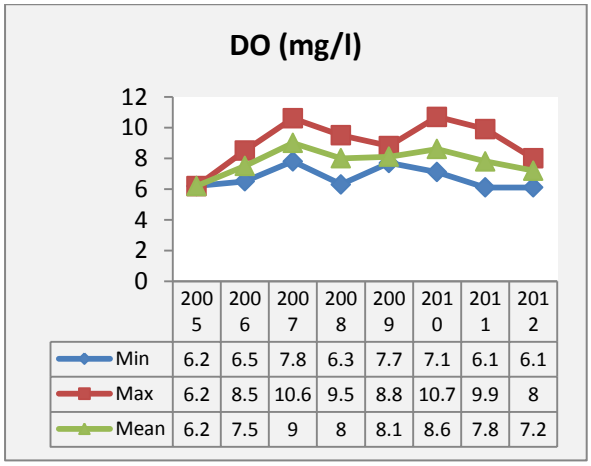


Figure 152

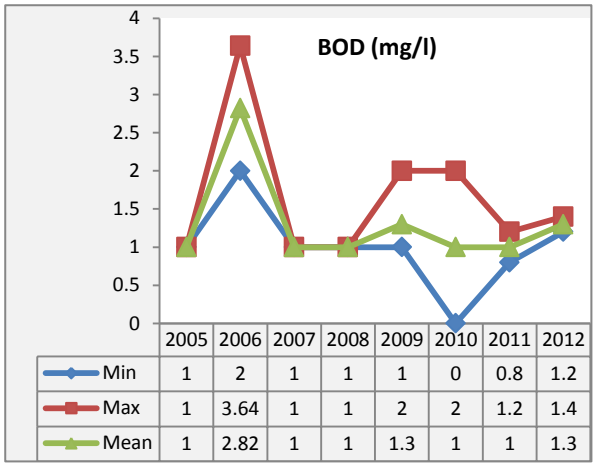


Figure 153

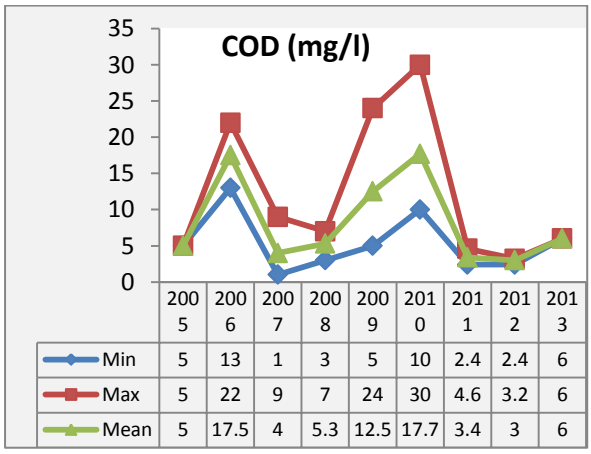


Figure 154

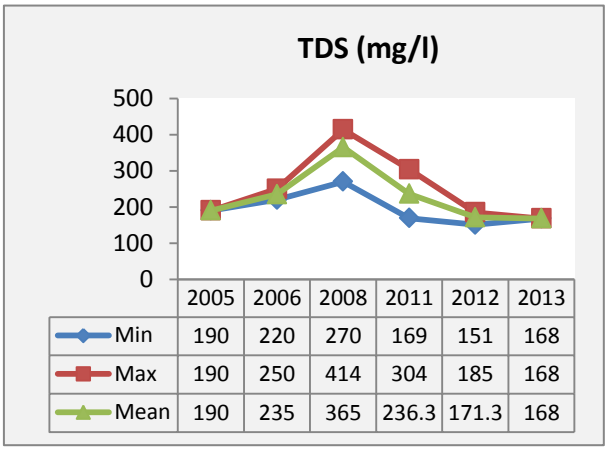


Figure 155

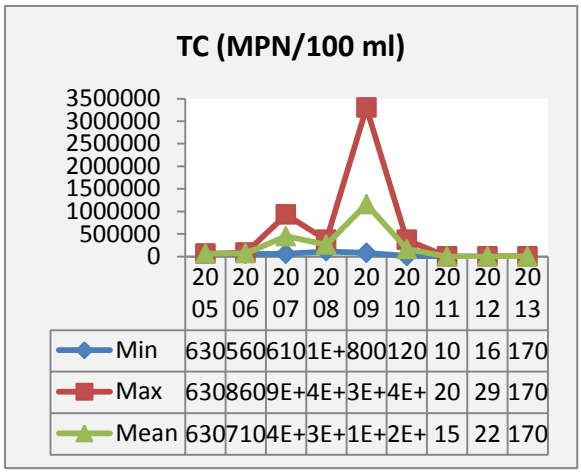


Figure 156

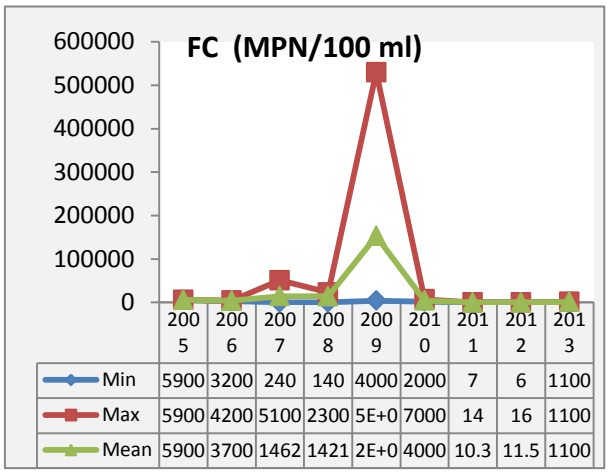


Figure 157

Close examination of figures 152 to 157 shows that:

Dissolved Oxygen concentration ranges between 6.1mg/l and 10.7 mg/l during 2011 and 2010 respectively. BOD concentration ranges 0 mg/l and 3.64 mg/l during year 2010 and 2006 respectively. COD concentration ranges between 1.0 mg/l and 30 mg/l during the year 2010 . TDS concentration ranges between 151 mg/l and 414 mg/l during year 2012 and 2008 respectively. TC count ranges between 10 MPN/100ml and 3300000 MPN/100 ml during year 2011 and 2009 respectively. FC count ranges between 6MPN/100ml and 30000MPN/100ml during year 2012 and 2009 respectively.

7.14.3 River Yamuna at Buriya U/S Jagadhari, Mandoli, (Haryana)

The water Quality of river Yamuna at Buriya U/S Jagadhari, Mandoli, (Haryana) is monitored for year 2005-13 having 17 Number of observations at the interstate boundary of Haryana and H.P.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2012	2013	Total
Observations	1	2	2	3	4	1	2	2	17

Water Quality of River Yamuna at Buriya U/S Jagadhari, Mandoli, (Haryana) during 2005-2013 is depicted in graphs (from figures 158-163):

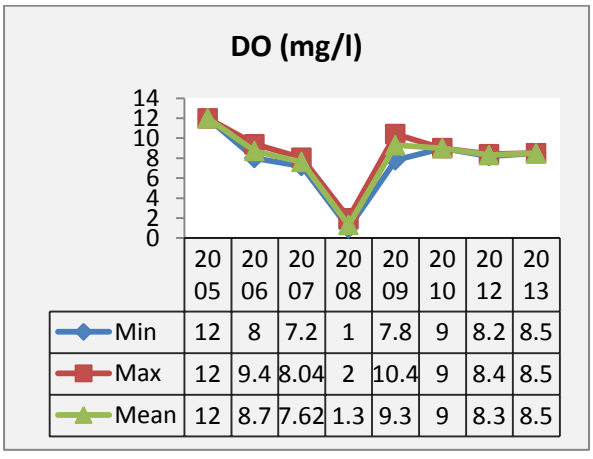


Figure 158

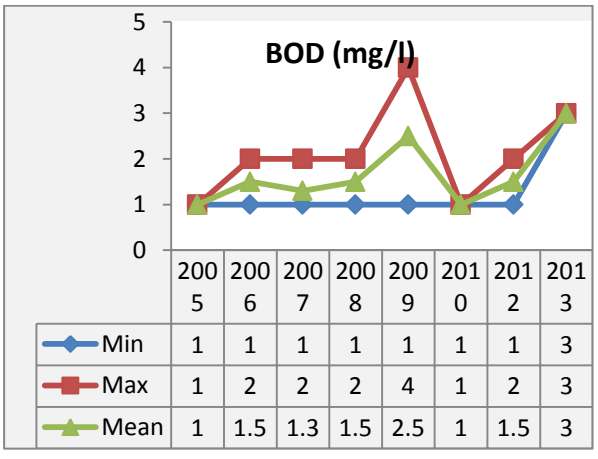


Figure 159

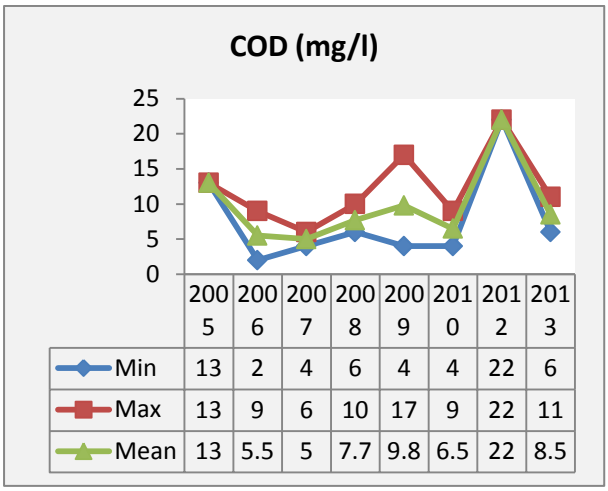


Figure 160

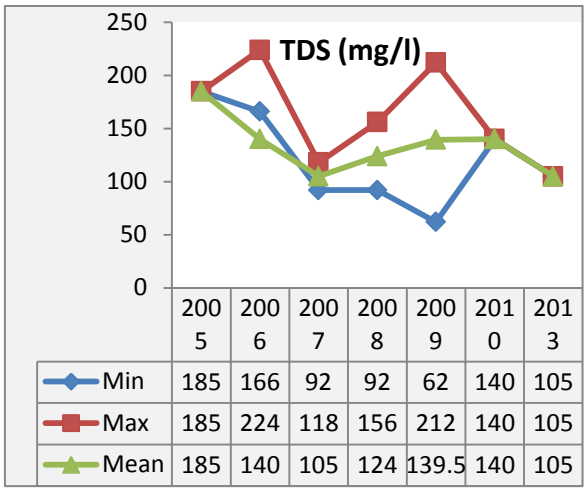


Figure 161

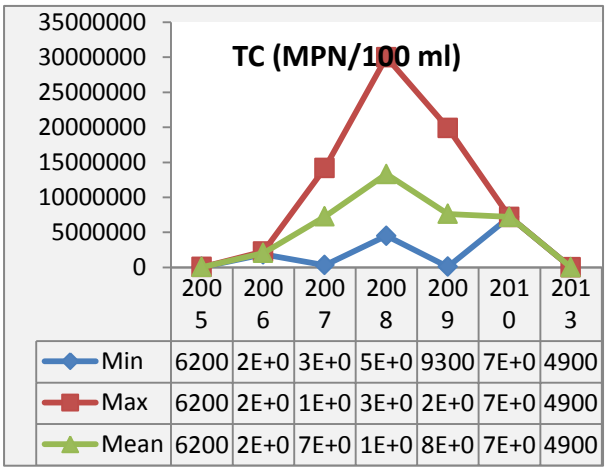


Figure 162

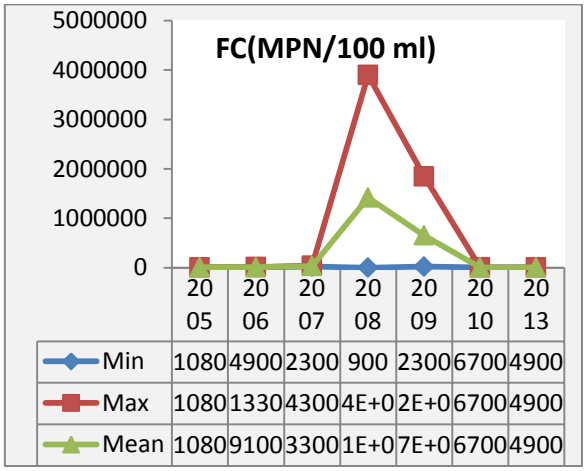


Figure 163

Close examination of figures 158 to 163 shows that:

DO concentration ranges between 1.0 mg/l and 12.0 mg/l during 2008 and 2005. BOD concentration ranges between 1 mg/l and 4 mg/l in year 2009. COD concentration ranges between 2 mg/l and 22 mg/l during year 2006 and 2012 respectively. TDS concentration ranges between 62 mg/l and 224 mg/l during year 2009 and 2006 respectively. TC count ranges between 4900 MPN/100ml and 30000000 MPN/100ml during year 2013 and 2008 respectively. FC count ranges between 900MPN/100ml and 3900000 MPN/100ml in the year 2008.

7.14.4 Yamuna at Sonipat Baghpat Road (Haryana)

The water Quality of river Yamuna at Sonipat Baghpat Road (Haryana) is monitored for year 2005-13 having 25 Number of observations at the interstate boundary of Haryana and H.P.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	1	3	3	4	4	4	3	2	25

Water Quality of River Yamuna at Sonipat Baghpat Road (Haryana) during 2005-2013 is depicted in graphs (from figures 164-168):

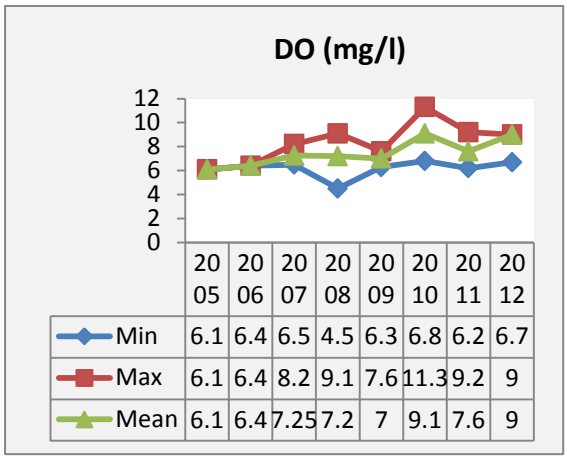


Figure 164

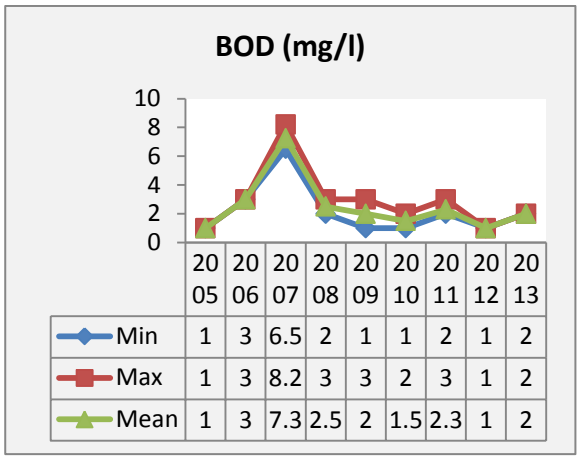


Figure 165

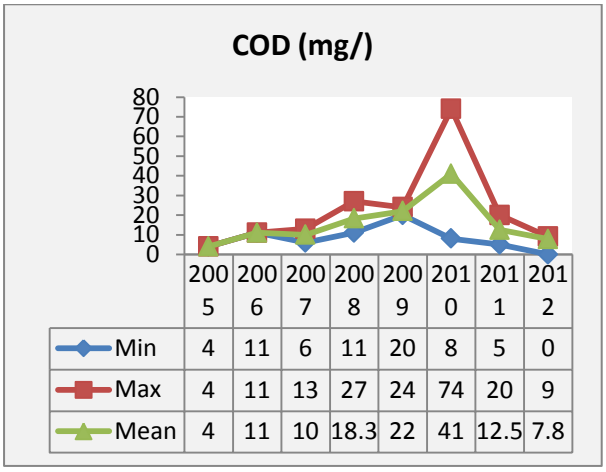


Figure 166

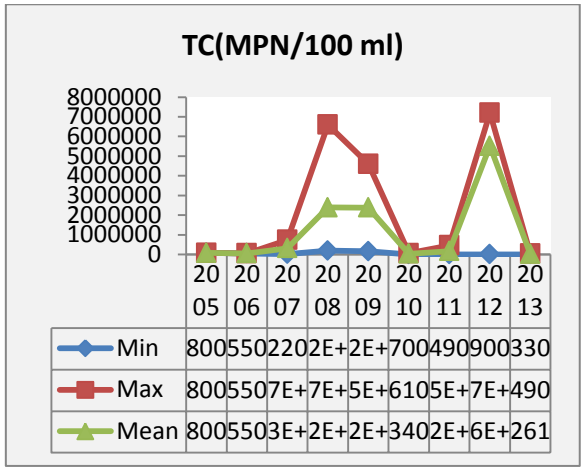


Figure 167

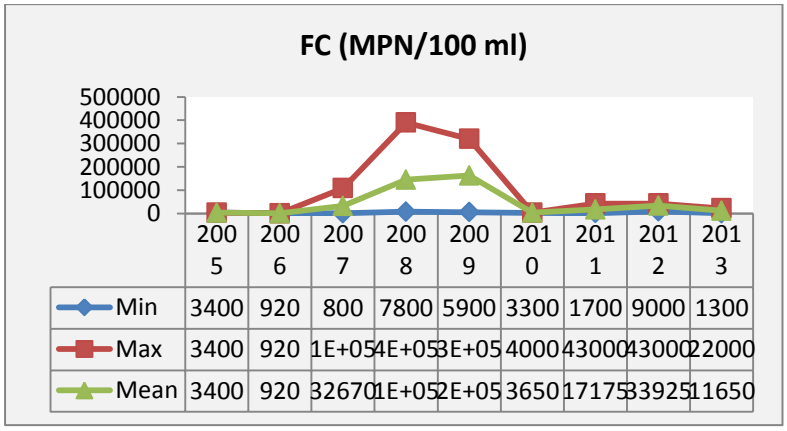


Figure 168

**** TDS was not analyzed at River Yamuna at Sonipat - Baghpat Road (Haryana).**

Close examination of figures 164 to 168 shows that:

DO concentration ranges between 4.5 mg/l and 11.3 mg/l in 2008 and 2010 respectively. BOD concentration ranges between 1.0 mg/l and 8.2 mg/l during year 2007. COD concentration is 0 mg/l and 74 mg/l during year 2010 and 2012 respectively. TC count ranges between 3300 MPN/100ml and 7200000 MPN/100ml during year 2013 and 2012 respectively. FC count ranges between 800 MPN/100ml and 390000 MPN/100ml during year 2007 and 2008 respectively.

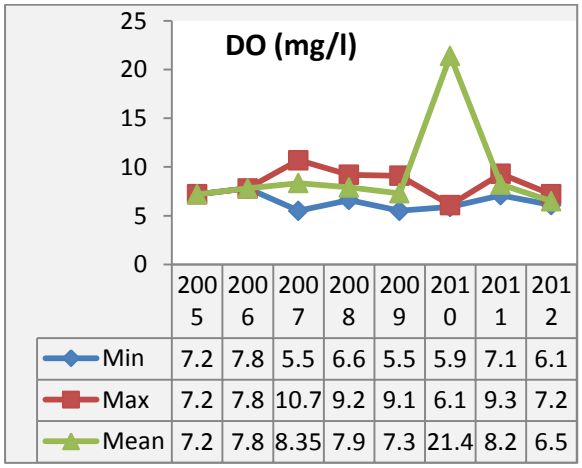
7.14.5 River Yamuna at Palla, Wazirabad (Delhi)

The water Quality of river Yamuna at Palla, Wazirabad (Delhi) is monitored for year 2005-12 having 25 Number of observations at the interstate boundary of Haryana and Delhi.

Summary of observations:

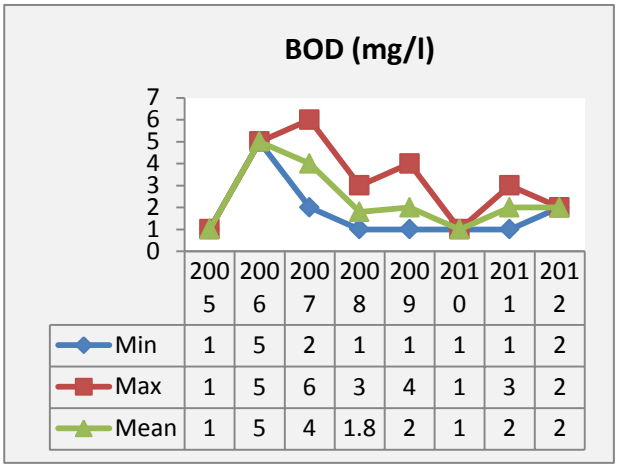
Year	2005	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	1	4	4	4	4	4	3	25

Water Quality of River Yamuna at Palla, Wazirabad (Delhi) during 2005-2012 is depicted in graphs (from figures 169-174):



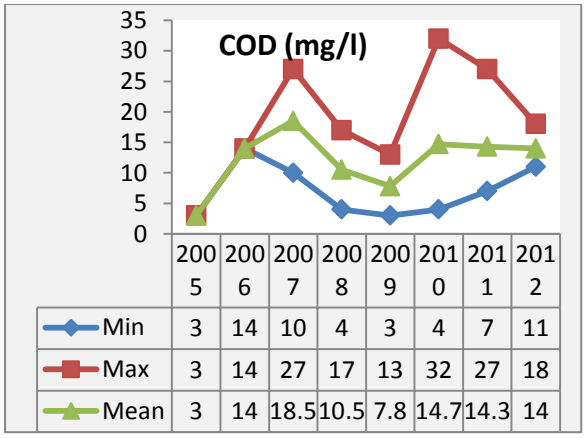
	2005	2006	2007	2008	2009	2010	2011	2012
Min	7.2	7.8	5.5	6.6	5.5	5.9	7.1	6.1
Max	7.2	7.8	10.7	9.2	9.1	6.1	9.3	7.2
Mean	7.2	7.8	8.35	7.9	7.3	21.4	8.2	6.5

Figure 169



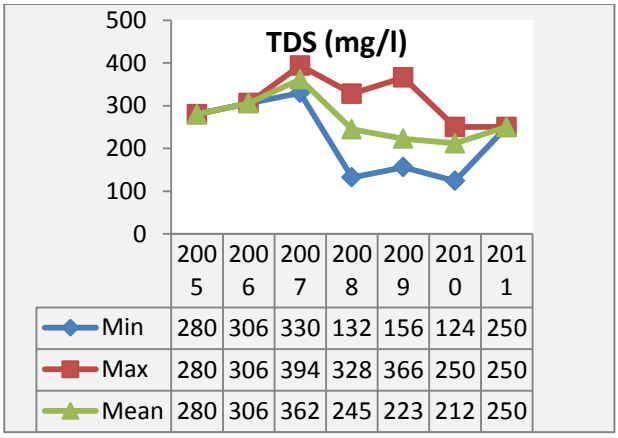
	2005	2006	2007	2008	2009	2010	2011	2012
Min	1	5	2	1	1	1	1	2
Max	1	5	6	3	4	1	3	2
Mean	1	5	4	1.8	2	1	2	2

Figure 170



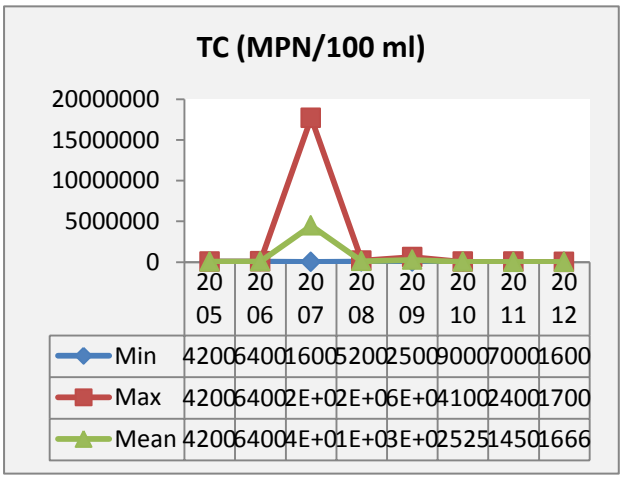
	2005	2006	2007	2008	2009	2010	2011	2012
Min	3	14	10	4	3	4	7	11
Max	3	14	27	17	13	32	27	18
Mean	3	14	18.5	10.5	7.8	14.7	14.3	14

Figure 171



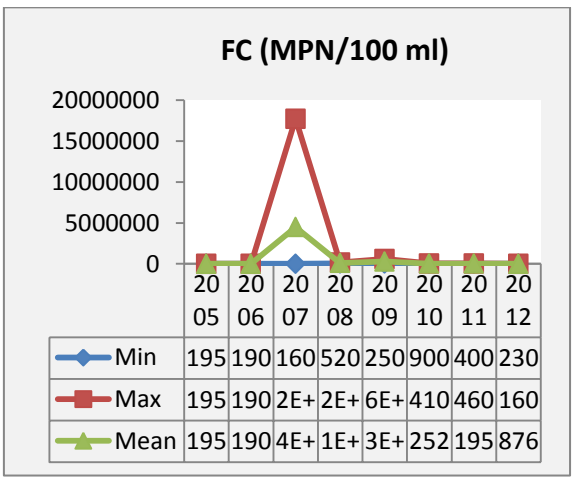
	2005	2006	2007	2008	2009	2010	2011
Min	280	306	330	132	156	124	250
Max	280	306	394	328	366	250	250
Mean	280	306	362	245	223	212	250

Figure 172



	2005	2006	2007	2008	2009	2010	2011	2012
Min	4200	6400	1600	5200	2500	9000	7000	1600
Max	4200	6400	2E+02	2E+06	6E+04	1002	4002	1700
Mean	4200	6400	4E+01	1E+03	3E+02	525	1450	1666

Figure 173



	2005	2006	2007	2008	2009	2010	2011	2012
Min	195	190	160	520	250	900	400	230
Max	195	190	2E+	2E+	6E+	410	460	160
Mean	195	190	4E+	1E+	3E+	252	195	876

Figure 174

Close examination of figures 169 to 174 shows that:

DO concentration ranges between 5.5 mg/l and 10.7 mg/l during year 2007 and 2009. BOD concentration ranges between 1 mg/l and 6 mg/l in the year 2007. COD concentration ranges between 3 mg/l and 32 mg/l during year 2005 and 2010. TDS concentration ranges between 124 mg/l and 394 mg/l in year 2010 and 2007 respectively. TC count ranges between 7000 MPN/100 ml and 17700000 MPN/100 ml during year 2011 and 2007 respectively. FC count ranges between 1900MPN/100ml and 17700000 MPN/100ml during year 2006 and 2007.

7.14.6 Yamuna at Asgarpur village, (U.P.)

The water Quality of river Yamuna at Asgarpur village, (U.P.) is monitored for year 2005-13 having 17 Number of observations at the interstate boundary of U.P. and Delhi.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	3	4	1	1	1	2	17

Water Quality of River Yamuna, Asgarpur village, U.P. (Delhi/UP Border) during 2005-2013 is depicted in graphs (from figures 175-179):

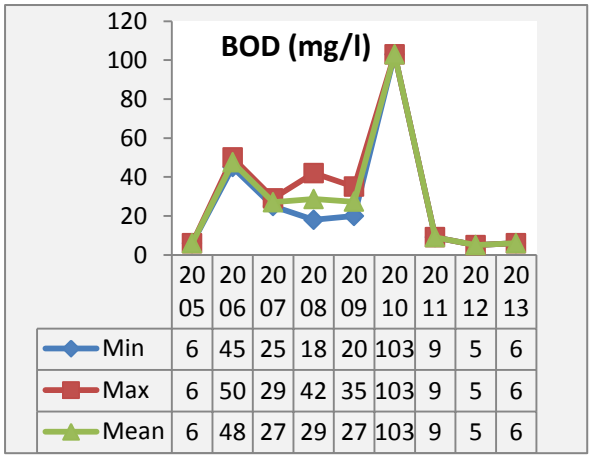


Figure 175

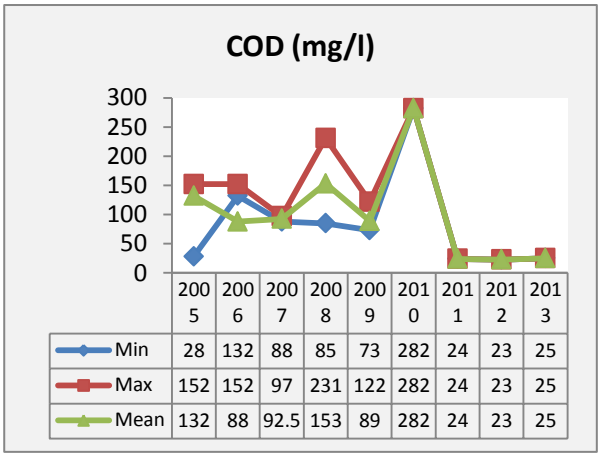


Figure 176

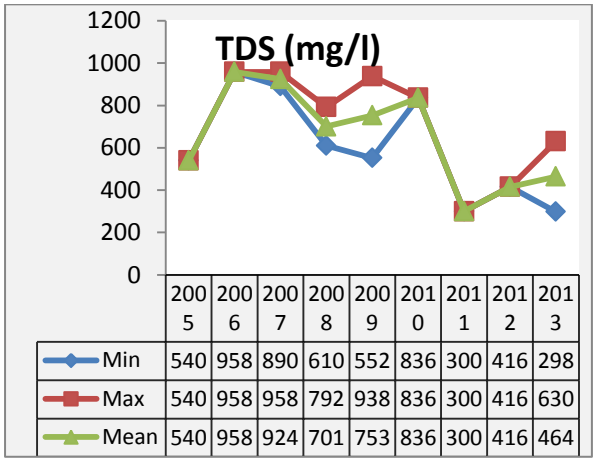


Figure 177

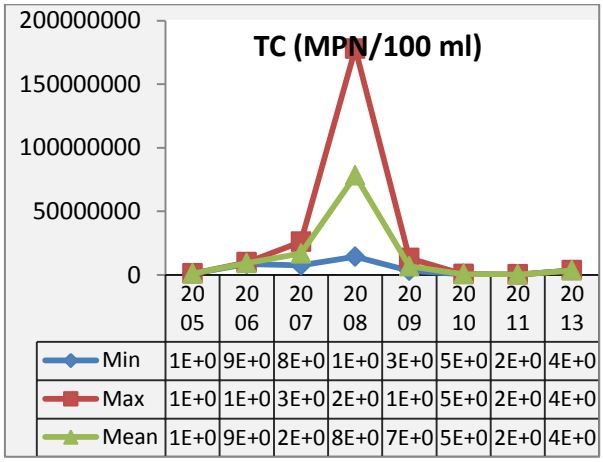


Figure 178

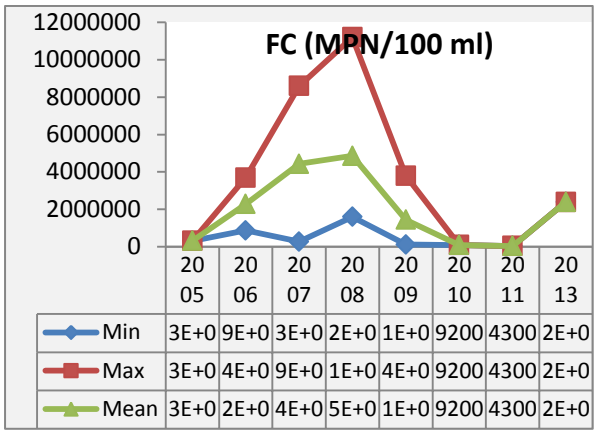


Figure 179

Close examination of figures 175 to 179 shows that:

BOD concentration ranges between 5 mg/l and 103 mg/l during year 2012 and 2010 respectively COD concentration ranges between 23 mg/l and 282 mg/l during year 2012 and 2010 respectively. TDS concentration ranges between 298 mg/l and 958 mg/l during year 2013 and 2007 respectively. TC count 240000 MPN/100ml and 178000000 MPN/100 ml during year 2011 and 2008. FC count ranges between 43000 MPN/100ml and 11200000MPN/100ml during year 2011 and year 2008 respectively.

7.14.7 Yamuna at Mohena Palwal Road (Haryana)

The water Quality of river Yamuna at Mohena Palwal Road (Haryana) is monitored for year 2005-13 having 18 Number of observations at the interstate boundary of U.P. and Delhi.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2013	Total
Observations	1	2	2	3	4	4	2	18

Water Quality of River Mohena Palwal Road (Haryana) during 2005-2013 is depicted in graphs (from figures 180-185):

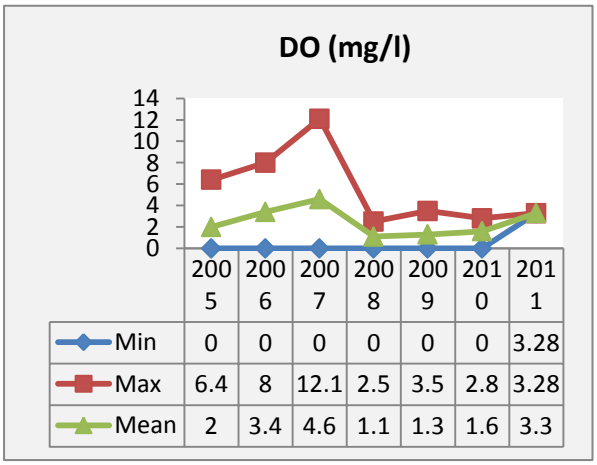


Figure 180

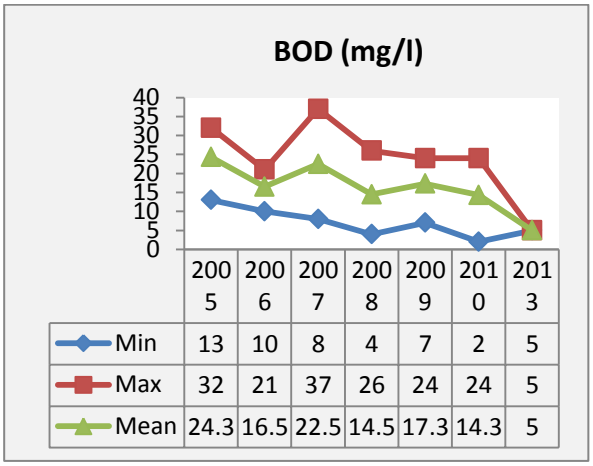


Figure 181

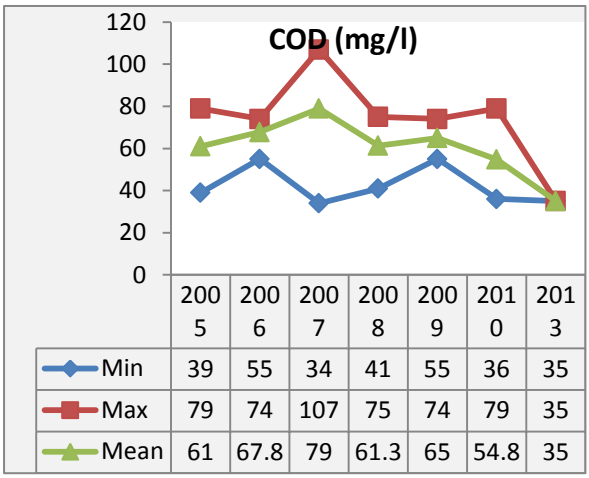


Figure 182

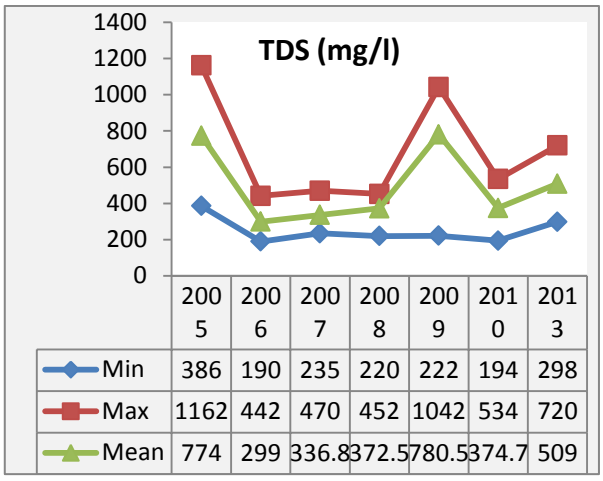


Figure 183

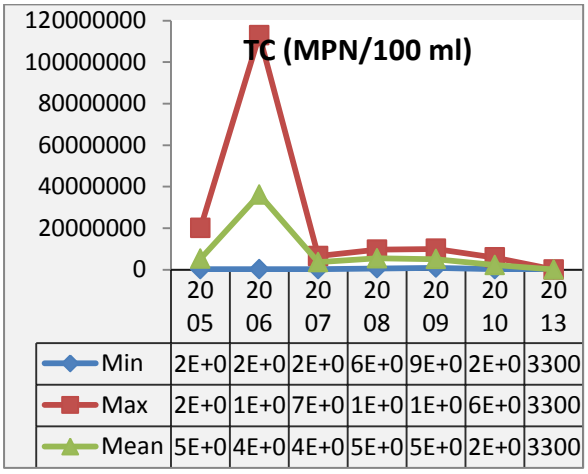


Figure 184

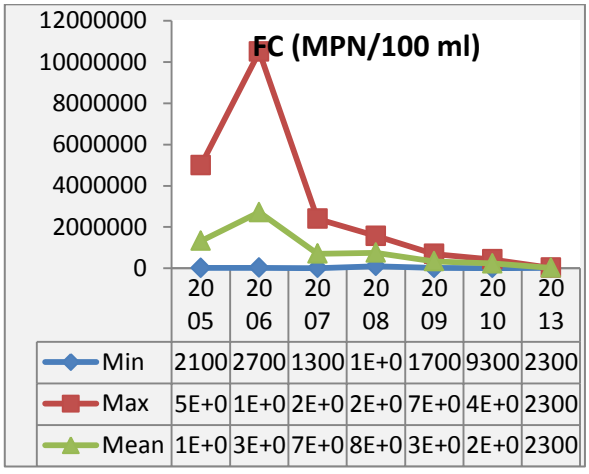


Figure 185

Close examination of figures 180 to 185 shows that:

DO concentration ranges 0 mg/l and 12.1 mg/l during 2007. BOD concentration is 2 mg/l and 37 mg/l during year 2010 and 2007. COD concentration ranges between 34 mg/l and 107 mg/l during year 2007. TDS concentration ranges between 190 mg/l and 1162 mg/l during year 2006 and 2005 respectively. TC count ranges between 33000 MPN/100ml and 113000000 MPN/100 ml during year 2013 and 2006. FC count ranges between 9300 MPN/100ml and 10500000MPN/100 ml during year 2010 and 2006.

7.14.8 Yamuna at Shergarh, Juhika (U. P.)

The water Quality of river Yamuna at Shergarh, Juhika (U. P.) is monitored for year 2005-13 having 25 Number of observations at the interstate boundary of U.P. and Haryana.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2013	Total
Observations	4	4	4	4	4	4	1	25

Water Quality of River Yamuna at Shergarh , Juhika (U. P.) during 2005-2013 is depicted in graphs (from figures 186-191):

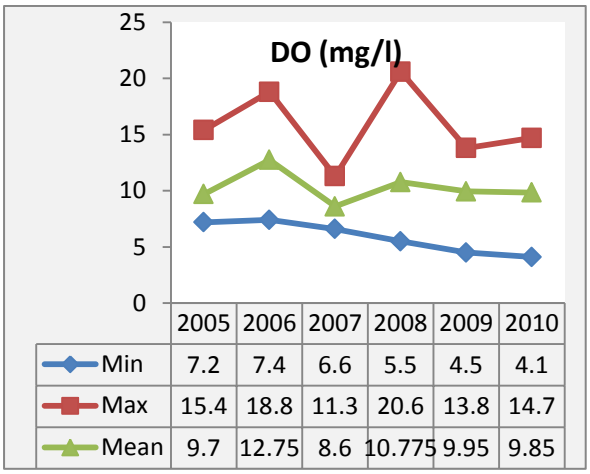


Figure 186

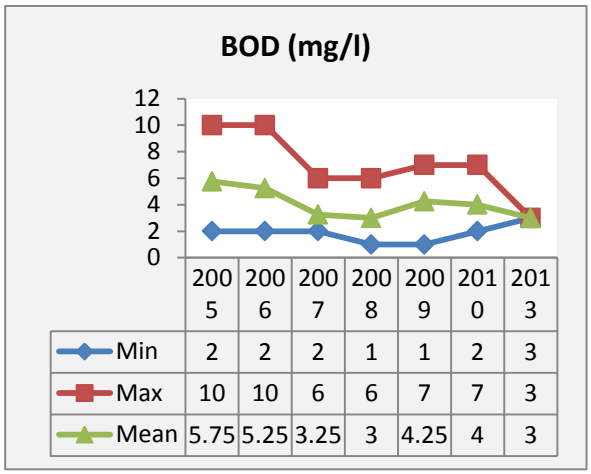


Figure 187

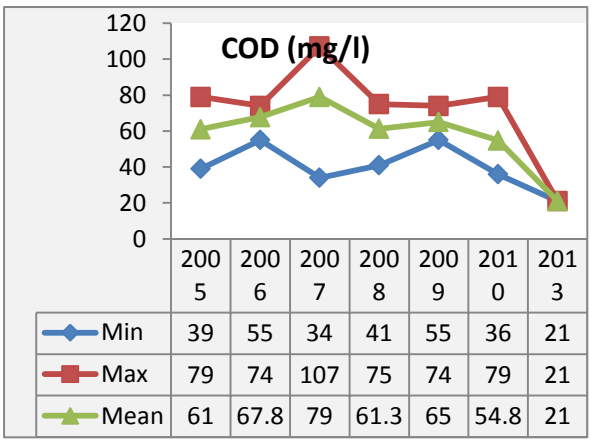


Figure 188

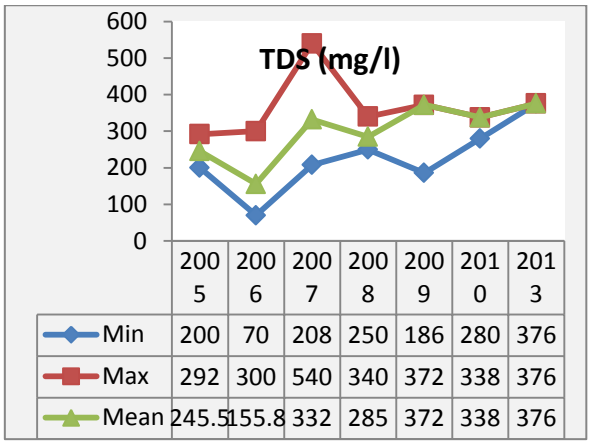


Figure 189

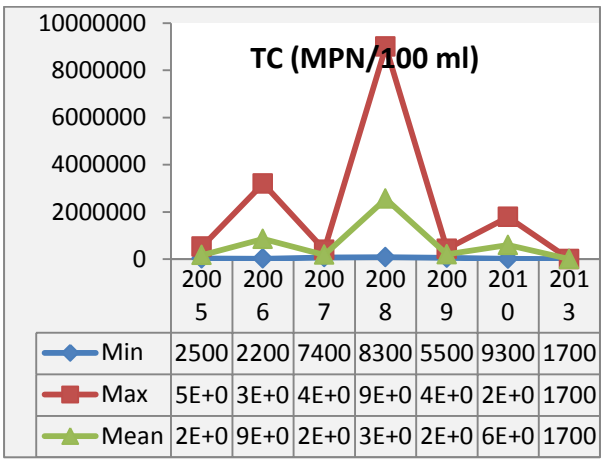


Figure 190

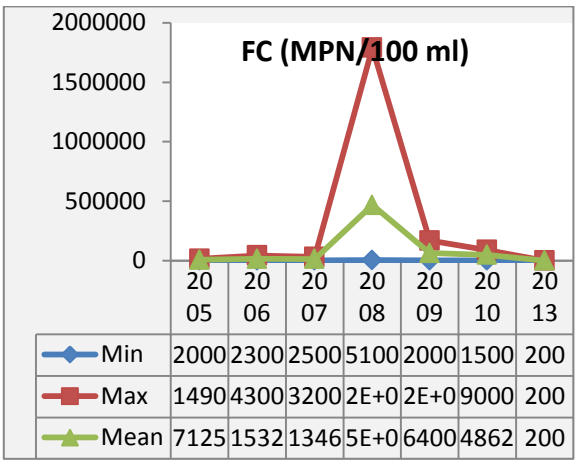


Figure 191

Close examination of figures 186 to 191 shows that:

DO concentration ranges between 4.1 mg/l and 20.6 mg/l during year 2010 and 2008 respectively. BOD concentration ranges between 1 mg/l and 10 mg/l during year 2008 and 2005 respectively. COD concentration ranges between 21 mg/l and 107 mg/l during year 2013 and 2007. TDS concentration ranges between 70 mg/l and 540 mg/l during year 2006 and 2007 respectively. TC count ranges between 1700 MPN/100ml and 9000000 MPN/100ml during year 2013 and 2008 respectively. FC count ranges between 200 MPN/100ml and 1790000 MPN/100ml during year 2013and 2008 respectively.

7.14.9 River Yamuna at Hasanpur, Mohali (Haryana)

The water Quality of river Yamuna at Hasanpur, Mohali (Haryana) is monitored for year 2009-13 having 07 Number of observations at the interstate boundary of U.P. and Haryana.

Summary of Observation:

Year	2009	2010	2011	2012	2013	Total
Observations	1	2	1	1	2	7

Water Quality of River Yamuna at Hasanpur, Mohali (Haryana) during 2005-2013 is depicted in graphs (from figures 192-197):

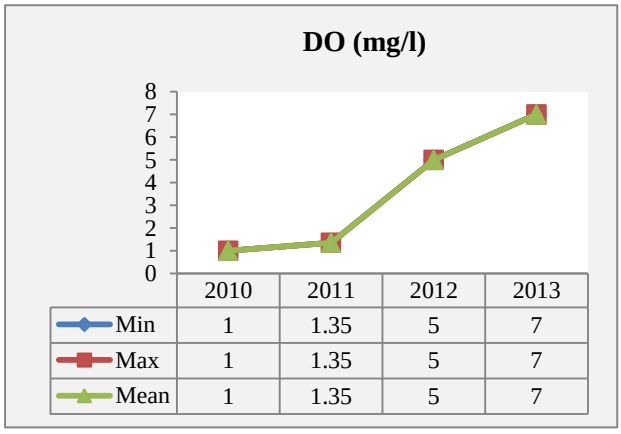


Figure 192

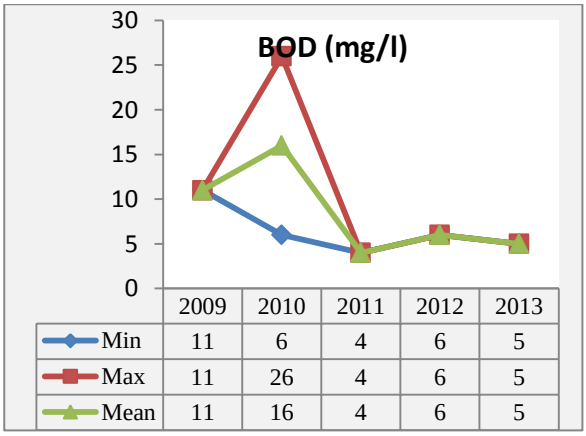


Figure 193

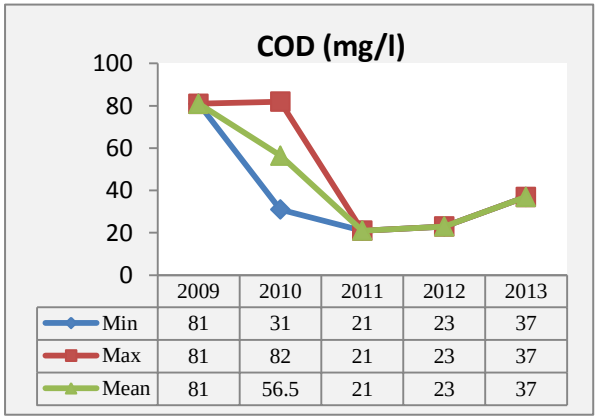


Figure 194

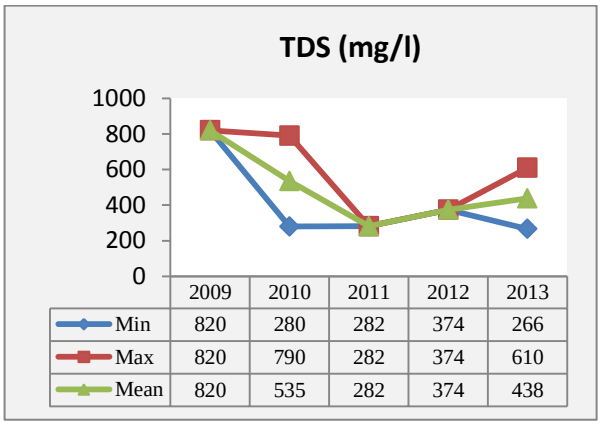


Figure 195

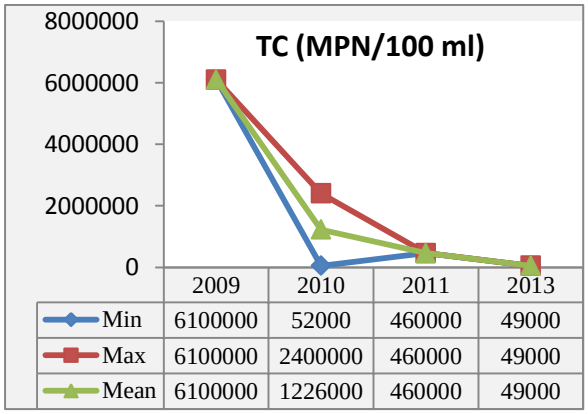


Figure 196

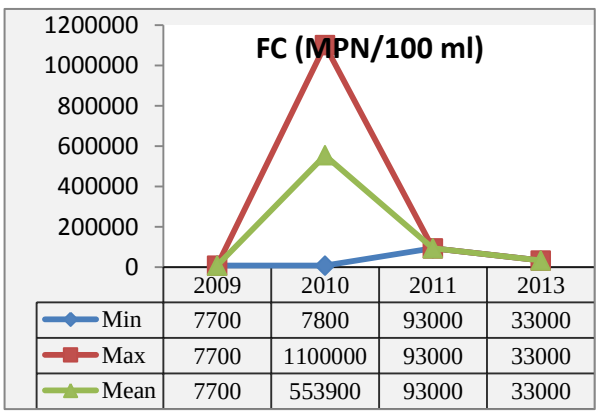


Figure 197

Close examination of figures 192 to 197 shows that:

DO concentration ranges between 1 mg/l and 7 mg/l during year 2010 and 2013 respectively. BOD concentration ranges between 4 mg/l and 26 mg/l during year 2011 and 2010. COD concentration ranges between 21 mg/l and 82 mg/l during year 2011 and 2010 respectively. TDS concentration ranges between 266 mg/l and 820 mg/l during year 2013 and 2009 respectively. TC count ranges between 49000 MPN/100 ml and 6100000 MPN/110 ml during year 2013 and 2009 respectively. FC count ranges between 7700 MPN/100 ml and 1100000 MPN/110 ml during year 2009 and 2010 respectively.

7.15 River Chambal at Udi (U.P.)

The water Quality of river Yamuna at Hasanpur, Mohali (Haryana) is monitored for year 2009-13 having 25 Number of observations at the interstate boundary of U.P. and M.P.

Summary of observations:

Year	2005	2006	2007	2008	2009	2010	2013	Total
Observations	4	4	4	4	4	4	1	25

Water Quality of River Chambal at Udi (U.P.) during 2005-2013 is depicted in graphs (from figures 198-203):

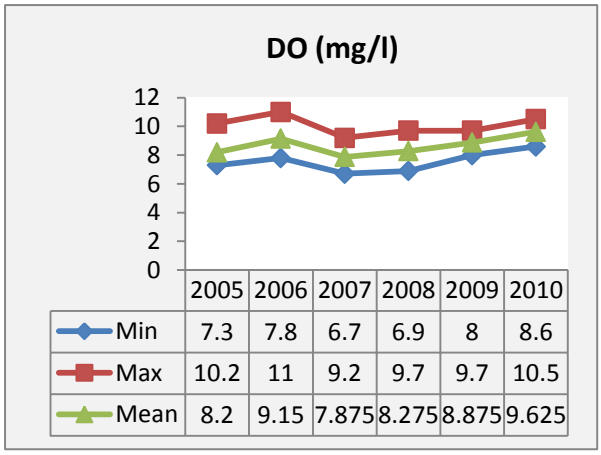


Figure 198

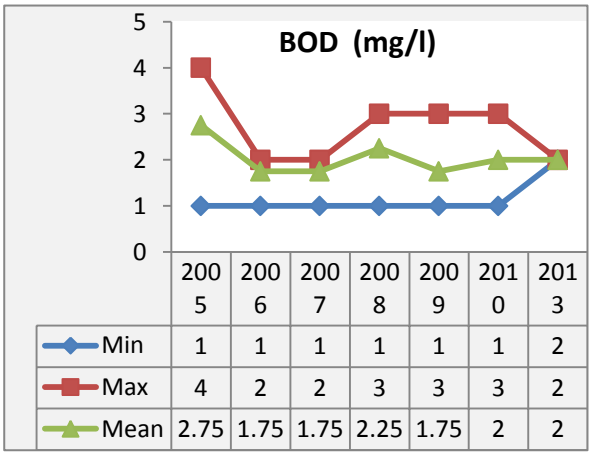


Figure 199

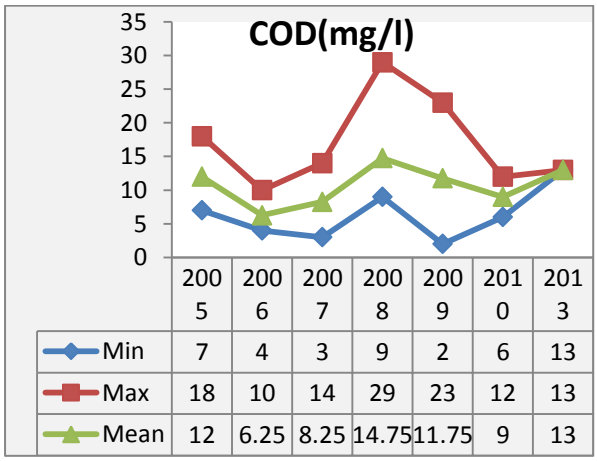


Figure 200

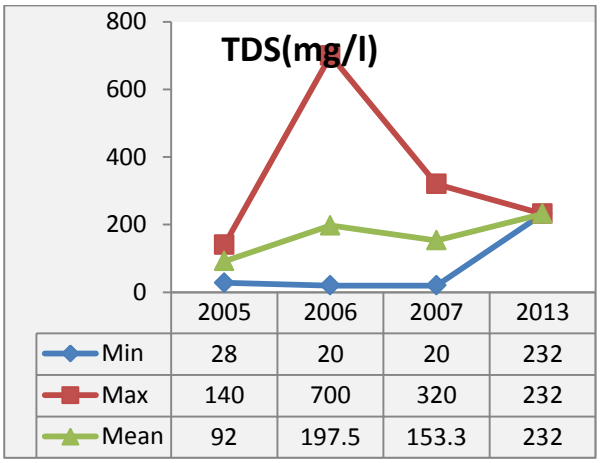


Figure 201

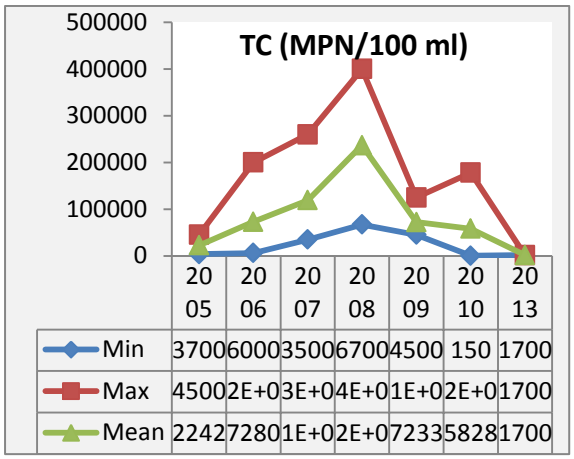


Figure 202

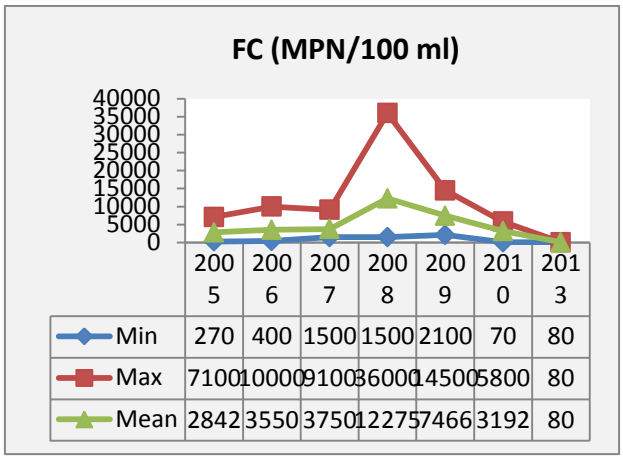


Figure 203

Close examination of figures 198 to 203 shows that:

Concentration of Dissolved Oxygen ranges between 6.7 mg/l and 11.0 mg/l during year 2007 and 2006 respectively. BOD concentration ranges between 1.0 mg/l and 4.0 mg/l during the year 2005. COD concentration ranges between 2 mg/l and 29 mg/l during year 2009 and 2008 respectively. TDS concentration ranges between 20 mg/l and 700 mg/l in year 2006 and 2007 respectively. TC count ranges 150 MPN/100ml and 400000 MPN/100ml in year 2010 and 2008 respectively. FC count 70 MPN/100ml and 36000MPN/100ml during year 2010 and 2008 respectively.

7.16 Water Quality of Indira Gandhi Canal:

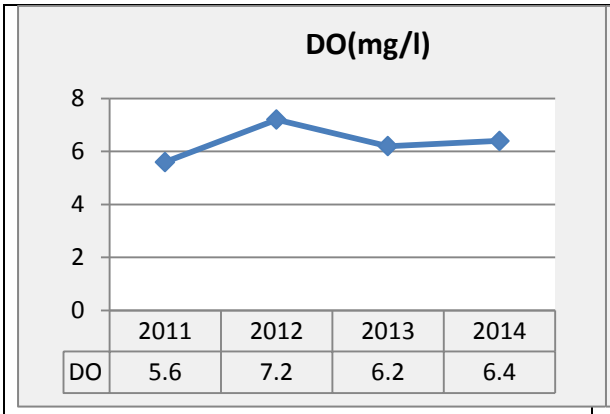


Figure 204

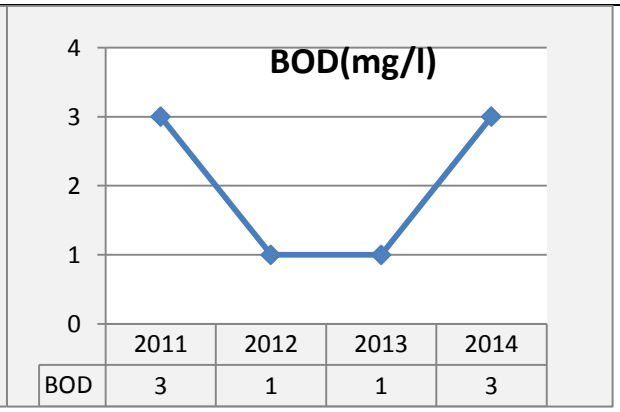


Figure 205

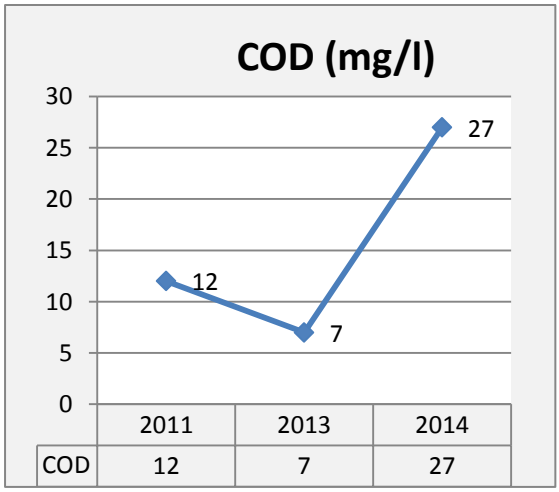


Figure 206

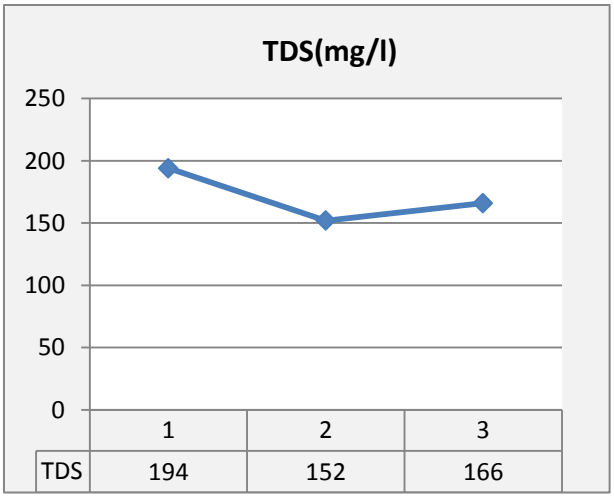


Figure 207

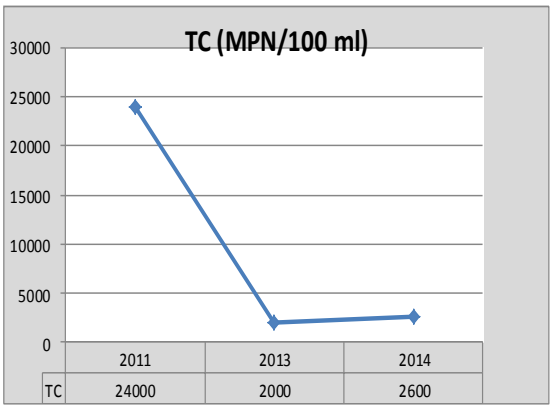


Figure 208

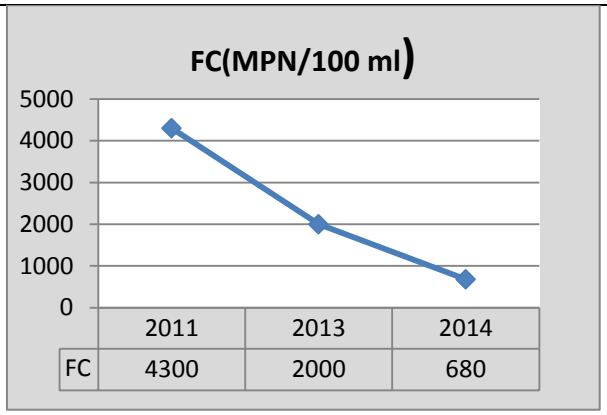


Figure 209

Close examination of figures 204 to 209 shows that:

BOD concentration is meeting the maximum limit of 3.0 mg/l in year 2010. Minimum and maximum BOD concentration is 1.0 mg/l and 4.0 mg/l respectively. COD concentration ranges between 4.0 mg/l and 22 mg/l during year 2009 and 2011 respectively. Minimum TDS concentration is 146mg/l in year 2013. Maximum TDS concentration is 317 mg/l in year 2011. Minimum count of TC is 2300MPN/100ml in year 2011. Maximum count of TC is 4600000MPN/100ml in year 2009. Minimum count of FC is 400 MPN/100ml in year 2010. Maximum count of FC is 250000 MPN/100ml in year 2009.

7.17 Water Quality of River Vardha at Bangaon Village near Pandhurana Village (M. P.)

Water Quality of River Vardha at Bangaon Village near Pandhurana Village (M. P.) is monitored for year 2006-12 having 12 Number of observations at the interstate boundary of M.P. and Maharashtra.

Summary of observations:

Year	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	2	1	3	1	2	2	12

Water Quality of Water Quality of River Vardha at Bangaon Village near Pandhurana Village (M. P.) during 2006-2013 is depicted in graphs (from figures 210-215):

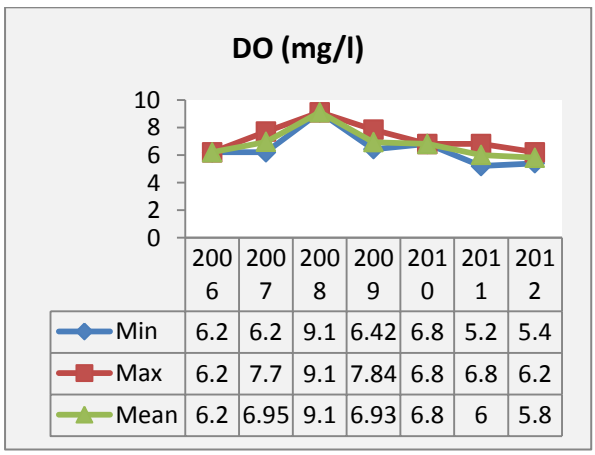


Figure 210

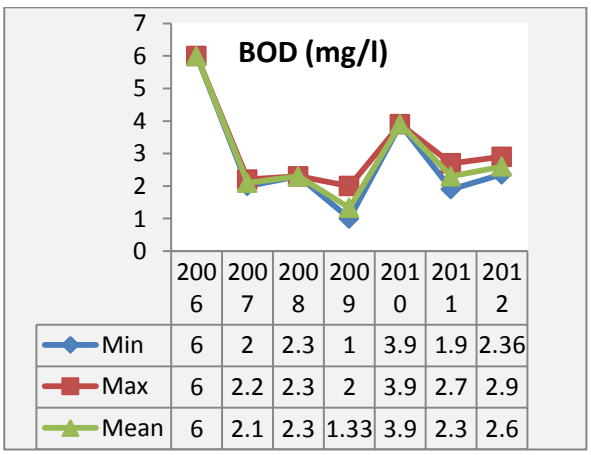


Figure 211

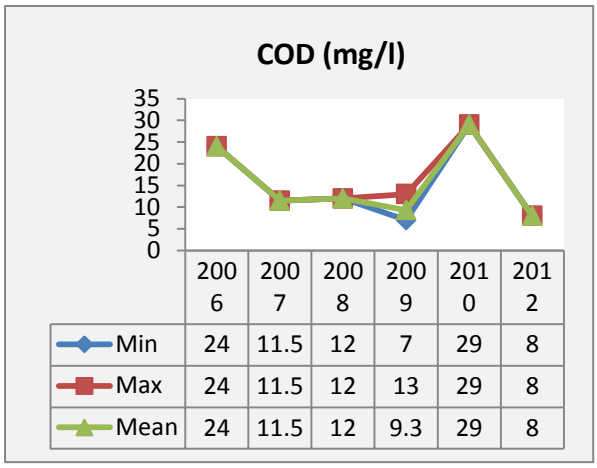


Figure 212

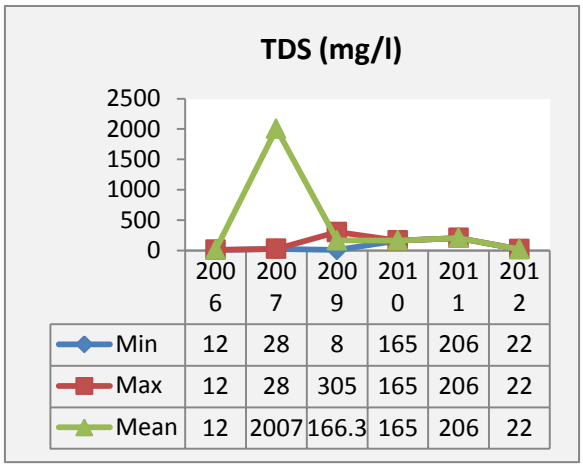


Figure 213

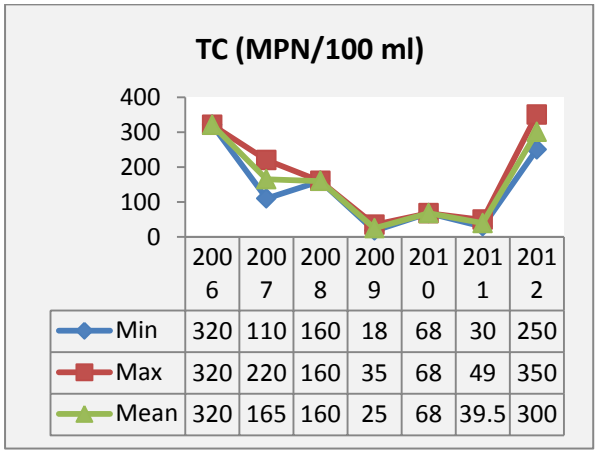


Figure 214

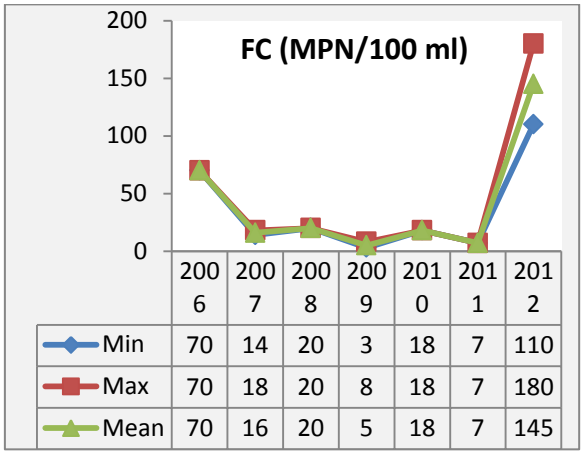


Figure 215

Close examination of figures 210 to 215 shows that:

Dissolved Oxygen concentration ranges between 5.2 mg/l and 9.1 mg/l during year 2006 and 2008 respectively. BOD concentration ranges between 1.0 mg/l and 6.0 mg/l during year 2009 and 2006 respectively. COD concentration ranges between 7.0 mg/l and 29.0 mg/l during year 2009 and 2010 respectively. TDS concentration ranges between 8 mg/l and 305 mg/l during the year 2009. TC concentration ranges between 18 mg/l and 350 mg/l during year 2009 and 2012 respectively. FC ranges between 3 mg/l and 180 mg/l during year 2009 and 2012 respectively.

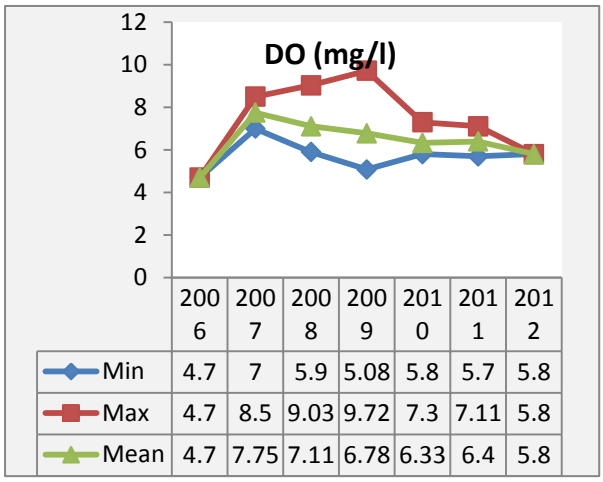
7.18.1 Water quality of River Mahi at Village Bajna, Ratlam (M. P.)

Water quality of River Mahi at Village Bajna, Ratlam (M. P.) is monitored for year 2006-12 having 18 Number of observations at the interstate boundary of M.P. and Rajasthan .

Summary of observations:

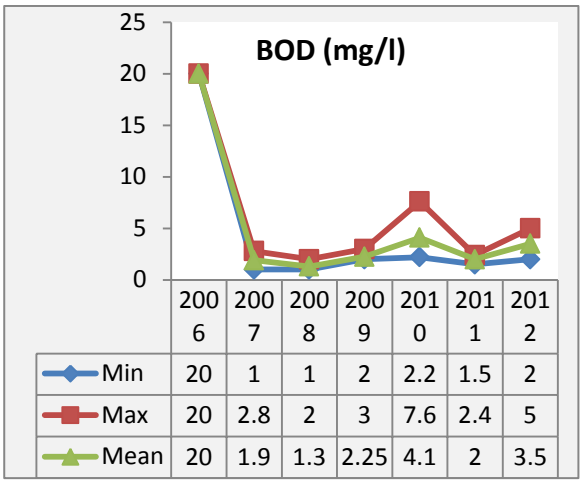
Year	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	2	4	4	3	2	2	18

Water Quality of River Mahi at Village Bajna, Ratlam (M. P.) during 2006-2013 is depicted in graphs (from figures 216-221):



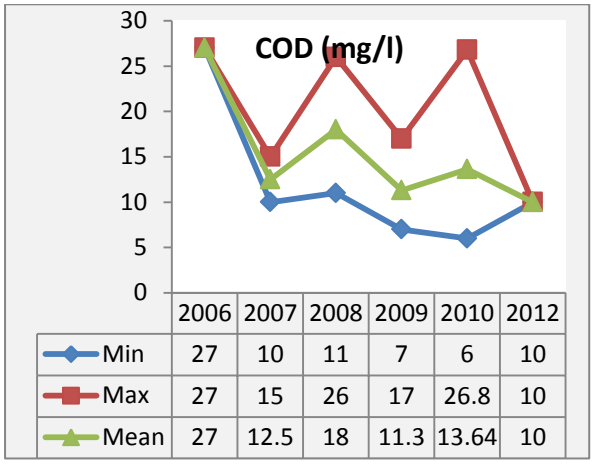
	2006	2007	2008	2009	2010	2011	2012
Min	4.7	7	5.9	5.08	5.8	5.7	5.8
Max	4.7	8.5	9.03	9.72	7.3	7.11	5.8
Mean	4.7	7.75	7.11	6.78	6.33	6.4	5.8

Figure 216



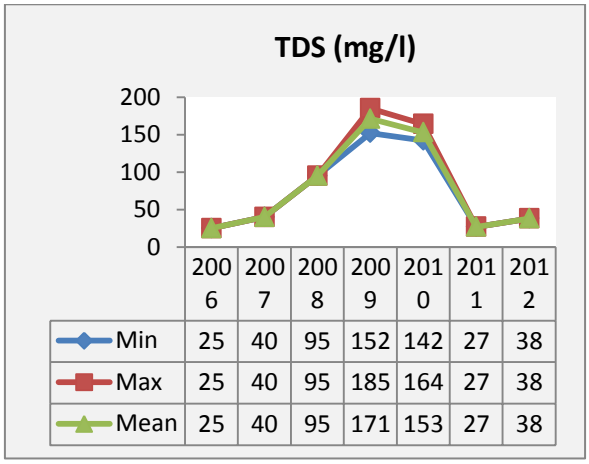
	2006	2007	2008	2009	2010	2011	2012
Min	20	1	1	2	2.2	1.5	2
Max	20	2.8	2	3	7.6	2.4	5
Mean	20	1.9	1.3	2.25	4.1	2	3.5

Figure 217



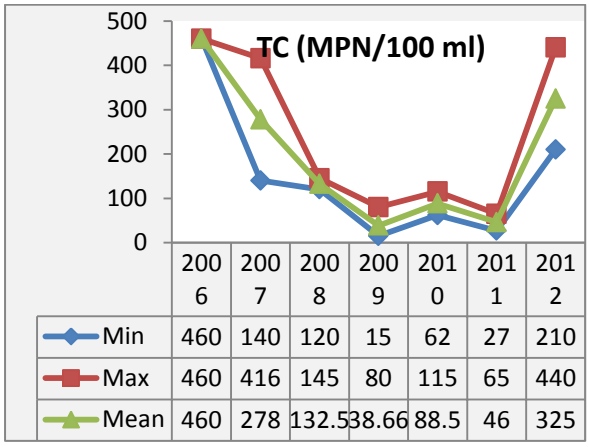
	2006	2007	2008	2009	2010	2012
Min	27	10	11	7	6	10
Max	27	15	26	17	26.8	10
Mean	27	12.5	18	11.3	13.64	10

Figure 218



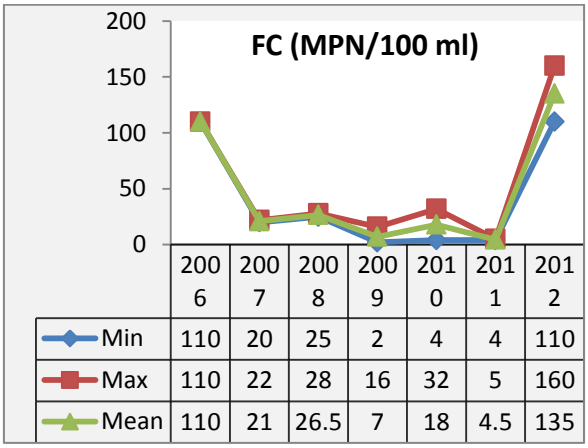
	2006	2007	2008	2009	2010	2011	2012
Min	25	40	95	152	142	27	38
Max	25	40	95	185	164	27	38
Mean	25	40	95	171	153	27	38

Figure 219



	2006	2007	2008	2009	2010	2011	2012
Min	460	140	120	15	62	27	210
Max	460	416	145	80	115	65	440
Mean	460	278	132.5	38.66	88.5	46	325

Figure 220



	2006	2007	2008	2009	2010	2011	2012
Min	110	20	25	2	4	4	110
Max	110	22	28	16	32	5	160
Mean	110	21	26.5	7	18	4.5	135

Figure 221

Close examination of figures 216 to 221 shows that:

DO concentration is meeting to the prescribed limit of 5.0 mg/l except in year 2006. DO concentration ranges between 4.7 mg/l and 9.72 mg/l during year 2006 and 2009 respectively. BOD concentration ranges between 1.0 mg/l and 20.0 mg/l during year 2007/ 2008 and 2006 respectively. COD concentration ranges between 6.0 mg/l and 27.0 mg/l during year 2010 and 2006 respectively. TDS concentration ranges between 25 mg/l in year 2006 and 2009 respectively. TC count ranges between 15 MPN/100 ml and 460 MPN/100 ml during year 2009 and 2006 respectively. FC count ranges between 2 MPN/100 ml and 160 MPN/100 ml in year 2009 and 2012 respectively.

7.18.2 Water quality of River Mahi at Bajaj Sagar Dam at Gammon Bridge, Nr. Bansawara (Rajasthan)

Water quality of River Mahi at Bajaj Sagar Dam at Gammon Bridge, Nr. Bansawara (Rajasthan) is monitored for year 2006-12 having 19 Number of observations at the interstate boundary of M.P. and Rajasthan .

Summary of observation:

Year	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	3	4	4	3	2	2	19

Water Quality of River Mahi at Bajaj sagar Dam at Gammon Bridge, Nr. Bansawara (Rajasthan) during 2005-2013 is depicted in graphs (from figures 222-227):

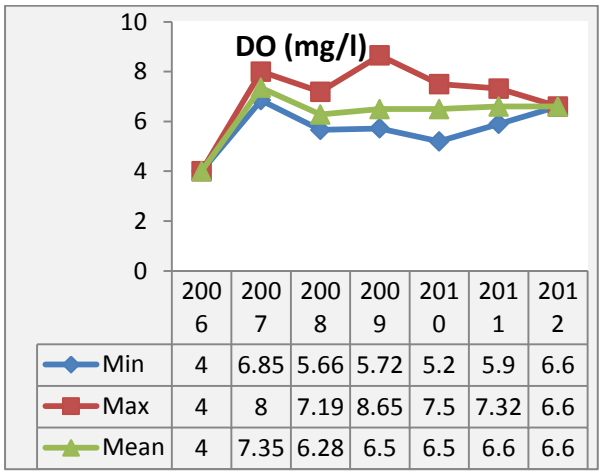


Figure 222

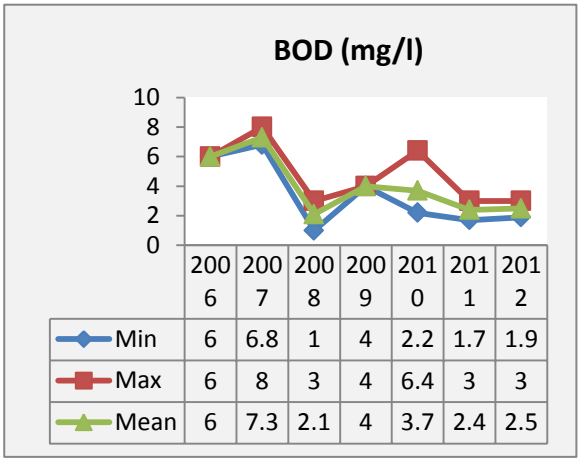


Figure 223

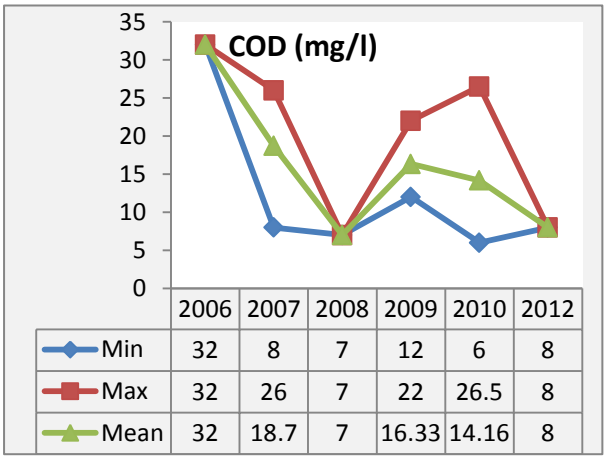


Figure 224

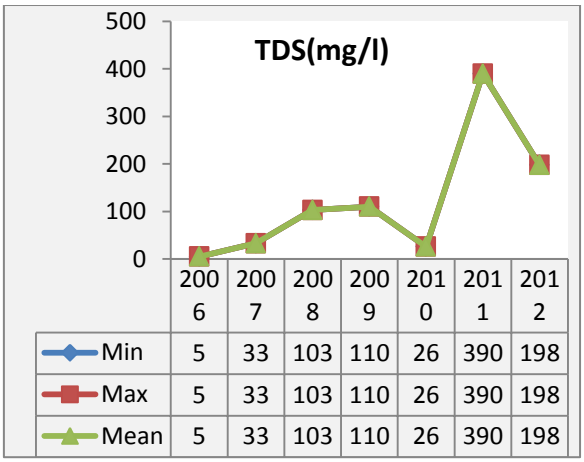


Figure 225

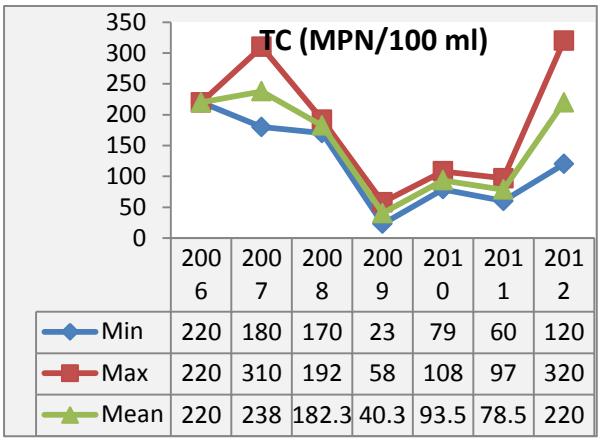


Figure 226

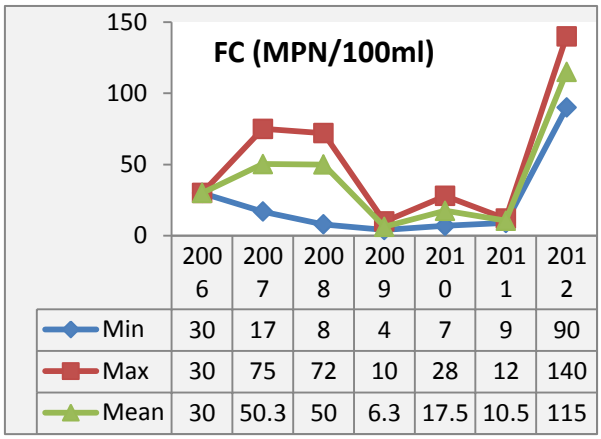


Figure 227

Close examination of figures 222 to 227 shows that:

Dissolved Oxygen concentration ranges between 4.0 mg/l and 8.65 mg/l during 2006 and 2009 respectively. BOD concentration ranges between 1.0 mg/l and 8.0 mg/l during year 2008 and 2007 respectively. COD concentration is 6.0 mg/l and 32.0 mg/l during year 2010 and 2006. TDS concentration ranges between 5.0 mg/l and 390 mg/l during year 2006 and 2011. TC ranges between 23 mg/l and 320 mg/l during year 2009 and 2012 respectively. FC count ranges between 4 mg/l and 140 mg/l during year 2009 and 2012.

7.19 Water Quality of River Chambal at Fish farm , Gandhisagar Dam, (M.P.)

Water Quality of River Chambal at Fish farm, Gandhisagar Dam, (M.P.) is monitored for year 2006-12 having 19 Number of observations at the interstate boundary of M.P. and Rajasthan .

Year	2006	2007	2008	2009	2010	2011	2012	Total
Observations	1	3	4	4	3	2	2	19

Water Quality of River Chambal at Fish farm , Gandhisagar Dam, (M.P.) during 2006-2012 is depicted in graphs (from figures 228-233):

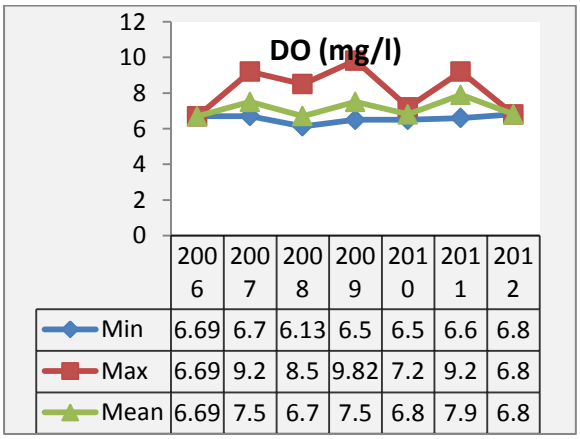


Figure 228

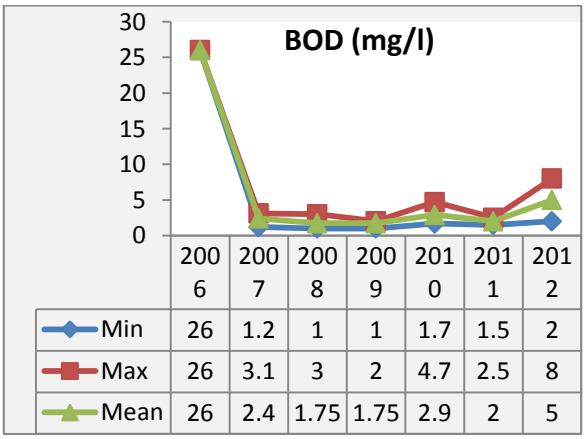


Figure 229

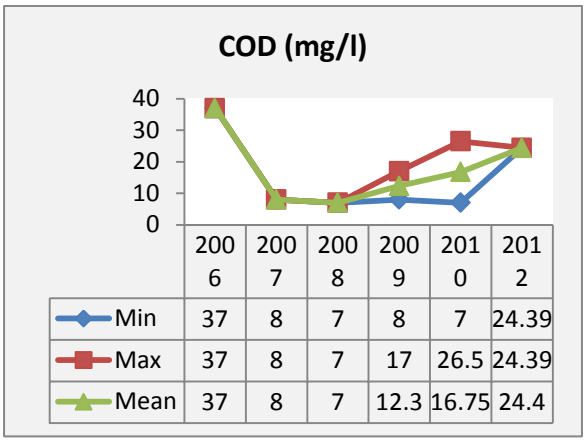


Figure 230

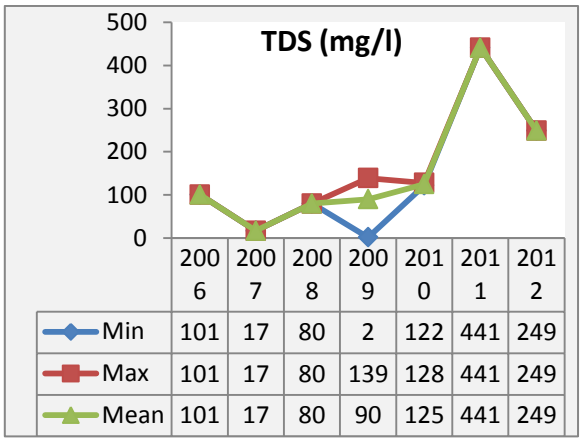


Figure 231

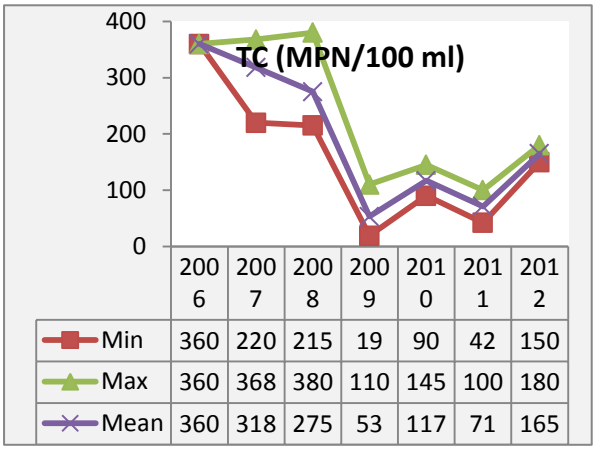


Figure 232

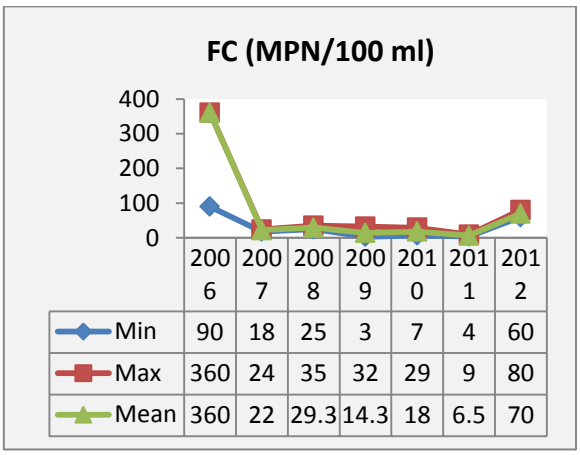


Figure 233

Close examination of figures 228 to 233 shows that:

Dissolved Oxygen ranges between 6.13 mg/l and 9.82 mg/l during year 2008 and 2009 respectively. BOD concentration ranges between 1.0 mg/l and 26.0 mg/l during year 2008 and 2009 respectively. COD concentration ranges 7.0 mg/l and 37.0 mg/l during year 2008/2010 and year 2006 respectively. TDS concentration ranges between 2.0 mg/l and 441.0 mg/l during year 2009 and 2011 respectively. TC ranges between 19 mg/l and 380 mg/l during year 2009 and 2008 respectively. FC count ranges between 3.0 MPN/100 and 360MPN/100 ml during year 2009 and year 2006 respectively.

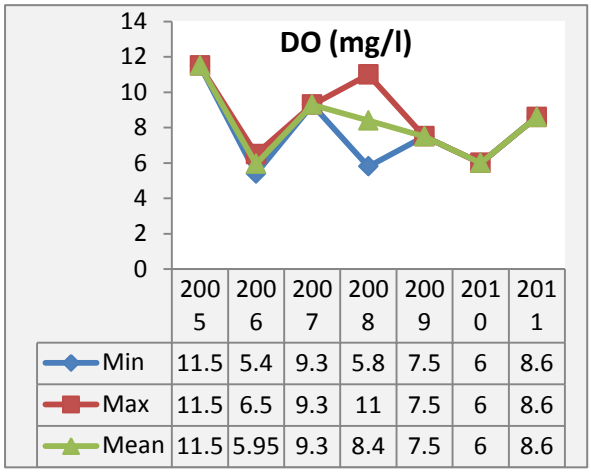
7. 20 Water Quality of River Krishna at Kurundwad, Kolhapur (Maharashtra)

Water Quality of River Krishna at Kurundwad, Kolhapur (Maharashtra) is monitored for year 2005-11 having 10 Number of observations at the interstate boundary of Maharashtra and Andhra Pradesh.

Summary of Observations:

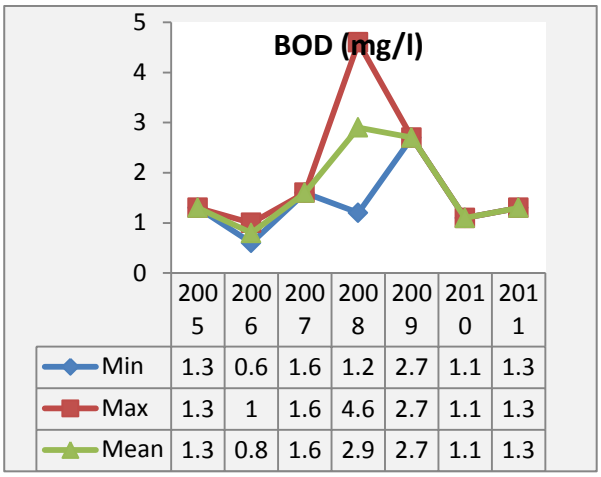
Year	2005	2006	2007	2008	2009	2010	2011	Total
Observations	1	2	1	2	1	1	2	10

Water Quality of River Krishna at Kurundwad, Kolhapur (Maharashtra) during 2005-2011 is depicted in graphs (from figures 234-239):



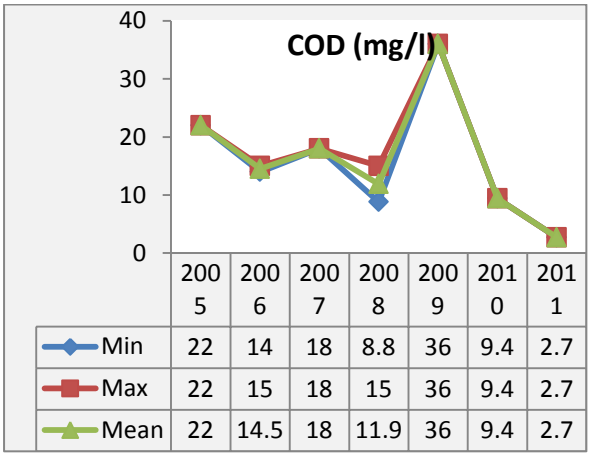
	2005	2006	2007	2008	2009	2010	2011
Min	11.5	5.4	9.3	5.8	7.5	6	8.6
Max	11.5	6.5	9.3	11	7.5	6	8.6
Mean	11.5	5.95	9.3	8.4	7.5	6	8.6

Figure 234



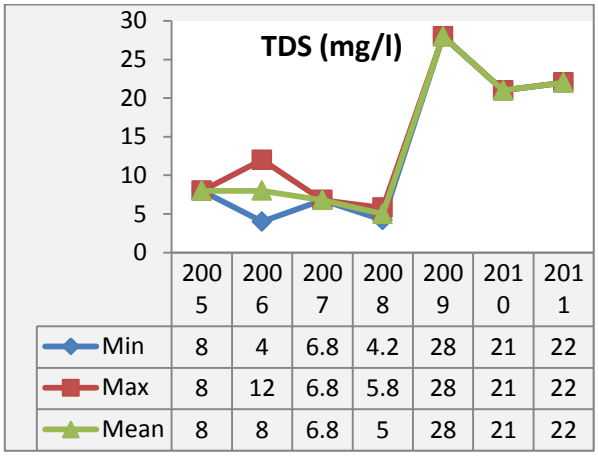
	2005	2006	2007	2008	2009	2010	2011
Min	1.3	0.6	1.6	1.2	2.7	1.1	1.3
Max	1.3	1	1.6	4.6	2.7	1.1	1.3
Mean	1.3	0.8	1.6	2.9	2.7	1.1	1.3

Figure 235



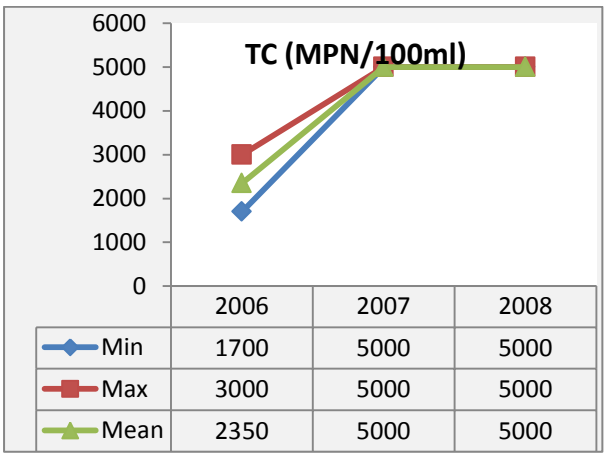
	2005	2006	2007	2008	2009	2010	2011
Min	22	14	18	8.8	36	9.4	2.7
Max	22	15	18	15	36	9.4	2.7
Mean	22	14.5	18	11.9	36	9.4	2.7

Figure 236



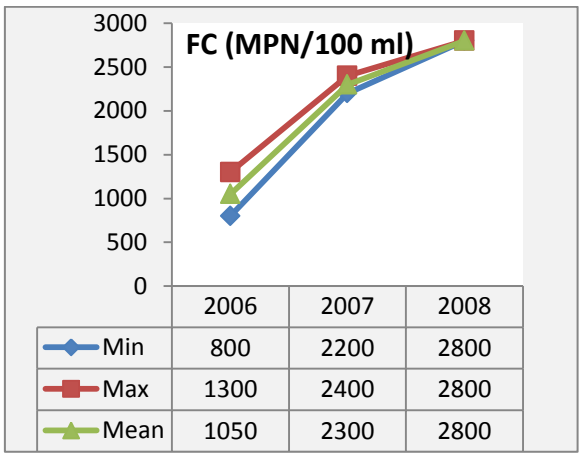
	2005	2006	2007	2008	2009	2010	2011
Min	8	4	6.8	4.2	28	21	22
Max	8	12	6.8	5.8	28	21	22
Mean	8	8	6.8	5	28	21	22

Figure 237



	2006	2007	2008
Min	1700	5000	5000
Max	3000	5000	5000
Mean	2350	5000	5000

Figure 238



	2006	2007	2008
Min	800	2200	2800
Max	1300	2400	2800
Mean	1050	2300	2800

Figure 239

Close examination of figures 214 to 219 shows that:

DO concentration ranges between 5.4 mg/l and 11.5 mg/l during year 2006 and 2005 respectively. BOD concentration ranges between 0.6 mg/l and 4.6 mg/l during year 2006 and 2008 respectively. COD concentration ranges between 2.7 mg/l and 36.0 mg/l during year 2011 and 2009. TDS concentration ranges between 4.0 mg/l and 28.0 mg/l during year 2006 and 2009. TC concentration ranges between 1700 MPN/100 ml and 5000 MPN/100 ml during year 2006 and 2007/2008 respectively. FC count ranges between 800 MPN/100 ml and 2800 MPN/100 ml in year 2006 and 2008 respectively.

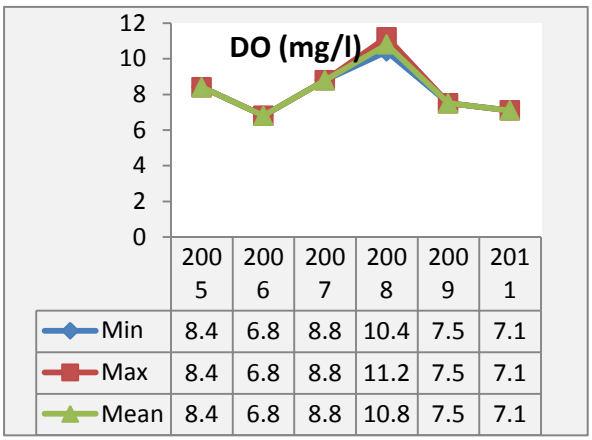
7.21 Water Quality of River Bhima at Takli, Solapur (Maharashtra)

Water Quality of River Bhima at Takli, Solapur (Maharashtra) is monitored for year 2005-11 having 09 Number of observations at the interstate boundary of Maharashtra and Karnataka .

Summary of Observations:

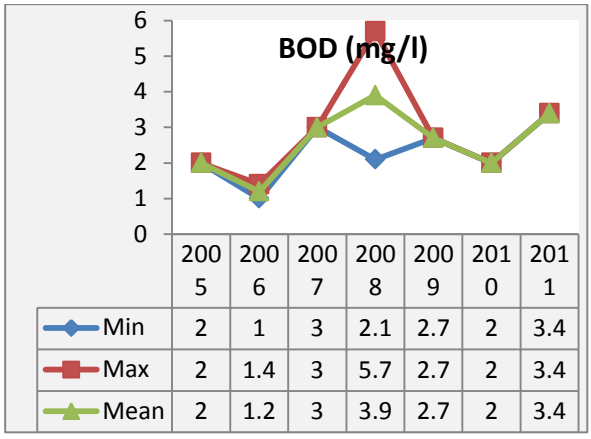
Year	2005	2006	2007	2008	2009	2010	2011	Total
Observations	1	2	1	2	1	1	1	9

Water Quality of River Bhima at Takli, Solapur (Maharashtra) during 2005-2011 is depicted in graphs (from figures 240-245):



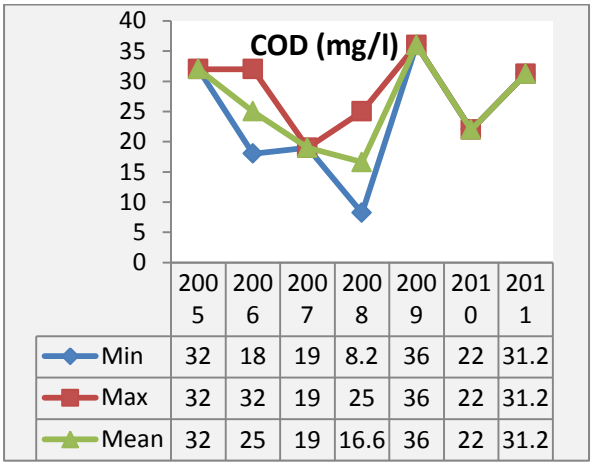
	2005	2006	2007	2008	2009	2011
Min	8.4	6.8	8.8	10.4	7.5	7.1
Max	8.4	6.8	8.8	11.2	7.5	7.1
Mean	8.4	6.8	8.8	10.8	7.5	7.1

Figure 240



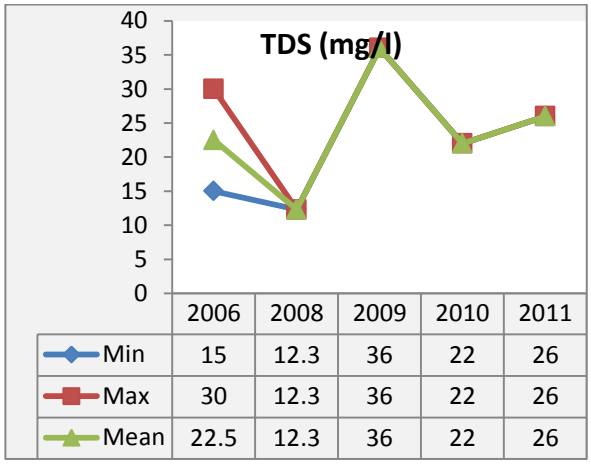
	2005	2006	2007	2008	2009	2010	2011
Min	2	1	3	2.1	2.7	2	3.4
Max	2	1.4	3	5.7	2.7	2	3.4
Mean	2	1.2	3	3.9	2.7	2	3.4

Figure 241



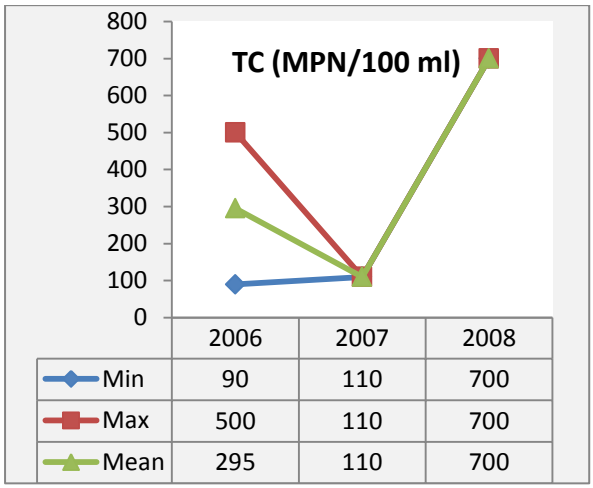
	2005	2006	2007	2008	2009	2010	2011
Min	32	18	19	8.2	36	22	31.2
Max	32	32	19	25	36	22	31.2
Mean	32	25	19	16.6	36	22	31.2

Figure 242



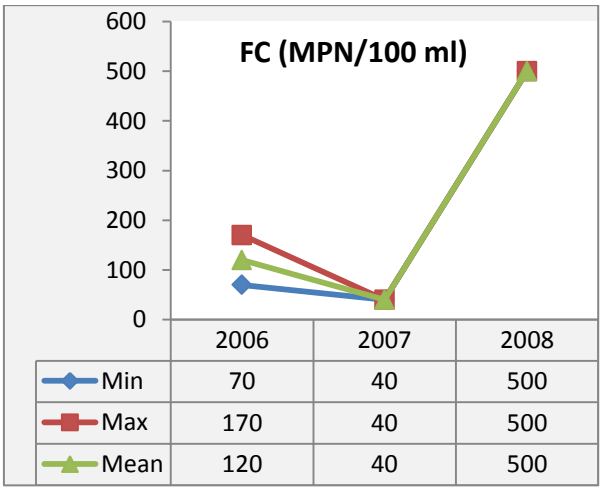
	2006	2008	2009	2010	2011
Min	15	12.3	36	22	26
Max	30	12.3	36	22	26
Mean	22.5	12.3	36	22	26

Figure 243



	2006	2007	2008
Min	90	110	700
Max	500	110	700
Mean	295	110	700

Figure 244



	2006	2007	2008
Min	70	40	500
Max	170	40	500
Mean	120	40	500

Figure 245

Close examination of figures 240 to 245 shows that:

DO concentration ranges between 6.8 mg/l and 11.2 mg/l during year 2006 and 2008 respectively. BOD concentration ranges between 1.0 mg/l and 5.7 mg/l during year 2006 and 2008 respectively. COD concentration ranges between 8.2 mg/l and 36.0 mg/l during year 2008 and 2009 respectively. TDS concentration ranges between 12.3 mg/l and 36.0 mg/l during year 2008 and 2009 respectively. TC concentration ranges between 90 MPN/100 ml and 700 MPN/100 ml during year 2006 and 2008 respectively. FC concentration ranges between 40 MPN/100 ml and 500 MPN/100 ml during year 2007 and 2008.

7.22 Water Quality of River Mahi at Kadana Dam (Gujarat)

Water Quality of River Mahi at Kadana Dam (Gujarat) is monitored for year 2005-12 having 08 Number of observations at the interstate boundary of Gujarat and Rajasthan.

Summary of Observations:

Year	2005	2006	2007	2008	2012	Total
Observations	1	3	1	2	1	8

Water Quality of River Mahi at Kadana Dam (Gujarat) during 2005-2012 is depicted in graphs (from figures 246-251):

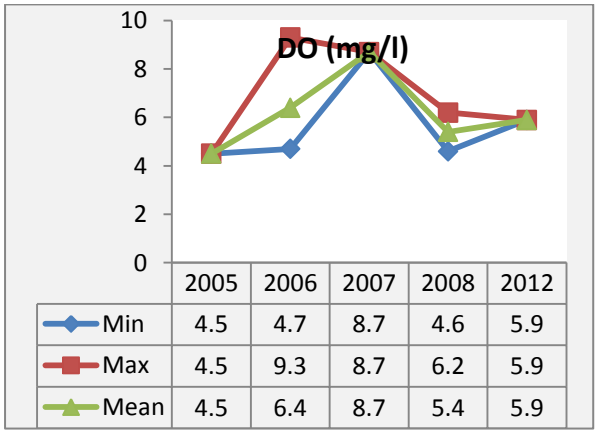


Figure 246

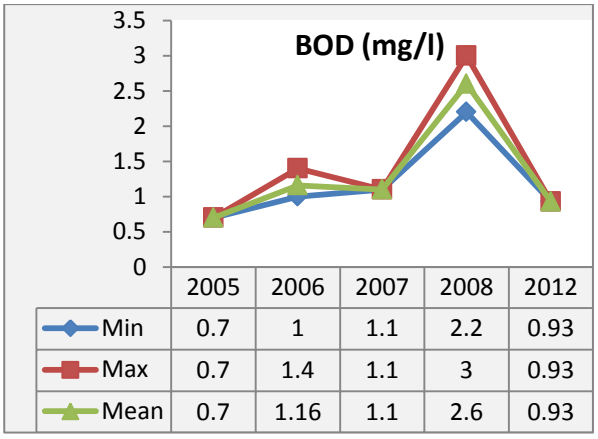


Figure 247

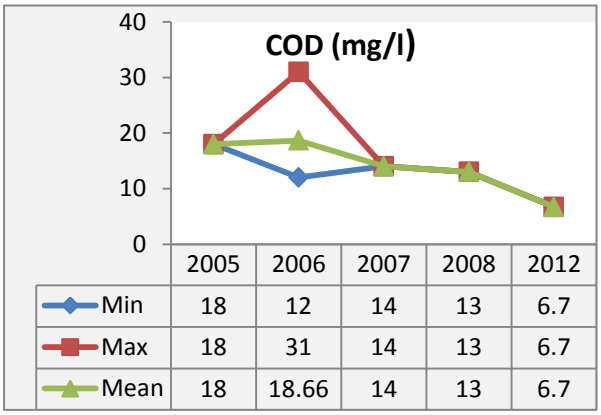


Figure 248

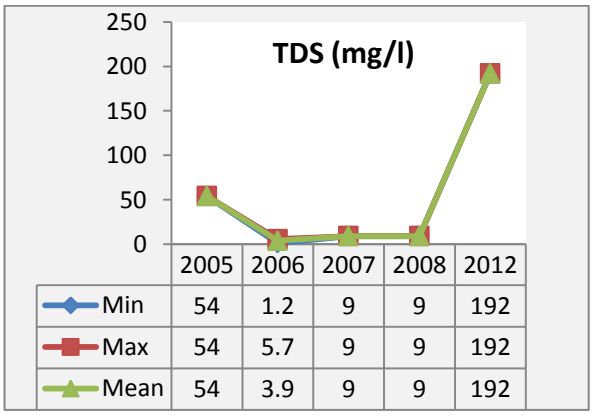


Figure 249

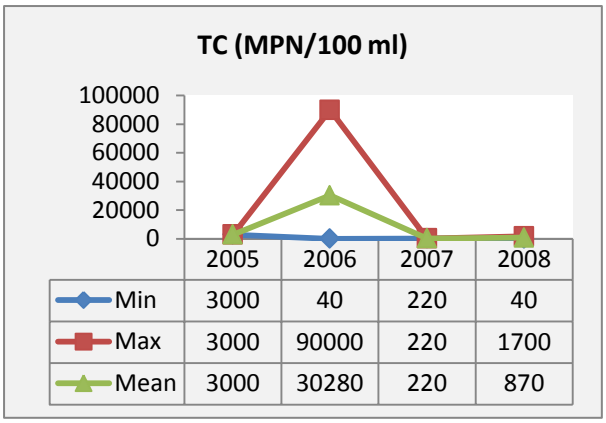


Figure 250

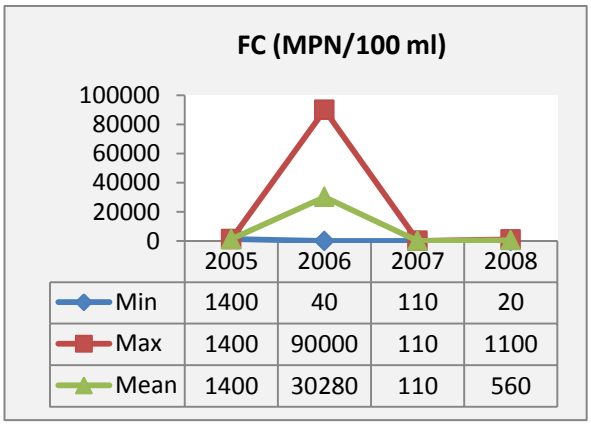


Figure 251

Close examination of figures 246 to 251 shows that:

DO concentration ranges between 4.5 mg/l and 9.3 mg/l during year 2005 and 2006 respectively. BOD concentration ranges between 0.7 mg/l and 3.0 mg/l during year 2005 and 2008 respectively. COD concentration ranges between 12 mg/l and 31 mg/l during the year 2006. TDS concentration ranges between 9 mg/l and 192 mg/ during year 2007/2008 and 2012. TC concentration ranges between 40 MPN/100 ml and 90000 MPN/100 ml during the year 2006. FC concentration ranges between 20 MPN/100 ml and 90000 MPN/100 ml in the year 2006.

7.23 River Tapi at Nizhar (Gujarat)

Water Quality of River Tapi at Nizhar (Gujarat) is monitored for year 2006-12 having 05 Number of observations at the interstate boundary of Gujarat and Maharashtra.

Year	2006	2008	2012	Total
Observations	2	2	1	5

Water Quality of River Tapi at Nizhar (Gujarat) during 2006-2012 is depicted in graphs (from figures 252-255):

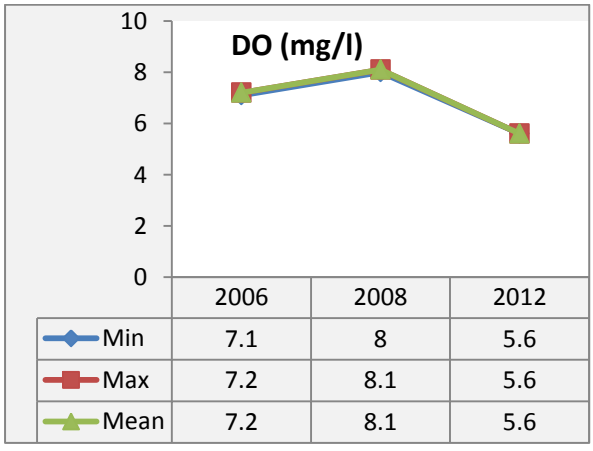


Figure 252

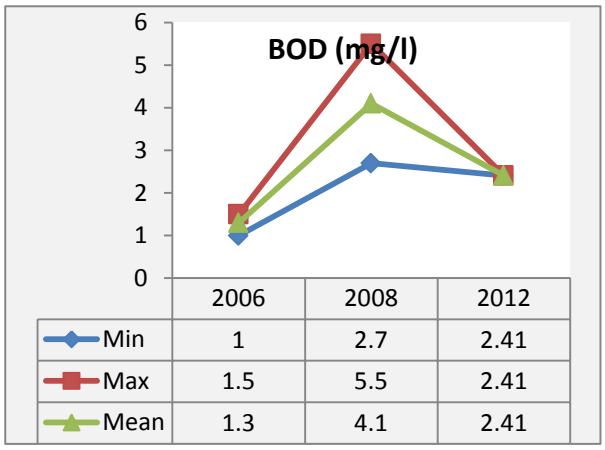


Figure 253

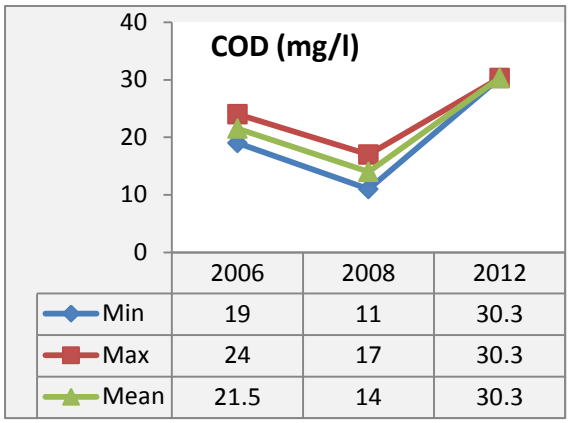


Figure 254

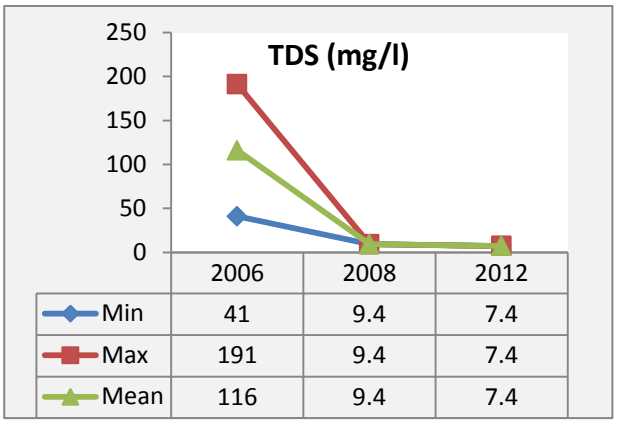


Figure 255

Close examination of figures 252 to 255 shows that:

Dissolved Oxygen ranges between 5.6 mg/l and 8.1 during year 2012 and 2008 respectively. BOD concentration ranges between 1.0 mg/l and 5.5 mg/l during year 2006 and 2008 respectively. COD concentration ranges between 11 mg/l and 30.3 mg/l during year 2008 and year 2012 respectively. TDS concentration ranges between 7.4 mg/l and 191 mg/l during year 2012 and 2006 respectively.

7.24 River Tapi at Prakasha (Maharashtra)

Water Quality of River Tapi at Prakasha (Maharashtra) is monitored for year 2006-12 having 05 Number of observations at the interstate boundary of Maharashtra and Gujarat.

Year	2006	2008	2011	2012	Total
Observations	2	1	1	1	5

Water Quality of River Tapi at Prakasha (Maharashtra) during 2006-2012 is depicted in graphs (from figures 256-260):

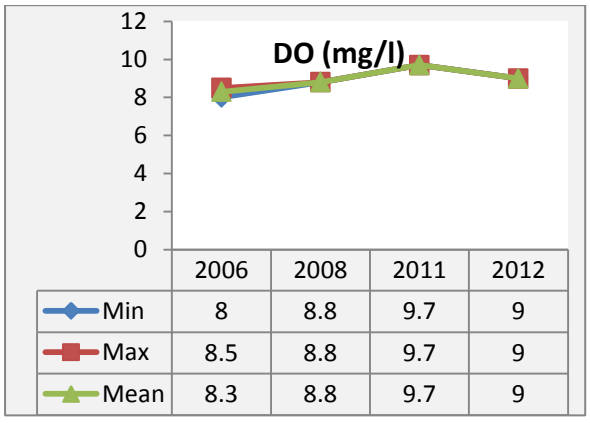


Figure 256

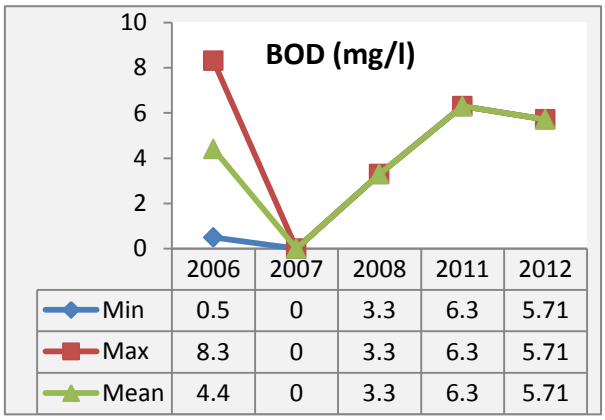


Figure 257

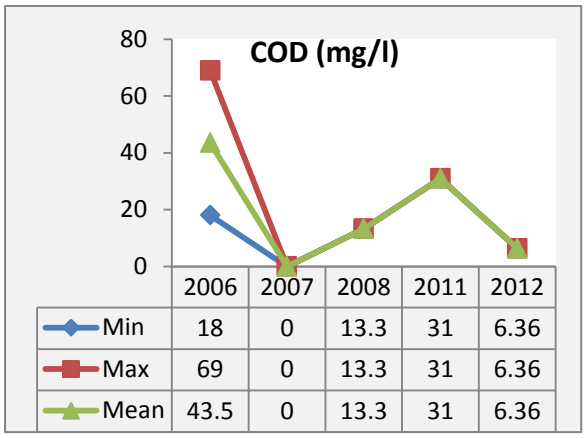


Figure 258

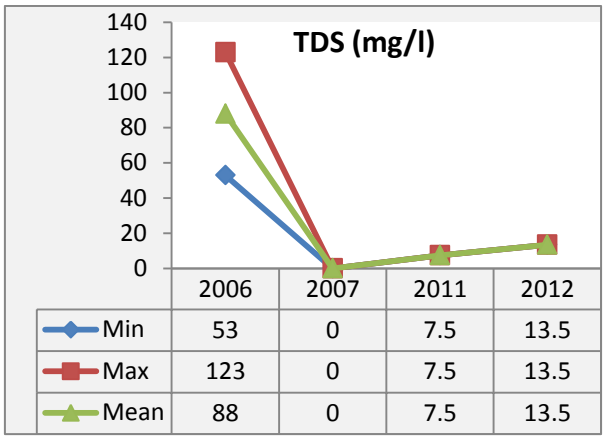


Figure 259

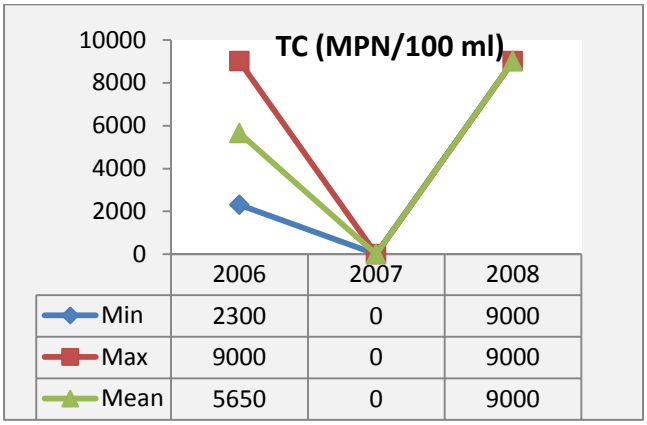


Figure 260

Close examination of figures 256 to 260 shows that:

DO concentration ranges between is 8.0 mg/l and 9.7 mg/l during 2006 and 2011 respectively. to the maximum prescribed limit of 3.0 mg/l. Concentration of BOD ranges between 0.5 mg/l and 8.3 mg/l during 2007 and 2012 respectively. COD Concentration ranges between 18 mg/l and 69 mg/l. TDS ranges between 7.5mg/l and 123 mg/l. TC count ranges between 2300 MPN/100 ml and 9000MPN/100 ml.

7.25 River Tapi at Ajnad Shahjani (Maharashtra):

Water Quality of River Tapi at Ajnad Shahjani (Maharashtra) is monitored for year 2006-12 having 06 Number of observations at the interstate boundary of Gujarat and Maharashtra.

Year	2006	2007	2008	2011	2012	Total
Observations	2	1	1	1	1	6

Water Quality of River Tapi at Ajnad (Maharashtra) during 2006-2012 is depicted in graphs (from figures 261-264):

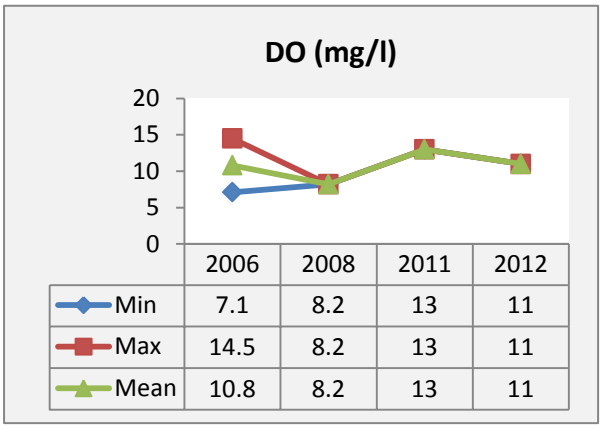


Figure 261

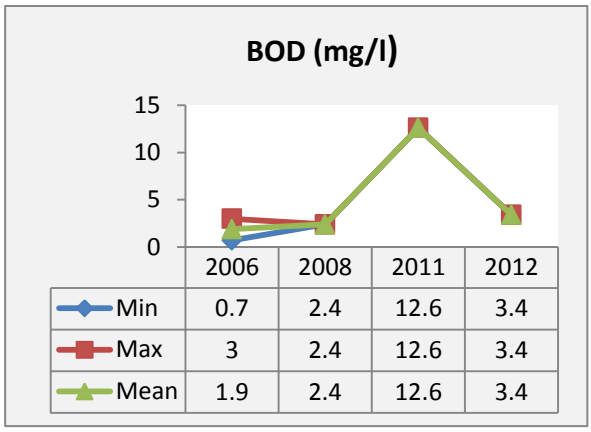


Figure 262

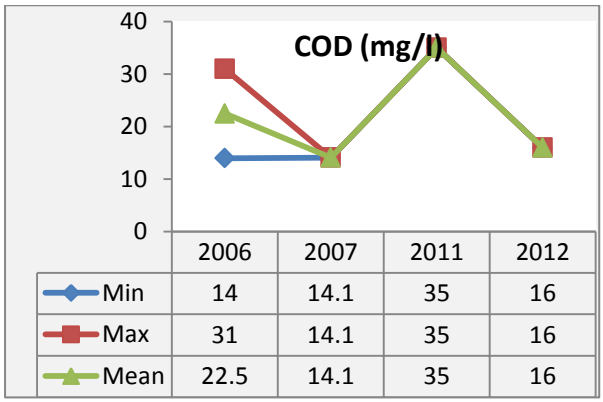


Figure 263

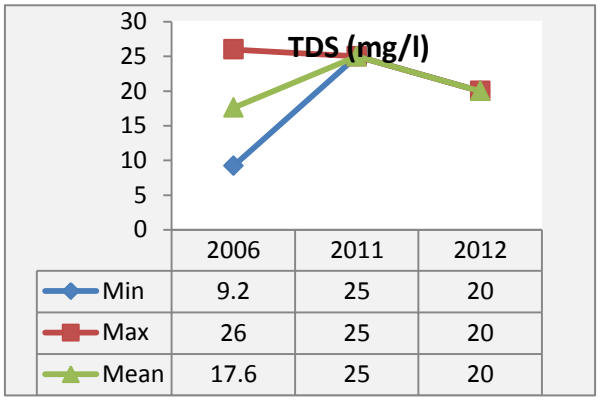


Figure 264

Close examination of figures 261 to 264 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l. DO concentration ranges between 7.1 mg/l and14.5 mg/l in the same year i.e. 2006. BOD concentration ranges between 0.7 mg/l and 12.6 mg/l during year 2006 & 2011 respectively. COD ranges between 14 mg/l and 35 mg/l during year 2006 & 2011 respectively. TDS ranges between 9.2 mg/l and 26 mg/l in year 2006.

7.26 River Narmada at Navagam (Gujarat)

Water Quality of River Narmada at Navagam (Gujarat) is monitored for year 2006-12 having 08 Number of observations at the interstate boundary of Gujarat and M.P.

Summary of Observation

Year	2006	2007	2008	2011	2012	Total
Observations	3	1	2	1	1	8

Water Quality of River Narmada at Navagam (Gujarat) during 2006-2012 is depicted in graphs (from figures 265-268):

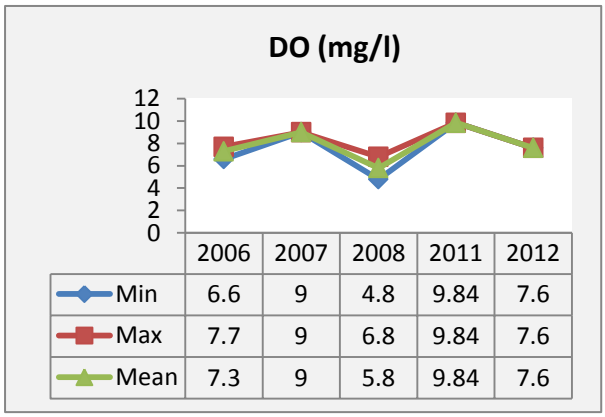


Figure 265

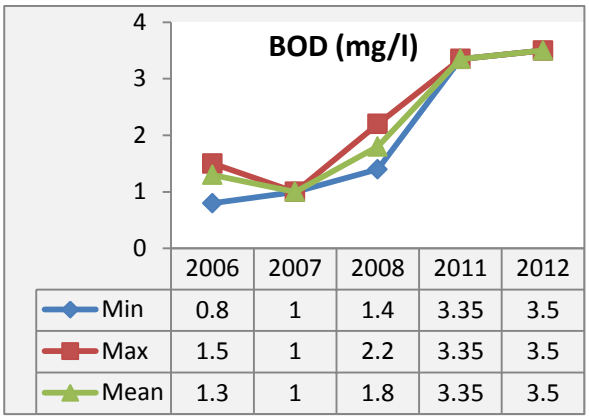


Figure 266

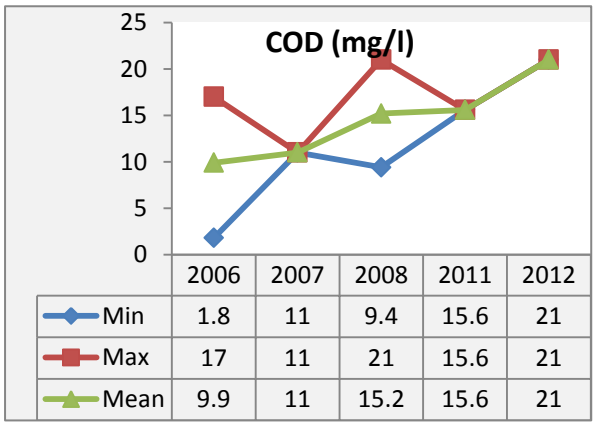


Figure 267

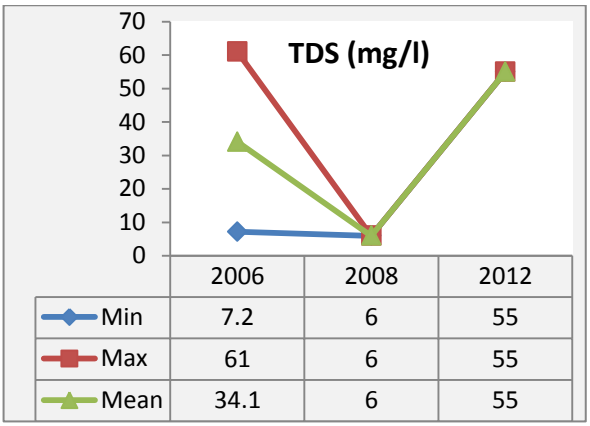


Figure 268

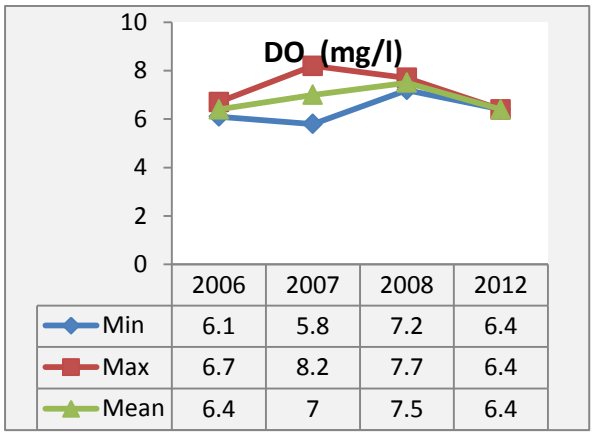
Close examination of figures 265 to 268 shows that during:
DO concentration ranges between 4.8 mg/l and 9.84 mg/l during year 2008 and 2011 respectively. BOD concentration ranges between 0.8 mg/l and 3.5 mg/l during year 2006 and 2011 respectively. COD concentration ranges between 1.8 mg/l and 21 mg/l during year 2006 and 2008 respectively. TDS concentration ranges between 6.0 mg/l and 61.0 mg/l during year 2008 and 2006 respectively.

7.27 River Wainganga at Bapera, Bhandara (Maharashtra)

Water Quality of River Wainganga at Bapera, Bhandara (Maharashtra) is monitored for year 2006-12 having 07 Number of observations at the interstate boundary of Maharashtra and M.P.

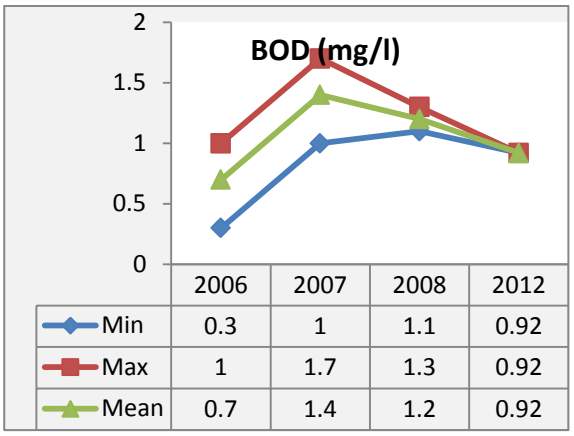
Year	**2006**	**2007**	**2008**	**2012**	**Total**
Observations	2	2	2	1	7

Water Quality of River Wainganga at Bapera, Bhandara (Maharashtra) during 2006-2012 is depicted in graphs (from figures 269-274):



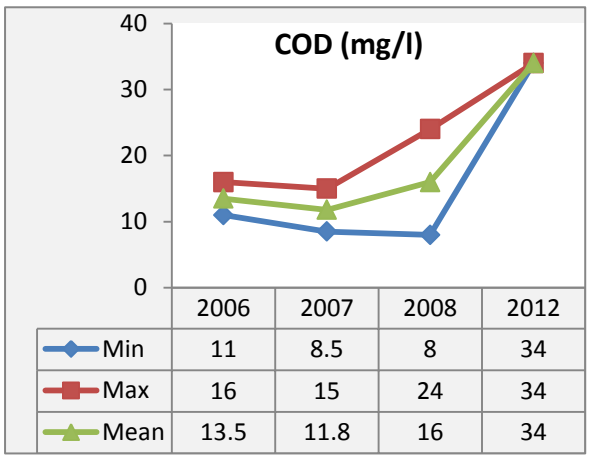
	2006	2007	2008	2012
Min	6.1	5.8	7.2	6.4
Max	6.7	8.2	7.7	6.4
Mean	6.4	7	7.5	6.4

Figure 269



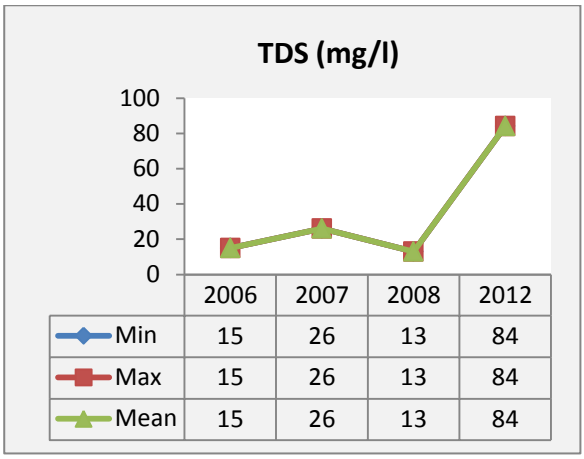
	2006	2007	2008	2012
Min	0.3	1	1.1	0.92
Max	1	1.7	1.3	0.92
Mean	0.7	1.4	1.2	0.92

Figure 270



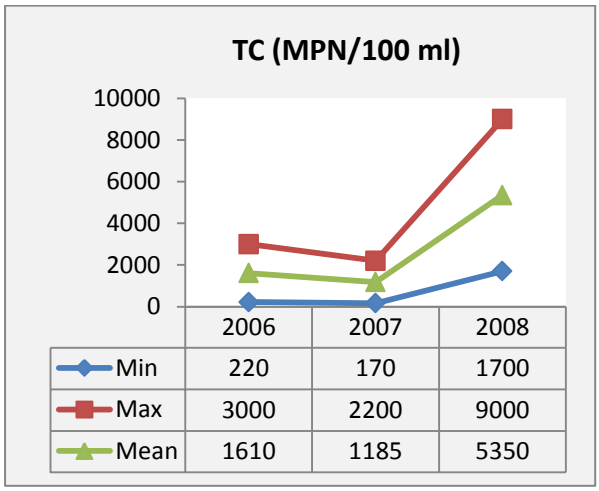
	2006	2007	2008	2012
Min	11	8.5	8	34
Max	16	15	24	34
Mean	13.5	11.8	16	34

Figure 271



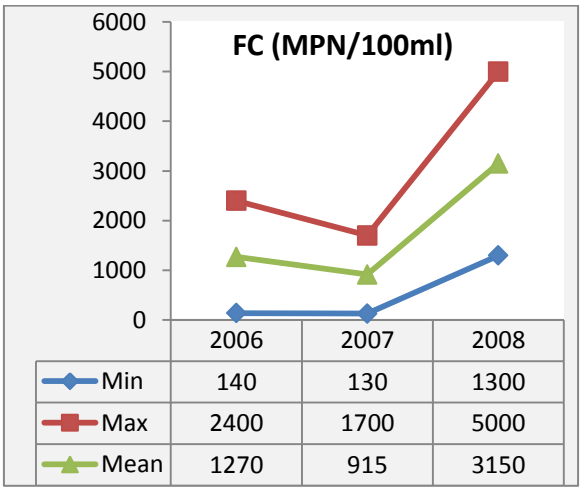
	2006	2007	2008	2012
Min	15	26	13	84
Max	15	26	13	84
Mean	15	26	13	84

Figure 272



	2006	2007	2008
Min	220	170	1700
Max	3000	2200	9000
Mean	1610	1185	5350

Figure 273



	2006	2007	2008
Min	140	130	1300
Max	2400	1700	5000
Mean	1270	915	3150

Figure 274

Close examination of figures 269 to 274 shows that:

DO concentration ranges between 5.8 mg/l and 8.2 mg/l during 2008 and 2007 respectively. BOD concentration ranges between 0.3 mg/l and 1.7mg/l during the year 2007. COD concentration ranges between 8.0 mg/l and 34 mg/l. TDS concentration ranges between 13 mg/l in year 2008 and 84 mg/l in year 2012. TC count ranges between 170 MPN/100ml and 9000 MPN/100ml during year 2007 and 2008 respectively. FC count ranges between 130 MPN/100ml and 5000 MPN/100ml during in year 2007 and 2008 respectively.

7.28 Water Quality of River Damanganga at Jarry Causeway D/S of CETP discharge

Water Quality of River Damanganga at Jarry Causeway D/S of CETP discharge is monitored for year 2006-12 having 07 Number of observations at the interstate boundary of Maharashtra and M.P.

Summary of observations:

Year	2007	2008	2009	2010	2011	2012	2103	Total
Observation	3	2	2	2	4	4	1	18

Water Quality of River Damanganga at Jerry Causeway D/S of CETP discharge during 2007-2013 is depicted in graphs (from figures 275-278):

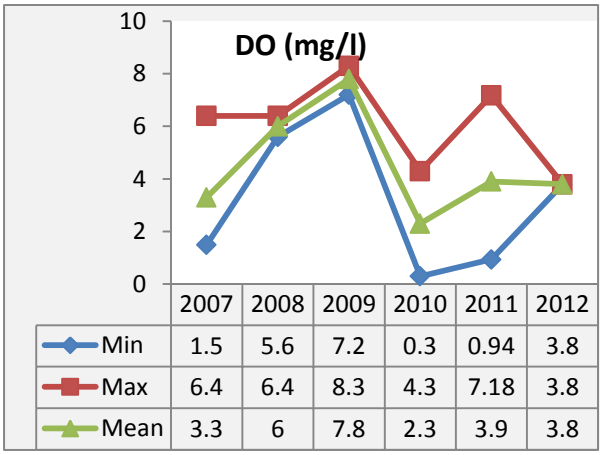


Figure 275

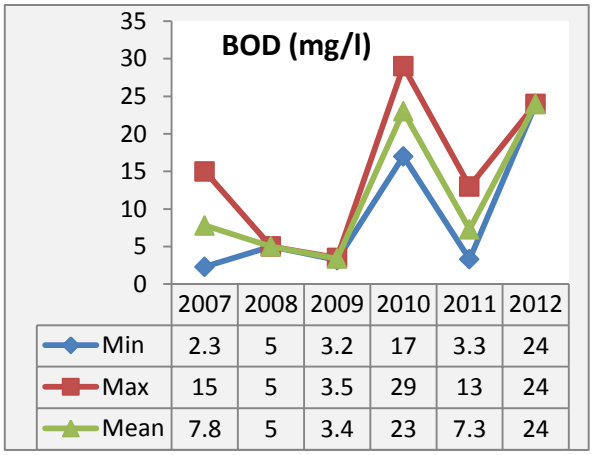


Figure 276

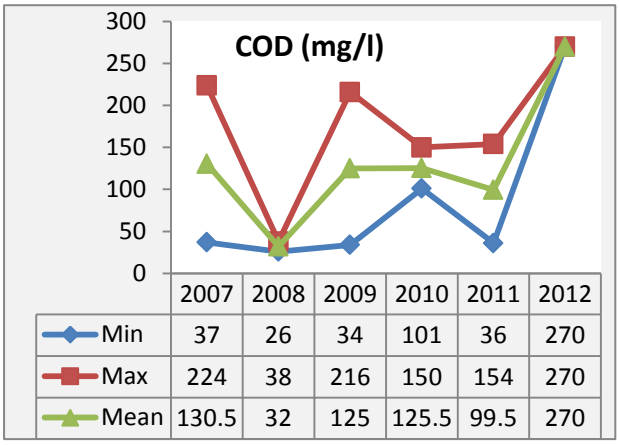


Figure 277

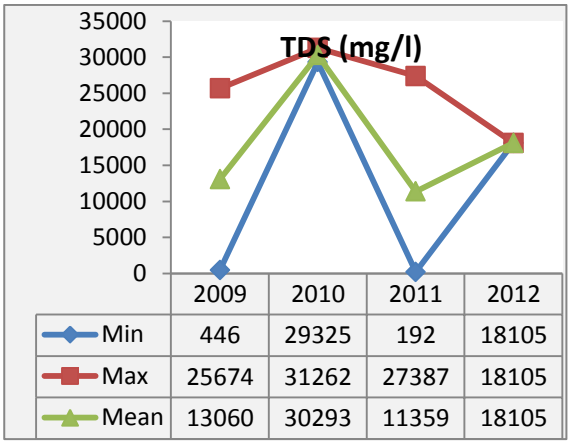


Figure 278

Close examination of figure 275 to 278 shows that:
DO concentration ranges between 0.3 mg/l and 8.47 mg/l during year 2010 and 2012 respectively. BOD concentration ranges between 1.41 mg/l and 29 mg/l in year 2012. in year 2010. Minimum COD concentration was observed 26 mg/l in year 2008 whereas maximum COD concentration was observed 270 mg/l in year 2012. Minimum TDS concentration was observed 192 mg/l in year 2011 whereas Maximum TDS concentration was observed31262 mg/l in year 2010.

7.29 River Damanganga at U/S of CETP discharge GIDC Weir

Water Quality of River Damanganga at U/S of CETP discharge GIDC Weir is monitored for year 2006-12 having 07 Number of observations at the interstate boundary of Maharashtra and M.P.

Year	2007	2008	2009	2010	2011	2012	2013	Total
Observation	3	2	2	2	4	4	1	18

Water Quality of River Damanganga at U/S of CETP discharge GIDC Weir during 2007-2013 is depicted in graphs (from figures 279-282):

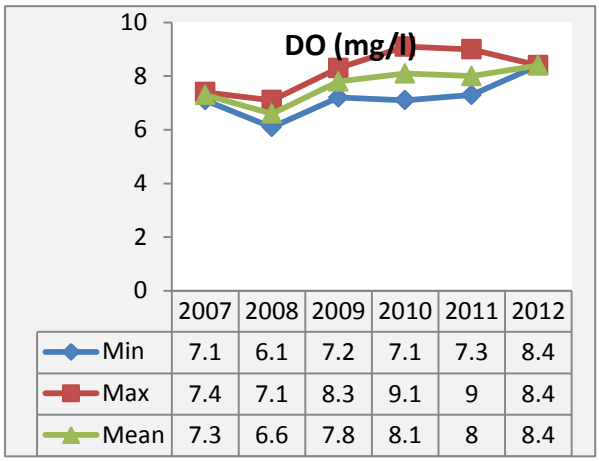


Figure 279

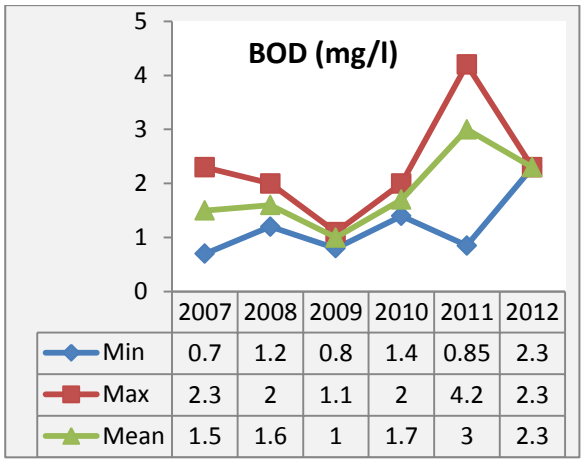


Figure 280

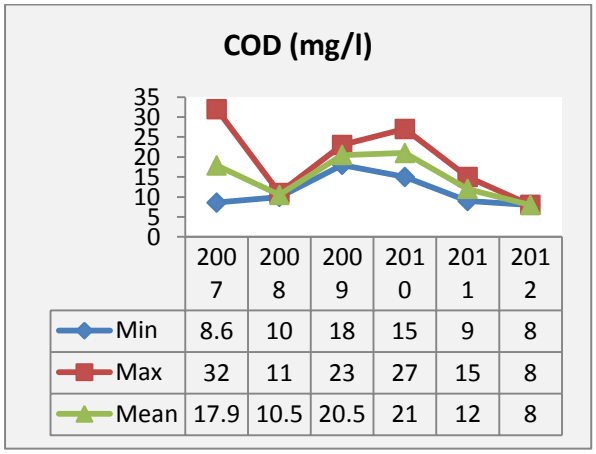


Figure 281

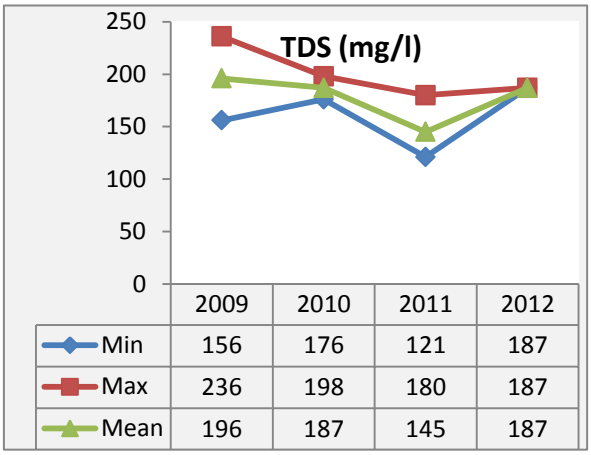


Figure 282

Close examination of figures 279 to 282 shows that:

DO concentration ranges between 6.1 mg/l and 9.1 mg/l during year 2008 and 2010 respectively. BOD concentration ranges between 0.7 mg/l and 4.2 mg/l during 2007 and 2011 respectively. COD concentration ranges between 4.3 mg/l and 32 mg/l between during 2007 and 2010 respectively. TDS concentration was observed 156 mg/l and 242 mg/l during 2011 and 2009 respectively.

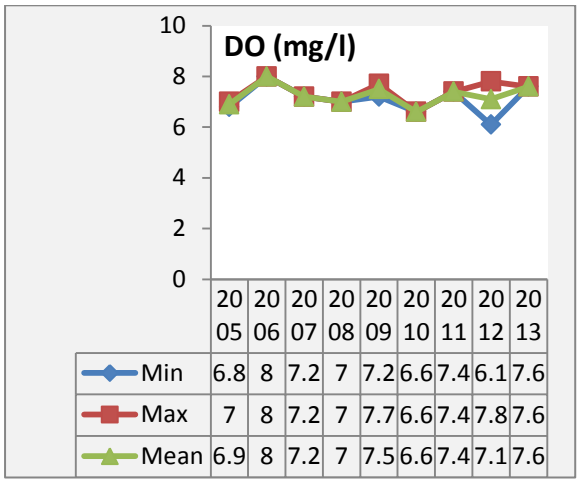
7.30 River Indravati at Nowrangpur (Orissa)

Water Quality of River Indravati at Nowrangpur (Orissa) is monitored for year 2005-13 having 14 Number of observations at the interstate boundary of Orissa and Chhattisgarh.

Summary of observation:

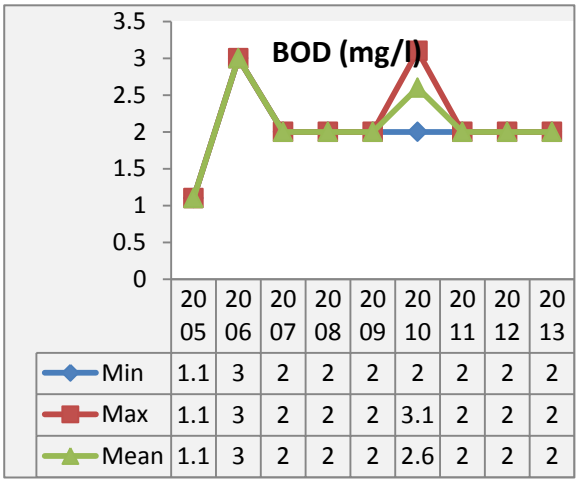
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	1	1	3	1	1	3	1	14

Water Quality of River Indravati at Nowrangpur (Orissa) during 2005-2013 is depicted in graphs (from figures 283-288):



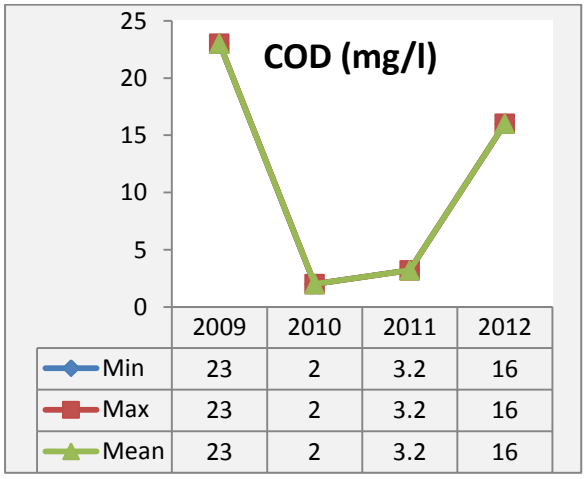
	2005	2006	2007	2008	2009	2010	2011	2012	2013
Min	6.8	8	7.2	7	7.2	6.6	7.4	6.1	7.6
Max	7	8	7.2	7	7.7	6.6	7.4	7.8	7.6
Mean	6.9	8	7.2	7	7.5	6.6	7.4	7.1	7.6

Figure 283



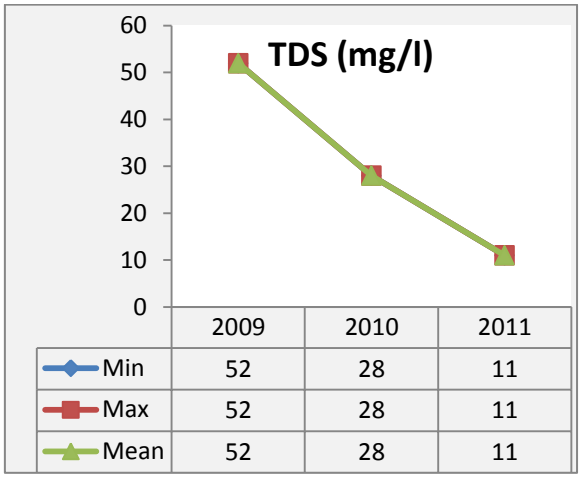
	2005	2006	2007	2008	2009	2010	2011	2012	2013
Min	1.1	3	2	2	2	2	2	2	2
Max	1.1	3	2	2	2	3.1	2	2	2
Mean	1.1	3	2	2	2	2.6	2	2	2

Figure 284



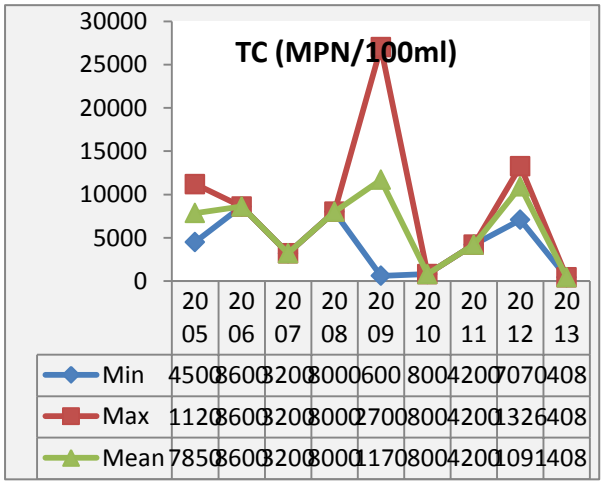
	2009	2010	2011	2012
Min	23	2	3.2	16
Max	23	2	3.2	16
Mean	23	2	3.2	16

Figure 285



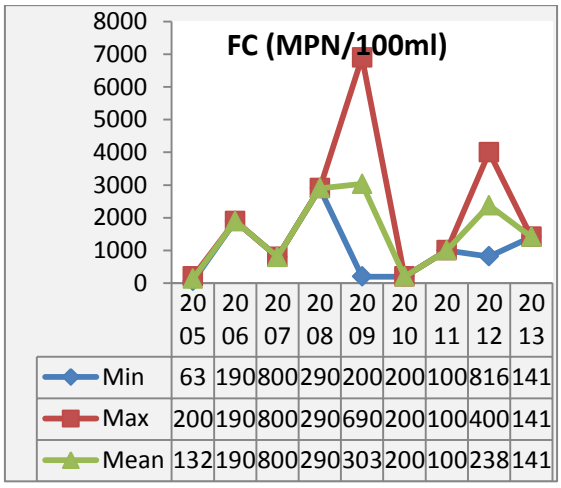
	2009	2010	2011
Min	52	28	11
Max	52	28	11
Mean	52	28	11

Figure 286



	2005	2006	2007	2008	2009	2010	2011	2012	2013
Min	4500	3600	3200	3000	600	800	4200	7070	408
Max	11200	3600	3200	3000	2700	800	4200	13264	408
Mean	7850	3600	3200	3000	1170	800	4200	10914	408

Figure 286



	2005	2006	2007	2008	2009	2010	2011	2012	2013
Min	63	190	800	290	200	200	100	816	141
Max	200	190	800	290	690	200	100	4000	141
Mean	132	190	800	290	303	200	100	2380	141

Figure 288

Close examination of figures 283 to 288 shows that:

DO concentration ranges between 6.1 mg/l and 8.0mg/l during year 2012 and 2006 respectively. BOD concentration ranges between ranges between 1.1 mg/l and 3.1 mg/l during 2005 and 2010 respectively. COD concentration ranges between 2mg/l and 23 mg/l during year 2010 and 2009 respectively. TDS ranges between 11 mg/l and 52mg/l during year 2011 and 2009 respectively. TC count ranges between 408 MPN/100 ml and 27000 MPN/100 ml during year 2013 and 2009 respectively. FC count ranges between 63 MPN/100 ml and 6900 MPN/100 ml during year 2005 and 2009 respectively.

7.31 Water Quality of River Mahanadi at Hirakund (Orissa)

Water Quality of Water Quality of River Mahanadi at Hirakund (Orissa) is monitored for year 2005-13 having 14 Number of observations at the interstate boundary of Orissa and Chhattisgarh .

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	1	1	3	1	1	3	1	14

Water Quality of River Mahanadi at Hirakund (Orissa) during 2005-2013 is depicted in graphs (from figures 289-294):

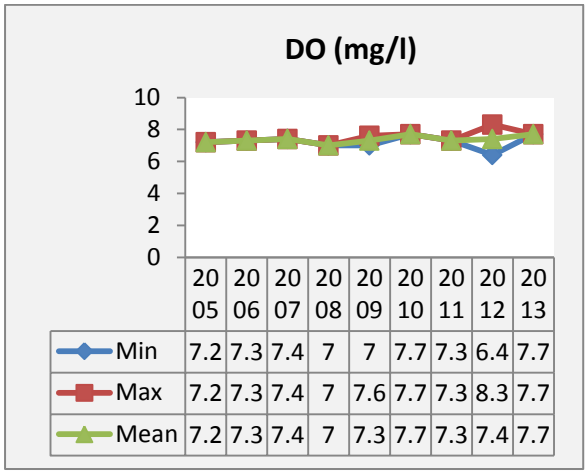


Figure 289

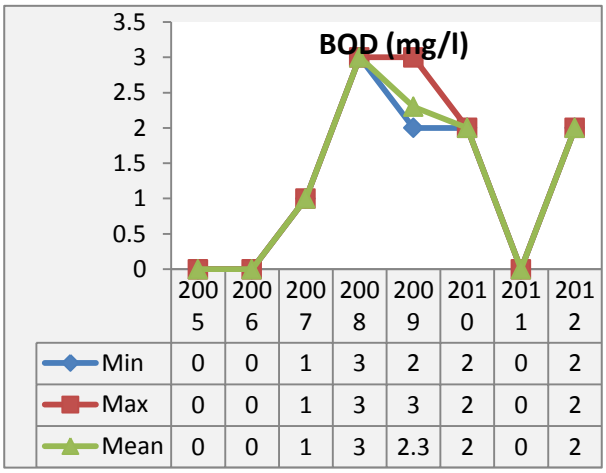


Figure 290

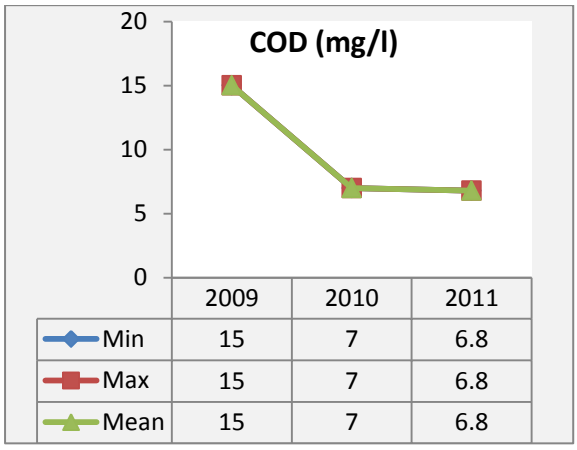


Figure 291

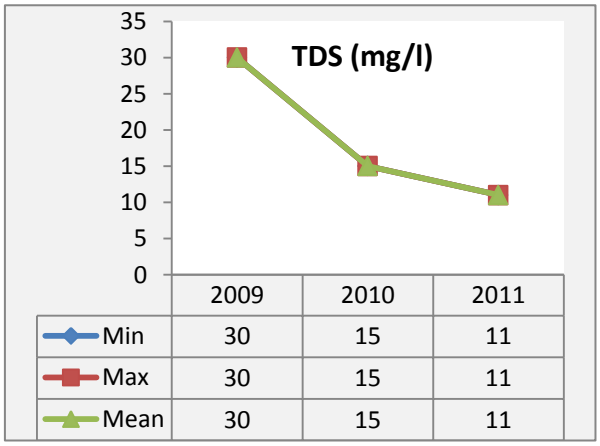


Figure 292

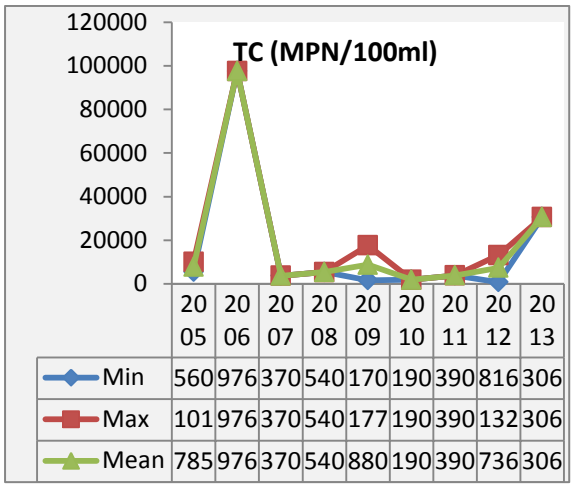


Figure 293

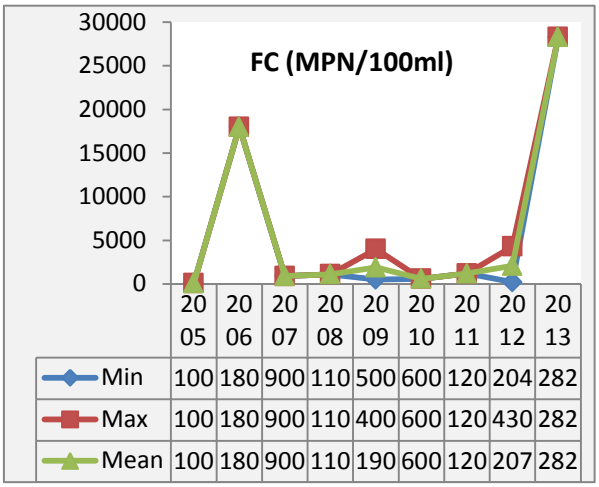


Figure 294

Close examination of figures 289 to 294 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l in each observation. Concentration of DO ranges between 6.4 mg/l and 7.7 mg/l during year 2012 and 2010 respectively. BOD concentration ranges between 0 mg/l and 3.0 mg/l during year 2005 and 2009 respectively. COD concentration ranges between 6.8 mg/l and 15 mg/l during 2011 and 2009 respectively. TDS ranges between 11 mg/l and 30mg/l during year 2011 and 2009 respectively. TC count ranges between 816 MPN/100ml and 97600 MPN/100 ml during year 2012 and 2006 respectively. FC count ranges between 100 MPN/100 ml and 28280 MPN/100 ml during year 2005 and 2013 respectively.

7.32 River Churni at Bijoypur (West Bengal)

Water Quality of Water Quality of River Churni at Bijoypur (West Bengal) is monitored for year 2005-13 having 17 Number of observations at the boundary of West Bengal and Bangladesh .

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	1	2	2	1	3	1	3	3	1	17

Water Quality of River Churni at Bijoypur (West Bengal) during 2005-2013 is depicted in graphs (from figures 295-300):

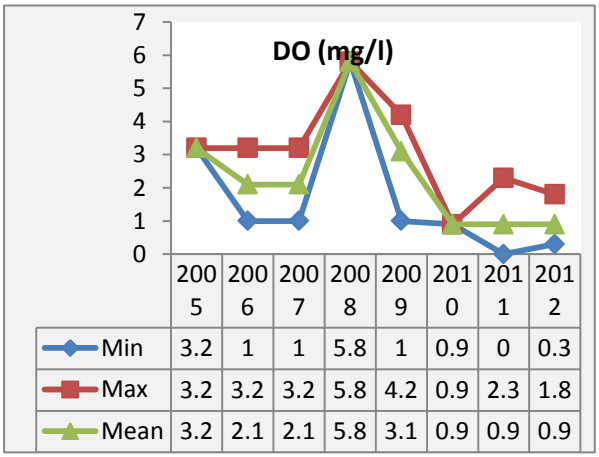


Figure 295

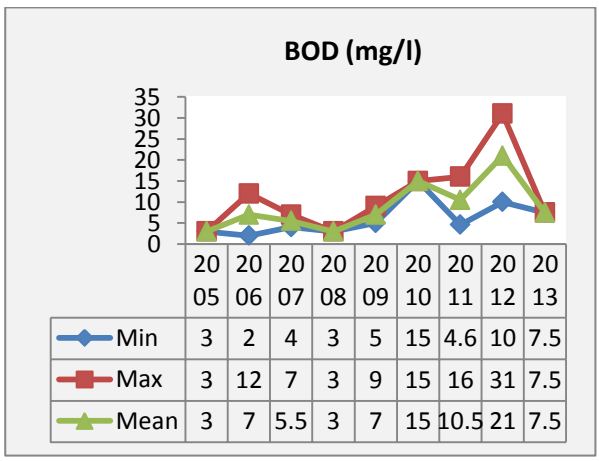


Figure 296

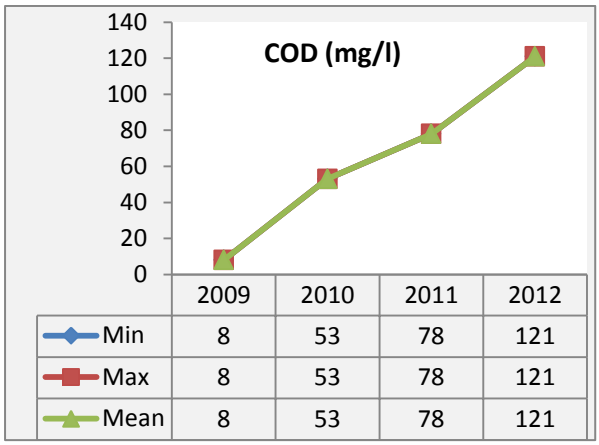


Figure 297

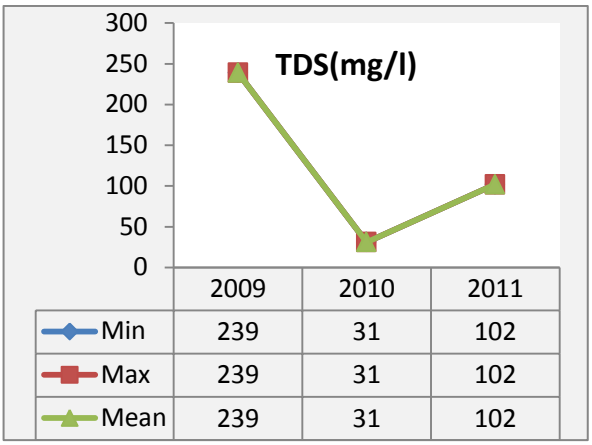


Figure 298

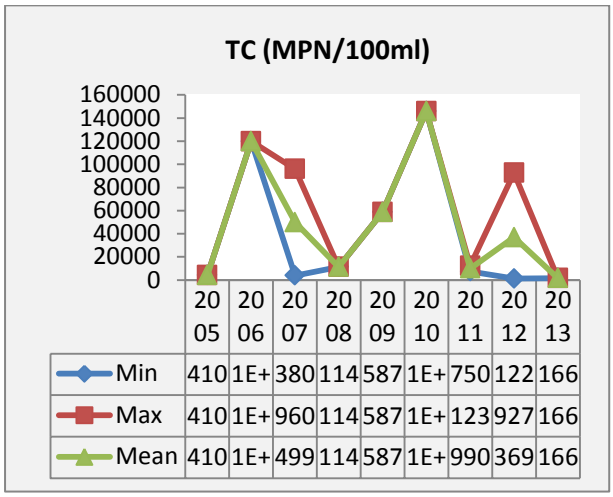


Figure 299

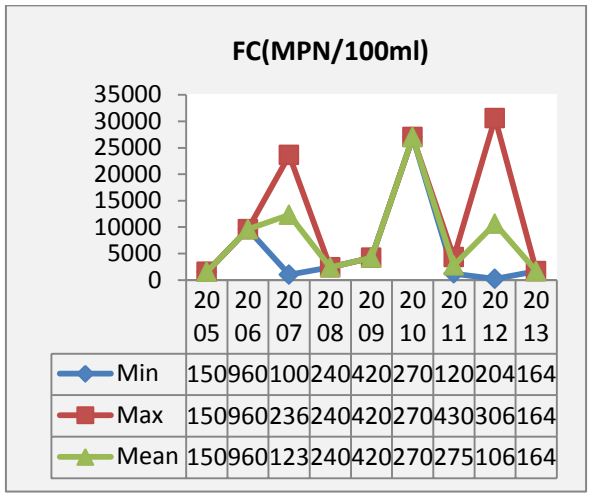


Figure 300

Close examination of figures 283 to 288 shows that:

DO concentration ranges between 0 mg/l and 5.8 during year 2011 and year 2010 respectively. BOD concentration ranges between 2 mg/l and 31.0 mg/l during year 2006 and 2012 respectively. COD concentration ranges between 8 mg/l and 121 in year 2009. TDS concentration ranges between 31 mg/l and 239 mg/l during year 2010 and 2009 respectively. TC count ranges between 1224 MPN/100 ml and 146000 MPN/100 ml during the year 2012. FC count ranges between 204 MPN/100 ml and 30600 MPN/100 ml during the year 2012.

7.33Water Quality of River Damodar

Water Quality of River Damodar is monitored at two locations: (i) Sindri (Jharkhand) and Dishergarh (West Bengal) at interstate boundaries of West Bengal and Jharkhand.

7.33.1 River Damodar at Sindri (Jharkhand)

Water Quality of River Damodar at Sindri (Jharkhand) is monitored at is monitored for 2005-13 having 17 Number of observations at the boundary of West Bengal and Jharkhand.

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	2	1	3	1	3	3	1	17

Water Quality of River River Damodar at Sindri (Jharkhand) during 2005-2013 is depicted in graphs (from figures 301-304):

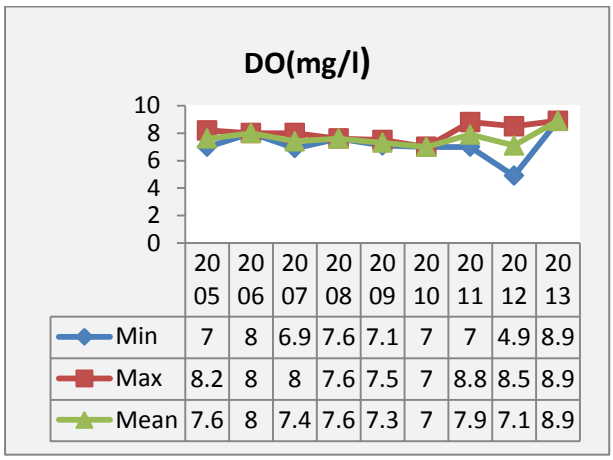


Figure 301

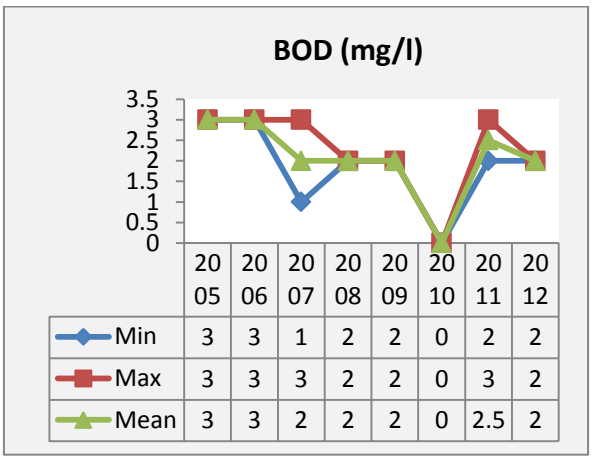


Figure 302

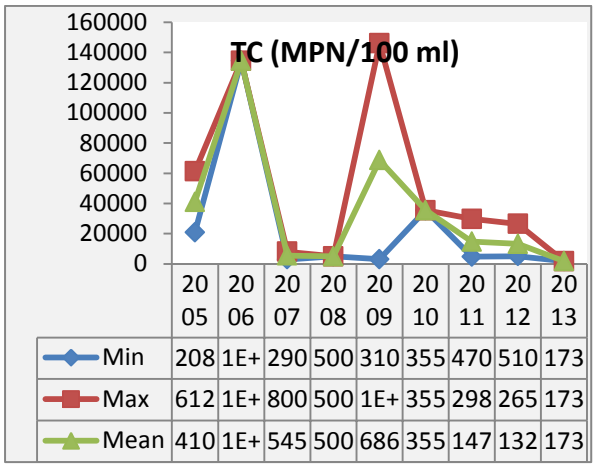


Figure 303

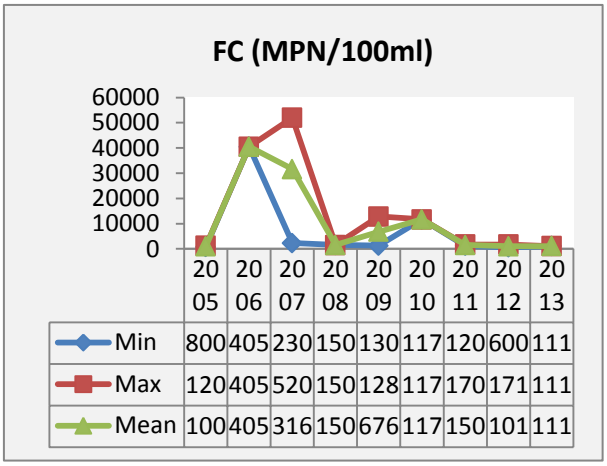


Figure 304

Close examination of figures 301 to 304 shows that:

DO concentration ranges between 4.9 mg/l and 8.9 mg/l during year 2012 and 2013 respectively. BOD concentration ranges between 0 mg/l and 3.0 mg/l. TC count ranges between 1734 MPN/100 ml and 61200 MPN/100 ml during year 2013 and 2005 respectively. FC count ranges between 600 MPN/100 ml and 52000 MPN/100 ml during year 2012and 2007 respectively.

7.33.2 Water Quality of River Damodar at Dishergarh (West Bengal)

Water Quality of River Damodar at at Dishergarh (West Bengal) is monitored for 2005-13 having 17 Number of observations at the boundary of West Bengal and Jharkhand.

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	2	1	3	1	3	3	1	17

Water Quality of River Damodar at Dishergarh (West Bengal) during 2005-2013 is depicted in graphs (from figures 305-309):

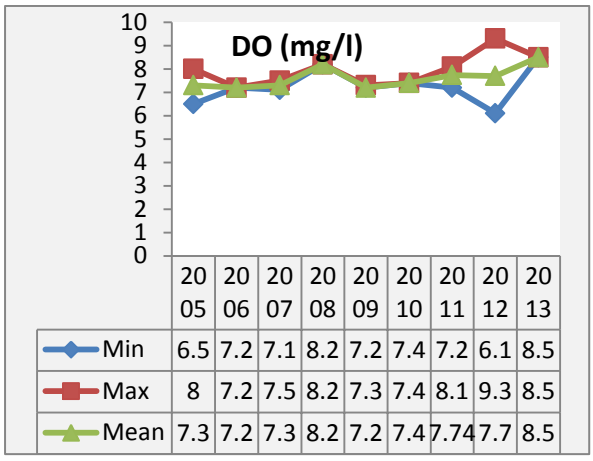


Figure 305

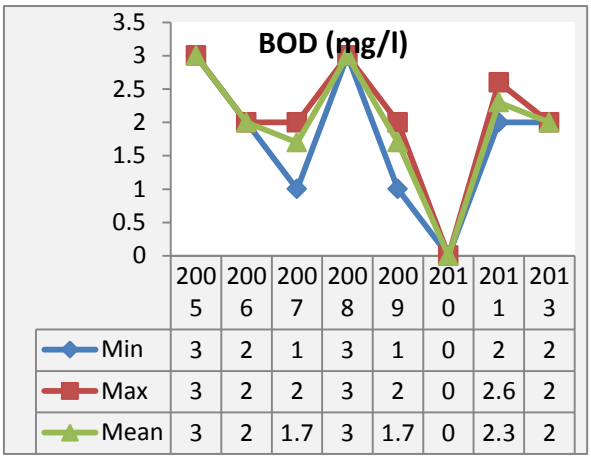


Figure 306

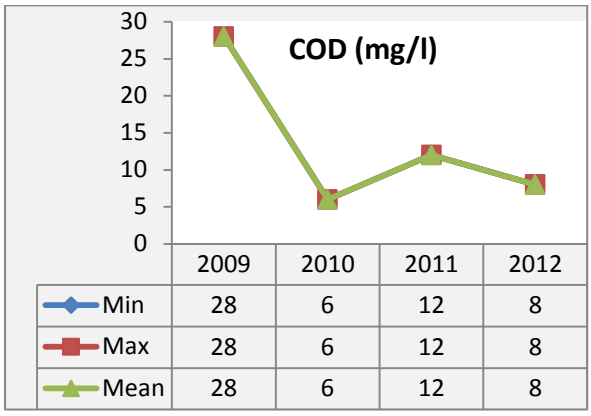


Figure 307

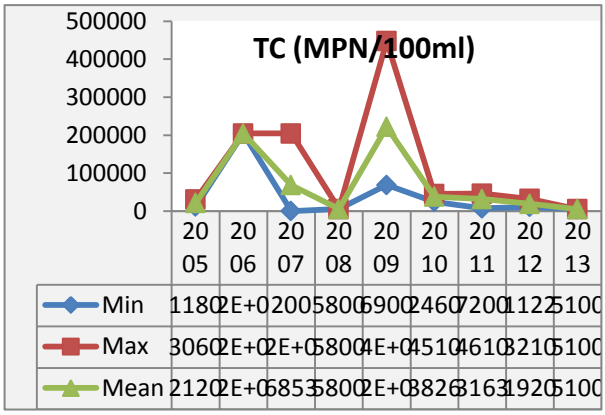


Figure 308

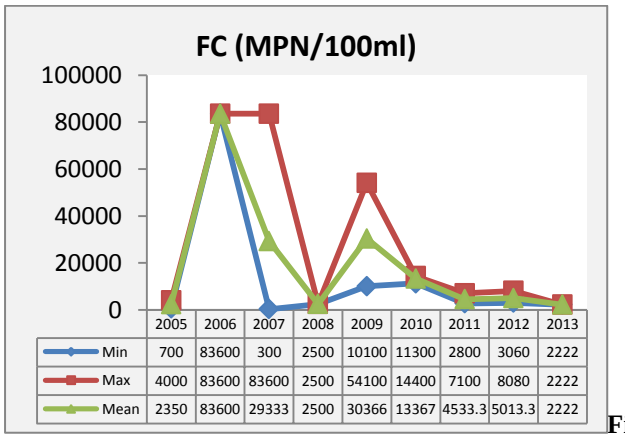


Figure 309

Close examination of figures 305 to 309 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l in each observation. DO concentration ranges between is 6.1 mg/l and 9.3 mg/l during year 2012 BOD concentration ranges between 0 mg/l and 3.0 mg/l during year 2010 and 2008 respectively. COD concentration ranges between 6 mg/l and 28 mg/l between year 2010 and 2009 respectively. TC count ranges between 200 MPN/100ml and 448000 MPN/100ml during year 2007 and 2009 respectively. FC count ranges between 300 MPN/100ml and 83600 MPN/100ml during year 2007 and year 2006/ 2007 respectively.

7.34 Water Quality of River Subarnarekha

7.34.1 River Subarnarekha at Behragora (Jharkhand)

Water Quality of River Subarnarekha at Behragora (Jharkhand) is monitored for 2005-13 having 17 Number of observations at the international boundary of Jharkhand and Odisha.

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	2	1	3	1	3	3	1	17

Water Quality of River Subarnarekha at Behragora (Jharkhand) during 2005-2013 is depicted in graphs (from figures 310-316):

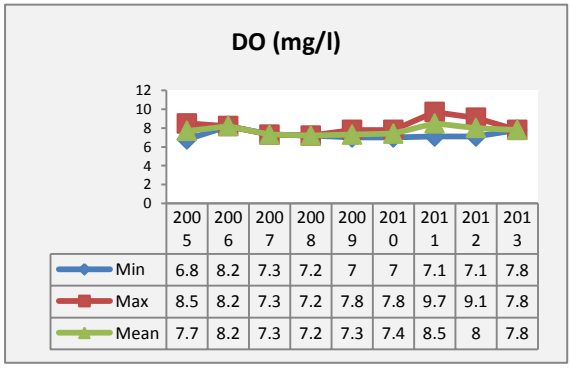


Figure 310

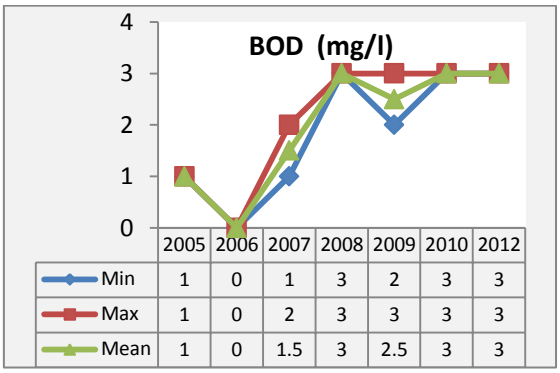


Figure 311

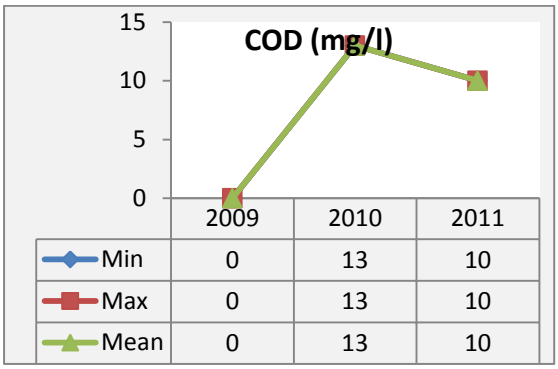


Figure 312

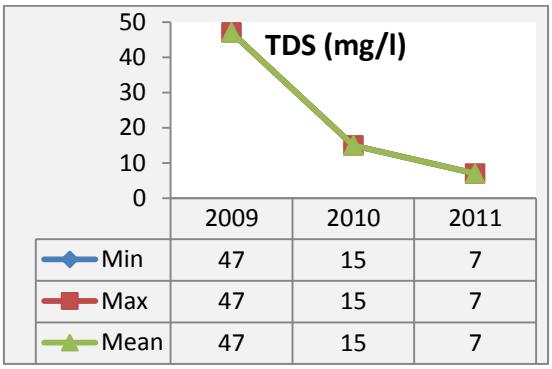


Figure 313

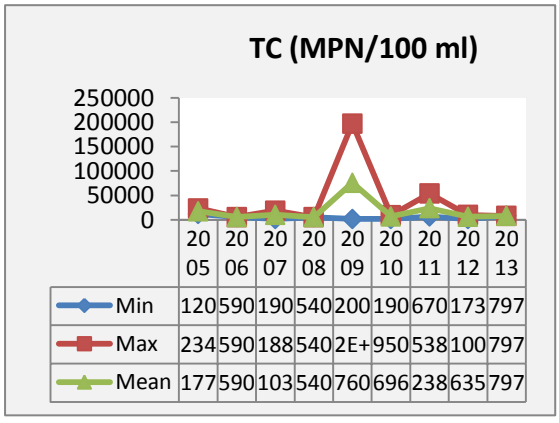


Figure 314

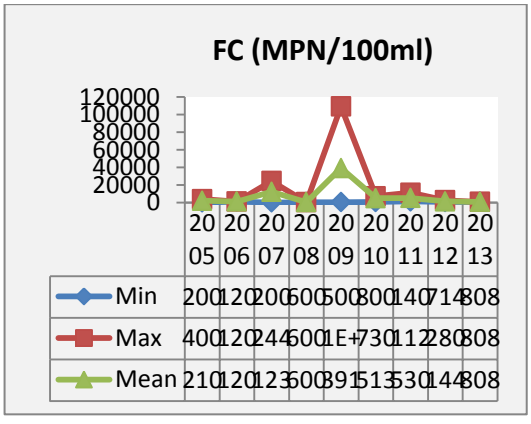


Figure 315

Close examination of figures 310 to 316 shows that:

DO concentration ranges between 6.8 mg/l and 9.7 mg/l during year 2005 and 2011. BOD concentration ranges between 0.0 mg/l and 3.0 mg/l during year 2006 and 2012. COD concentration ranges between 0 mg/l and 13.0 mg/l during year 2009 and 2010. Concentration of TDS ranges between 7 MPN/100 ml and 47 MPN/100 ml during year 2011 and 2009. TC count ranges between

1734 MPN/100 ml and 197000 MPN/100 ml during year 2012 and 2009 respectively. FC count ranges between 200 MPN/100 ml and 109000 MPN/100 ml during year 2005 and 2009 respectively.

7.34.2 River Subarnarekha at Gopiballavpur (West Bengal)

Water Quality of River at Gopiballavpur (West Bengal) is monitored for 2005-13 having 17 Number of observations at the boundary of West Bengal and Odisha.

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	2	1	3	1	3	3	1	17

Water Quality of River Subarnarekha at Gopiballavpur (West Bengal) during 2005-2013 is depicted in graphs (from figures 317-321):

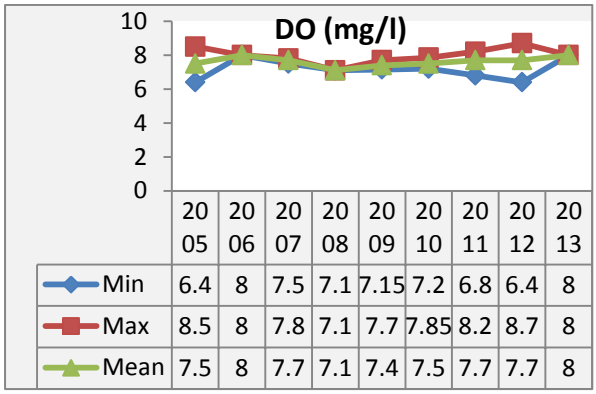


Figure 317

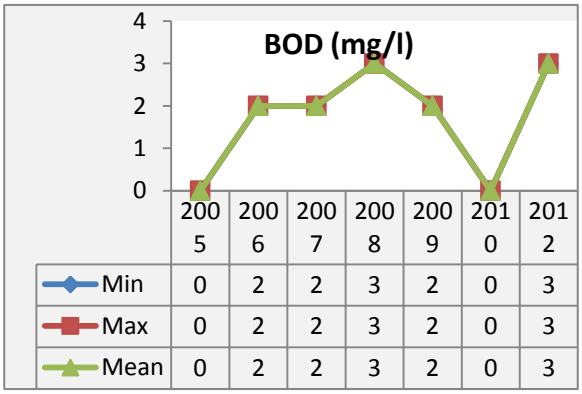


Figure 318

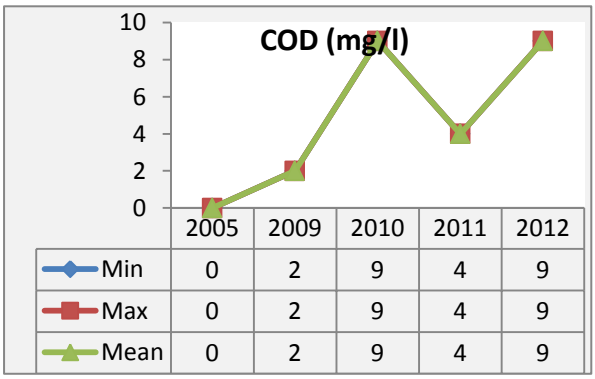


Figure 319

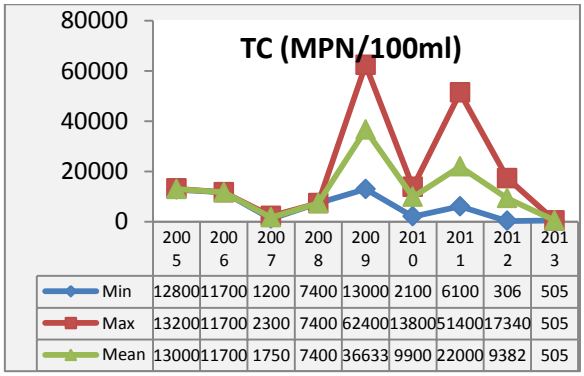


Figure 320

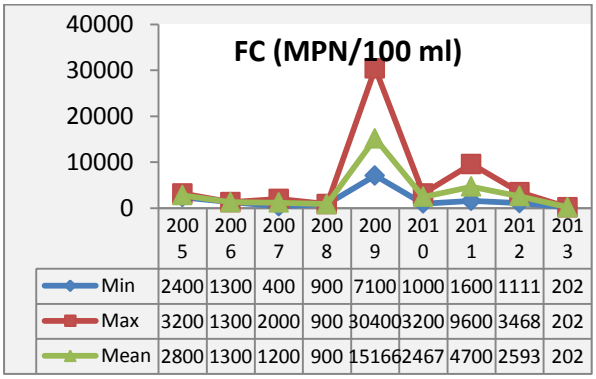


Figure 321

Close examination of figures 317 to 321 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l in each observation. DO concentration ranges between 6.4 mg/l and 8.7 mg/l during 2005 and 2012 respectively. BOD concentration ranges between 0 mg/l and 3.0 mg/l during 2005 and 2012 respectively. COD concentration ranges between 0 mg/l and 9.0 mg/l during year 2005 and 2012 respectively. TC count ranges between 306 MPN/100 ml and 62400 MPN/100 ml during year 2012 and 2009 respectively. FC count ranges between 202 MPN/100 ml and 30400 MPN/100 ml during year 2013 and 2009 respectively.

7.34.3 River Subarnarekha at Loknath (Odisha)

Water Quality of River at Subarnarekha at Loknath (Odisha) is monitored for 2005-13 having 17 Number of observations at the boundary of West Bengal and Odisha.

Summary of observation:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Observations	2	1	2	1	3	1	3	3	1	17

Water Quality of River Subarnarekha at Loknath (Odissa) during 2005-2013 is depicted in graphs (from figures 322-326):

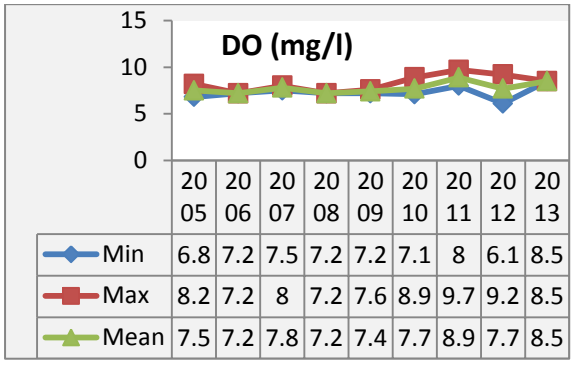


Figure 322

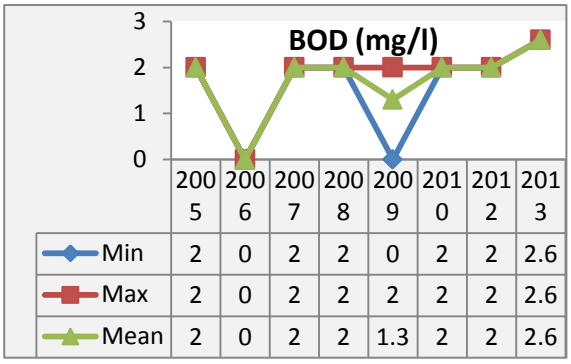


Figure 323

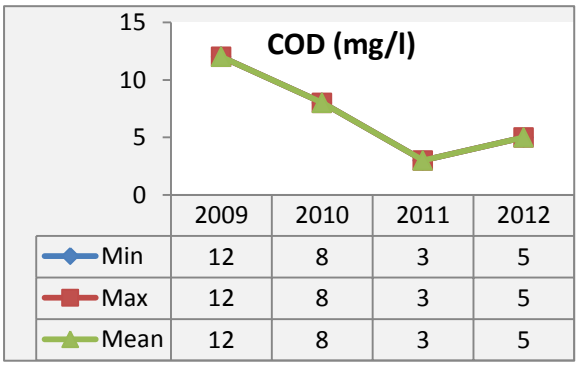


Figure 324

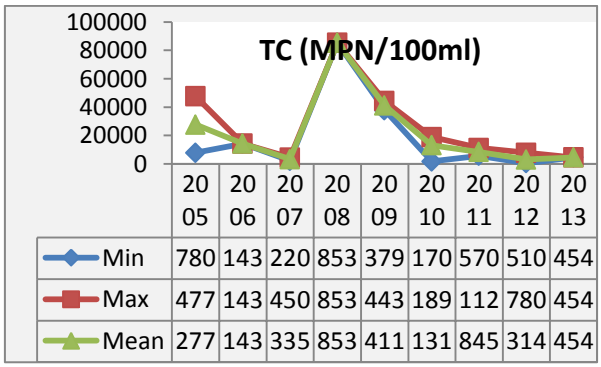


Figure 325

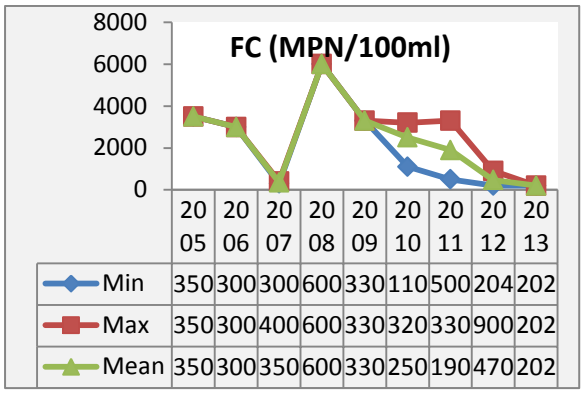


Figure 326

Close examination of figures 322 to 326 shows that:

DO concentration ranges between 6.1mg/l and 9.7 mg/l during 2012 and 2011 respectively. BOD concentration ranges between 0 mg/l and 2.6 mg/l during year 2006/2009 and 2013 respectively. COD concentration ranges between 3 mg/l and 12 mg/l during year 2011 and 2009 respectively. TC count ranges between 510 MPN/100ml and 85300 MPN/100 ml during year 2012 and 2008 respectively. FC count ranges between 202 MPN/100ml and 6000 MPN/100 ml during year 2013 and 2008 respectively.

7.35 Water Quality of River Cauvery

River Cauvery at Satyagala Bridge, Narsipur (Karnataka)

Water Quality of River Cauvery at Satyagala Bridge, Narsipur (Karnataka) is monitored for 2005-11 having 08 Number of observations at the interstate boundary of Karnataka and Tamilnadu.

Summary of observations:

Year	2005	2008	2009	2010	2011	Total
Observations	3	2	1	1	1	8

Water Quality of River Cauvery at Satyagala Bridge, Narsipur (Karnataka) during 2005-2011 is depicted in graphs (from figures 327-329):

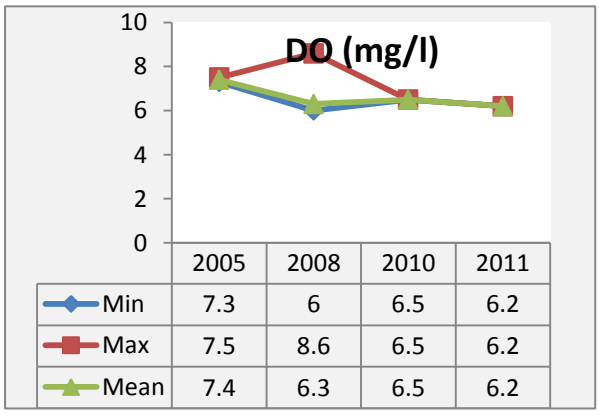


Figure 327

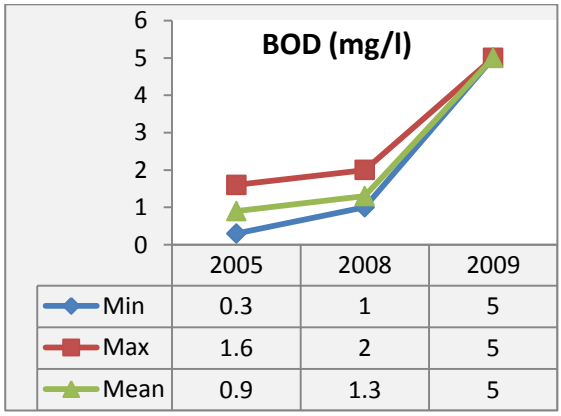


Figure 328

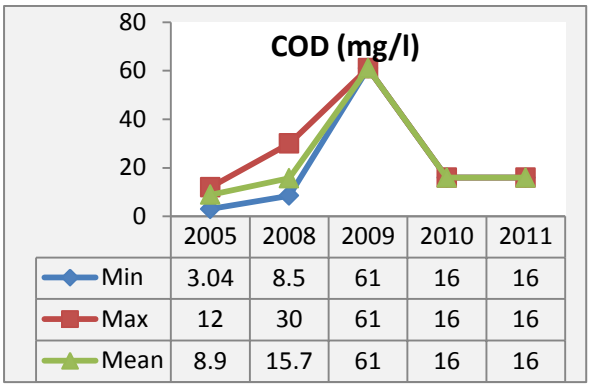


Figure 329

Close examination of figure 327 to 329 shows that:

DO concentration ranges between 6.2 mg/l and 8.6 mg/l during year 2011 and 2008 respectively. BOD concentration ranges between 0 mg/l and 5 mg/l during year 2010 and 2009 respectively. COD ranges between 3.04 mg/l and 61.0 mg/l during year 2010 and 2009.

7.36 Water Quality of River Thenpennai (South Pennar) at Mugalur Bridge, Bangalore (Karnataka)

Water Quality of River Thenpennai (South Pennar) at Mugalur Bridge, Bangalore (Karnataka) is monitored for 2005-11 having 11 Number of observations at the interstate boundary of Karnataka and Tamilnadu.

Summary of Observations:

Year	2005	2008	2009	2010	2011	Total
Observations	3	2	2	3	1	11

Water Quality of River Thenpennai (South Pennar) at Mugalur Bridge, Bangalore (Karnataka) during 2005-2011 is depicted in graphs (from figures 330-332):

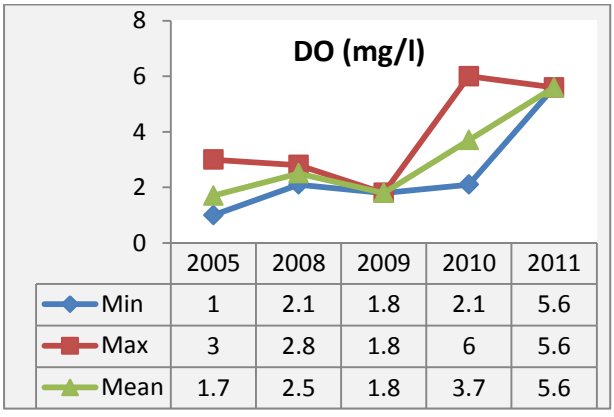


Figure 330

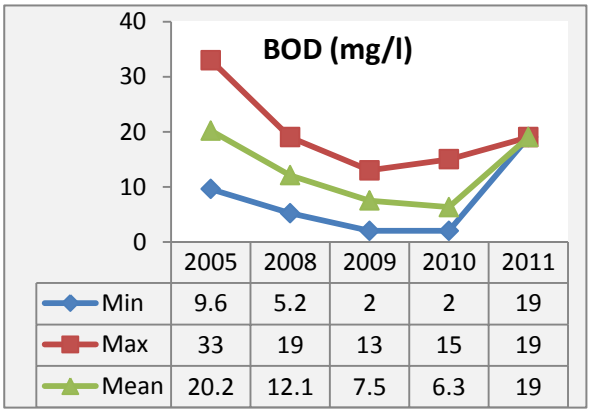
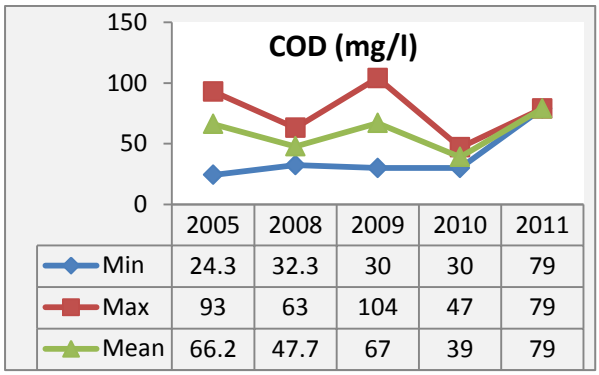


Figure 331



	2005	2008	2009	2010	2011
Min	24.3	32.3	30	30	79
Max	93	63	104	47	79
Mean	66.2	47.7	67	39	79

Figure 332

Close examination of figures 330 to 332 shows that:

DO concentration ranges between 1.0 & 6.0 mg/l during year 2005 & 2010. BOD concentration ranges between 2 mg/l and 33 mg/l during 2009 & 2005 respectively. COD concentration 24.3 mg/l and 104 mg/l during 2005 & 2009 respectively.

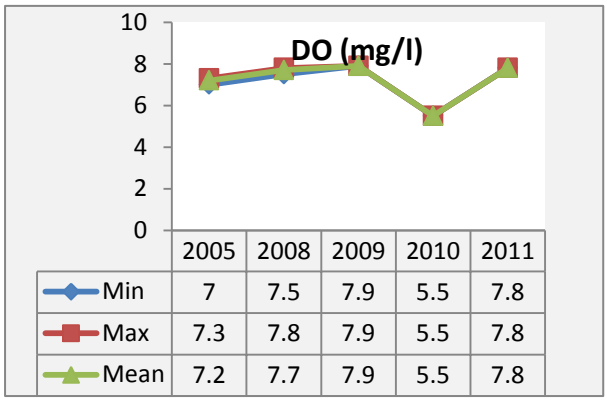
7.37 Water Quality of River Krishna at Deodurg (Karnataka)

Water Quality of River Krishna at Deodurg (Karnataka) is monitored for 2005-11 having 08Number of observations at the interstate boundary of Karnataka and Tamilnadu.

Summary of Observations:

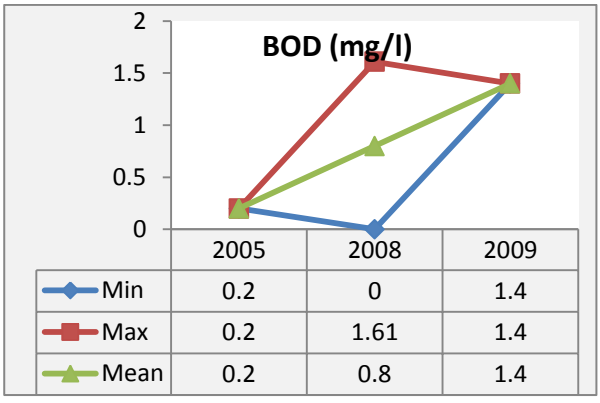
Year	2005	2008	2009	2010	2011	Total
Observations	3	2	1	1	1	8

Water Quality of River Krishna at Deodurg (Karnataka) during 2005-2011 is depicted in graphs (from figures 332-335):



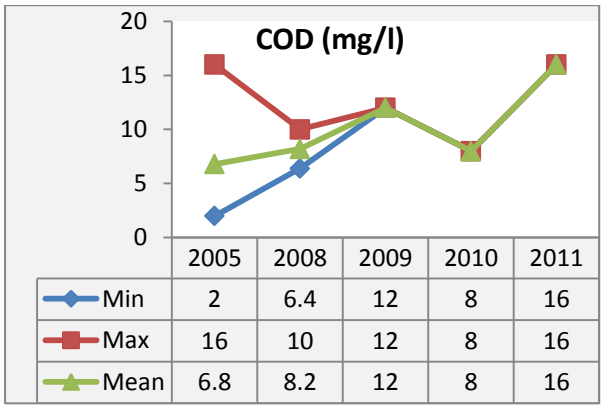
	2005	2008	2009	2010	2011
Min	7	7.5	7.9	5.5	7.8
Max	7.3	7.8	7.9	5.5	7.8
Mean	7.2	7.7	7.9	5.5	7.8

Figure 332

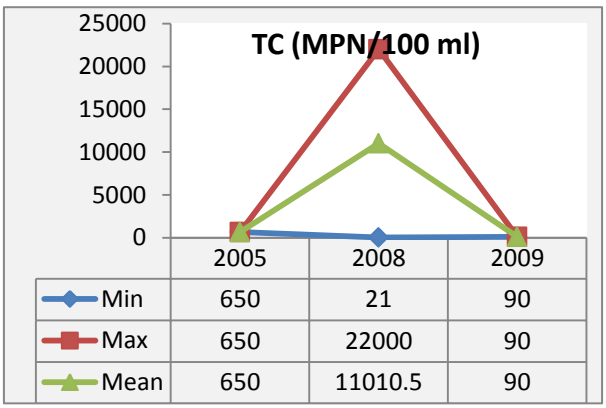


	2005	2008	2009
Min	0.2	0	1.4
Max	0.2	1.61	1.4
Mean	0.2	0.8	1.4

Figure 333



	2005	2008	2009	2010	2011
Min	2	6.4	12	8	16
Max	16	10	12	8	16
Mean	6.8	8.2	12	8	16



	2005	2008	2009
Min	650	21	90
Max	650	22000	90
Mean	650	11010.5	90

Figure 334 **Figure 335**

Close examination of figures 332 to 335 shows that:

DO concentration ranges between 5.5 mg/l and 7.9 mg/l during year 2010 and 2009 respectively. BOD ranges between 0 mg/l and 1.6 mg/l during year 2008 only. COD ranges between 2 mg/l and 16 mg/l during year 2005 and 2011respectively. TC ranges between 21MPN/100 ml and 22000 MPN/100 ml during year 2008 only.

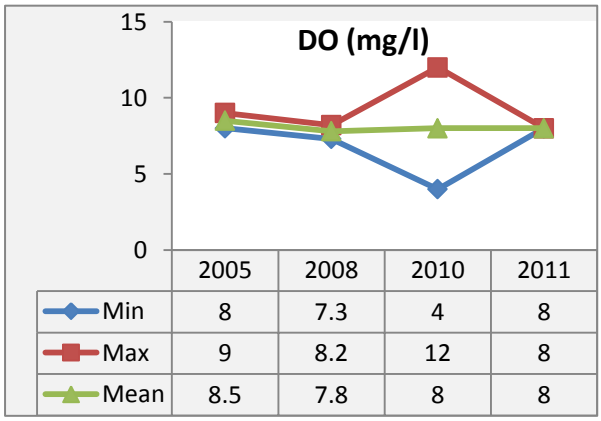
7.38 Water Quality of River Tungabhadra at Hochchelli (Karnataka)

Water Quality of River Tungabhadra at Hochchelli (Karnataka)is monitored for 2005-11 having 08 Number of observations at the interstate boundaries of Karnataka and Maharashtra

Summary of observation:

Year	2005	2008	2010	2011	Total
Observations	3	2	2	1	8

Water Quality of Tungabhadra at River Hochchelli (Karnataka)during 2005-2011 is depicted in graphs (from figures 336-338):



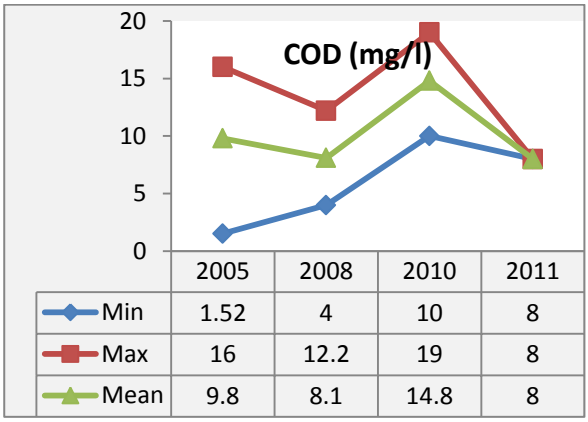


Figure 336 **Figure 337**

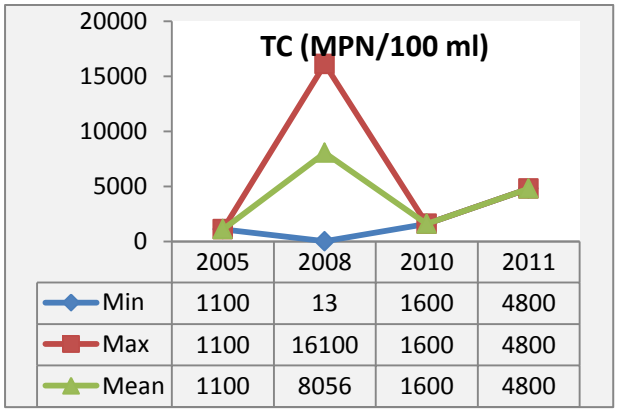


Figure 338

Close examination of figures 336 to 338 shows that:

DO concentration ranges between 4.0 mg/l and 12.0 mg/l in year 2010. BOD concentration ranges between 0 mg/l and 7.4 mg/l during year 2008 and 2010 respectively. COD ranges between 1.5

mg/l and 19mg/l during year 2005 and 2010 respectively. TC ranges between 13 MPN/100 ml and 16100 MPN/100 ml in the year 2008.

7.39 River Bhima at Jewargi, Gangapur, (Karnataka)

Water Quality of River Bhima at Jewargi, Gangapur, (Karnataka) is monitored for 2005-11 having 08 Number of observations at the interstate boundaries of Karnataka and Maharashtra.

Summary of observation:

Year	2005	2008	2009	2010	2011	Total
Observations	3	2	1	1	1	8

Water Quality of River Bhima at Jewargi, Gangapur, (Karnataka) during 2005-2011 is depicted in graphs (from figures 339-341):

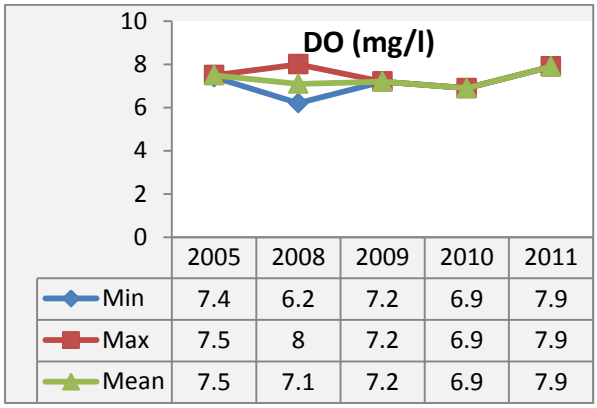


Figure 339

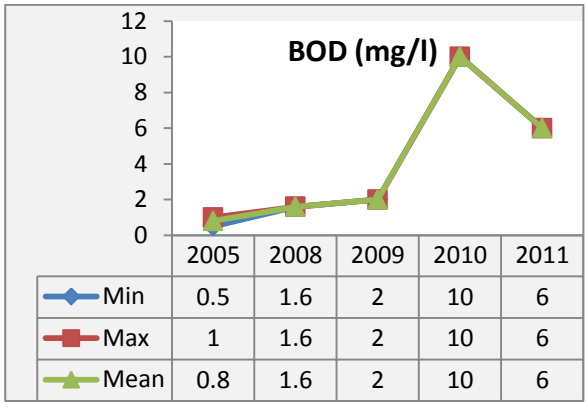


Figure 340

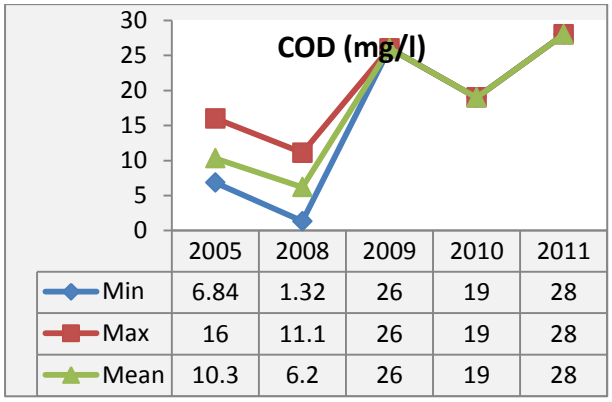


Figure 341

Close examination of figures 339 to 341 shows that:

DO concentration ranges between 6.2 mg/l and 8.0 mg/l in the year 2008. BOD concentration ranges between 0.5 mg/l and 10 mg/l during year 2005 and 2010 respectively. COD ranges between 1.3 mg/l and 28 mg/l during year 2008 and 2011 respectively.

7.40 Water Quality of River Manjira at Janwada (Karnataka)

Water Quality of River Manjira at Janwada (Karnataka) is monitored for 2005-12 having 05 Number of observations at the interstate boundaries of Karnataka and Maharashtra.

Summary of observation:

Year	2005	2008	2010	2012	Total
Observations	1	2	1	1	5

Water Quality of River Manjira at Janwada (Karnataka) during 2005-2012 is depicted in graphs (from figures 342-344):

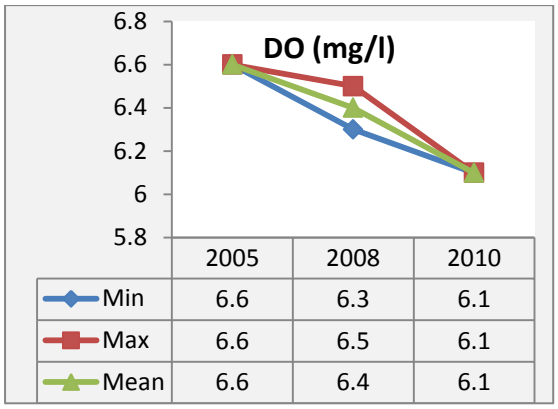


Figure 342

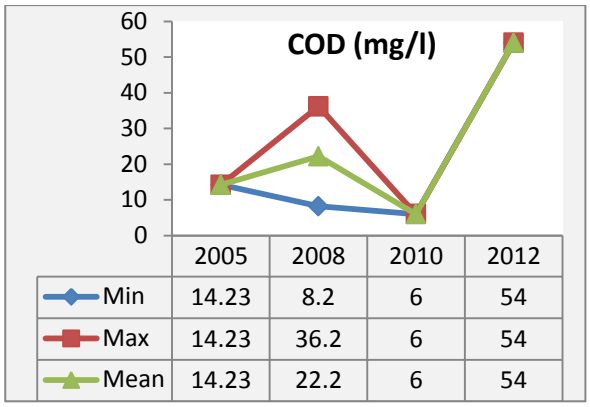


Figure 343

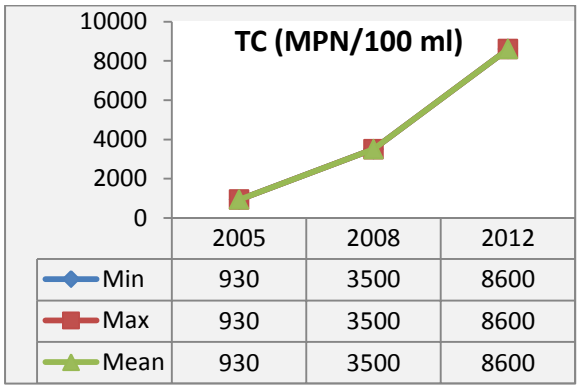


Figure 344

Close examination of figures 342 to 344 shows that:
DO concentration ranges between 6.1 mg/l and 6.6 mg/l during year 2010 and 2005 respectively. COD ranges between 6.0 mg/l and 54.0 mg/l during year 2010 and 2012. TC count ranges between 930 MPN/100ml and 8600 MPN/100 ml during year 2005 and 2012.

7.41 Water Quality of River Godavari at Basra (Kavalguda),Maharashtra

Water Quality of River Godavari at Basra (Kavalguda) is monitored for 2005-12 having 05 Number of observations at the interstate boundaries of Karnataka and Maharashtra.

Summary of observations:

Year	2005	2008	2010	2012	Total
Observations	1	2	1	1	5

Water Quality of River Godavari at Basra (Kavalguda), Maharashtra during 2005-2012 is depicted in graphs (from figures 345-348):

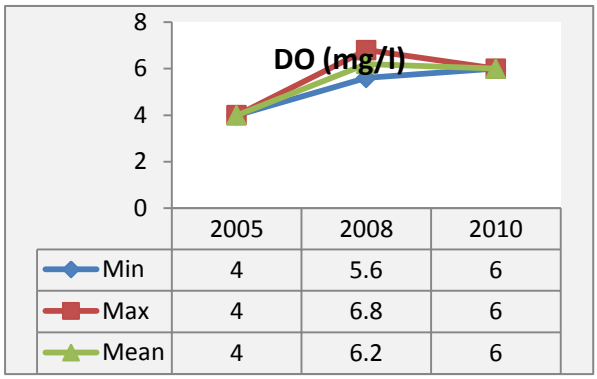


Figure 345

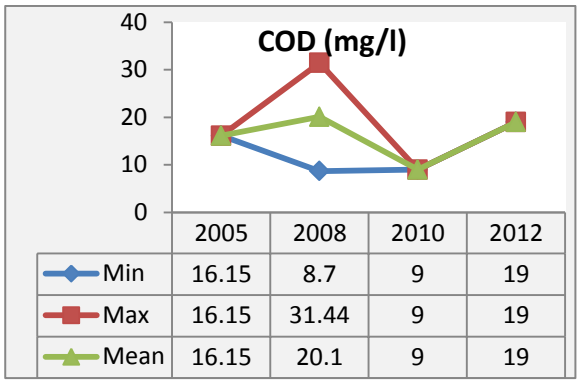


Figure 346

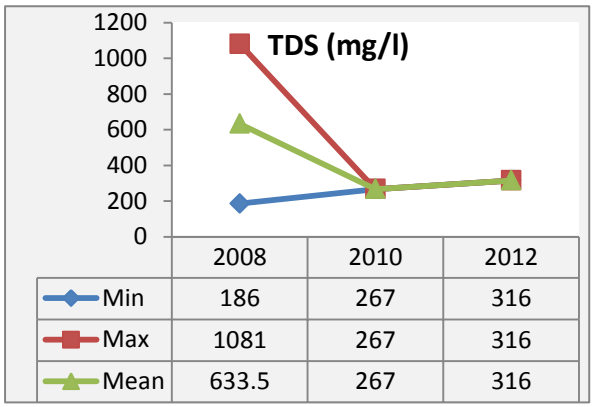


Figure 347

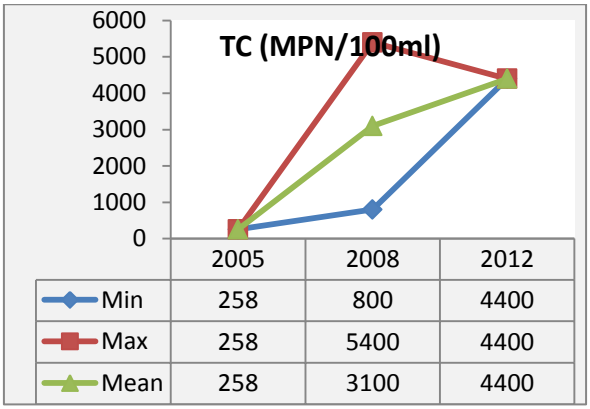


Figure 348

Close examination of figures 345 to 348 shows that:
DO concentration ranges between 4.0 mg/l and 6.8 mg/l during year 2005 and 2008. COD concentration ranges between 8.7 mg/l and 31.44 mg/l in the same year 2008. TDS concentration ranges between 186 mg/l and 1081 mg/l in year 2008. TC count ranges between 258 MPN/100ml and 5400 MPN/100 ml during year 2005 and 2008 respectively.

7.42 Water Quality of River Uttra-Pinakini (North Pennar) at Hindupur (Andhra Pradesh)

Water Quality of River Uttra-Pinakini (North Pennar) at Hindupur (Andhra Pradesh) is monitored for 2005-12 having 05 Number of observations at the interstate boundaries of Karnataka and Andhra Pradesh.

Summary of observations:

Year	2005	2008	2009	2010	Total
Observations	1	2	1	1	5

Water Quality of River Uttra-Pinakini (North Pennar) at Hindupur (Andhra Pradesh) during 2005-2010 is depicted in graphs (from figures 349-352):

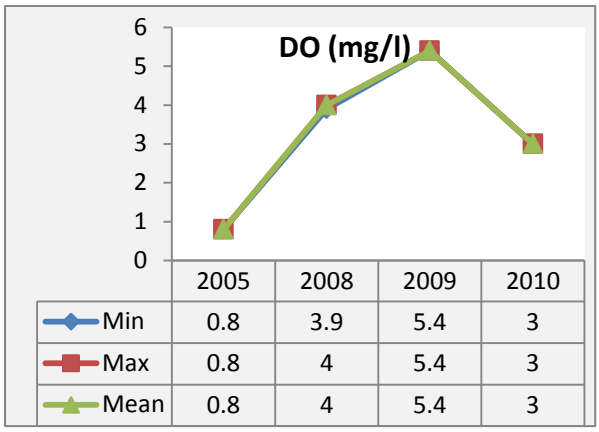


Figure 349

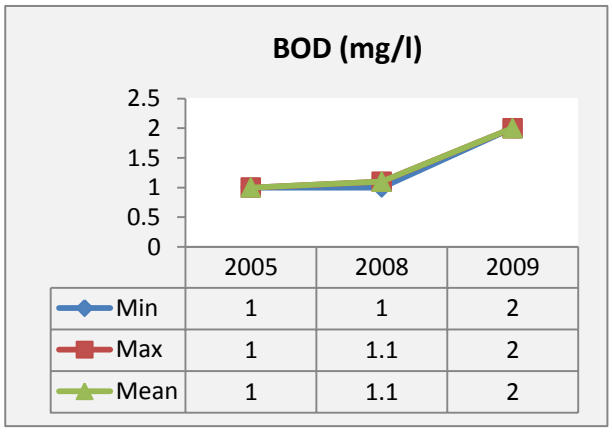


Figure 350

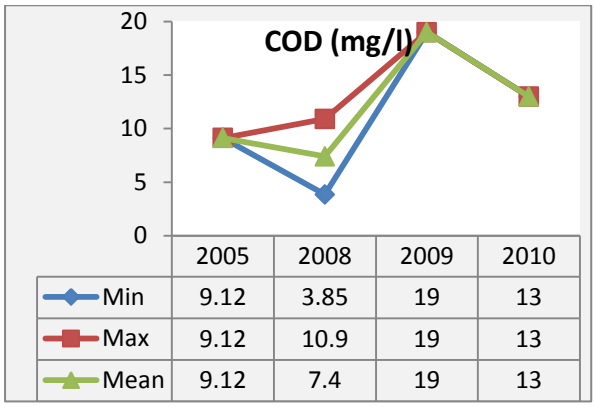


Figure 351

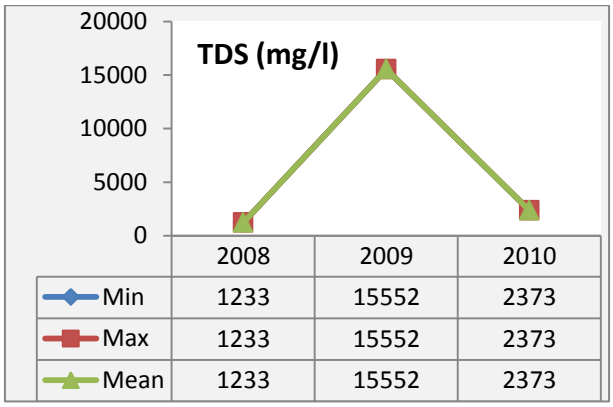


Figure 352

Close examination of figures 349 to 352 shows that:

DO concentration ranges between 0.8 mg/l and 5.4 during year 2005 and 2009 respectively. BOD concentration ranges between 0 mg/l and 2 mg/l during year 2010 and 2009 respectively. COD concentration ranges between 3.85 mg/l and 19 mg/l during year 2008 and 2009 respectively. TDS concentration ranges between 1223 mg/l and 15552 mg/l during year 2008 and 2009 respectively.

7.43 Water Quality of River Ganga at Tarighat, Gazipur (U. P.)

Water Quality of River Ganga at Tarighat, Gazipur (U. P.) is monitored for 2005-12 having 14 Number of observations at the interstate boundaries of Uttrakhand and Uttar Pradesh.

Summary of observations:

Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	1	2	3	2	2	3	1	14

Water Quality of River Ganga at Tarighat, Ghazipur (U. P.) during 2005-2012 is depicted in graphs (from figures 353-357):

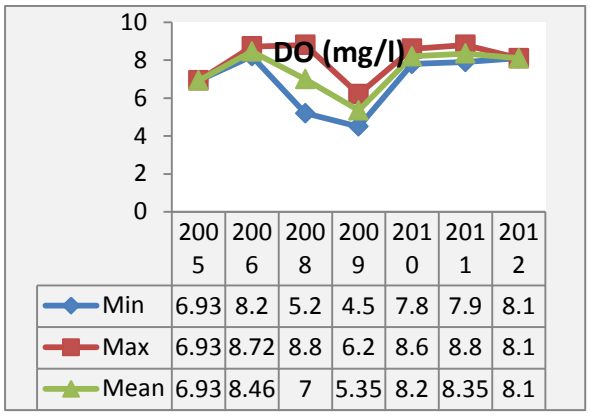


Figure 353

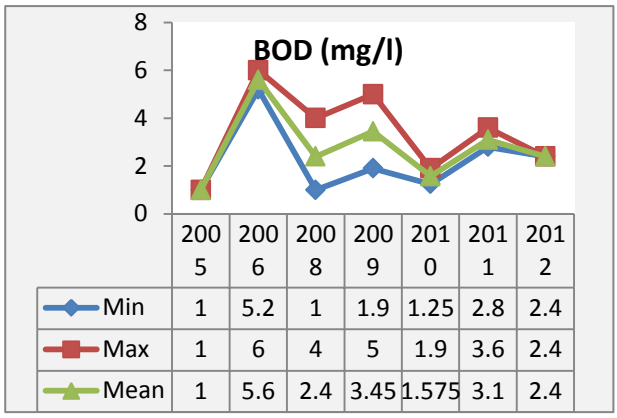


Figure 354

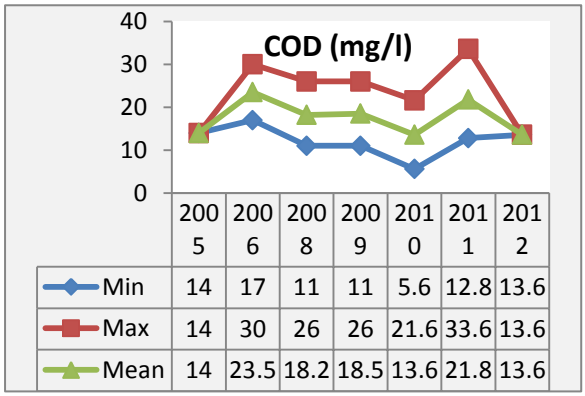


Figure 355

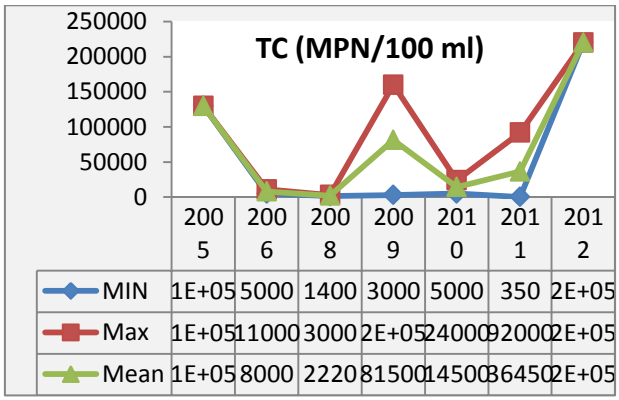


Figure 356

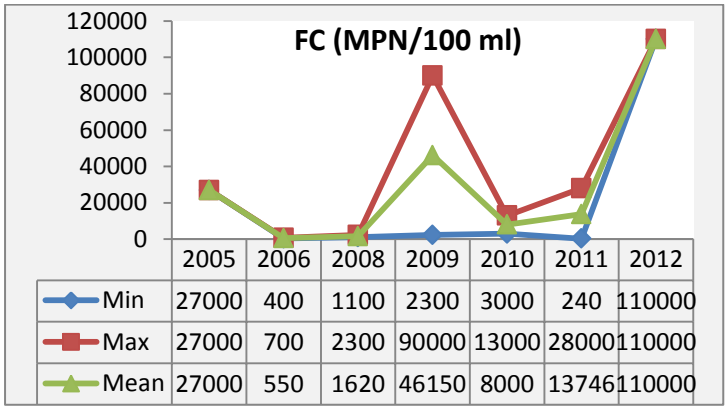


Figure 357

Close examination of figures 353 to 357 shows that:

DO concentration ranges between 4.5 mg/l and 8.8 during year 2009 and 2011 respectively. BOD concentration ranges between 1.0 mg/l and 6.0 mg/l during year 2005 and 2006 respectively. COD concentration ranges between 5.6 mg/l and 33.6 during year 2010 and 2011respectively. TC count ranges between 350 MPN/100 ml and 220000 MPN/100 ml during year 2011 and 2012 respectively. FC count ranges between 240 MPN/100 ml and 110000 MPN/100 ml during year 2011 and 2012 respectively.

7.44.1 Water Quality of River Betwa at Kanjira Bridge , Sagar (M.P.)

Water Quality of River Betwa at Kanjira Bridge, Sagar (M.P.) is monitored for 2005-12 having 15 Number of observations at the interstate boundaries of Madhya Pradesh and Uttar Pradesh.

Summary of observations:

Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	2	1	3	1	4	3	1	15

Water Quality of River Betwa at Kanjira Bridge , Sagar (M.P.) during 2005-2012 is depicted in graphs (from figures 358-362):

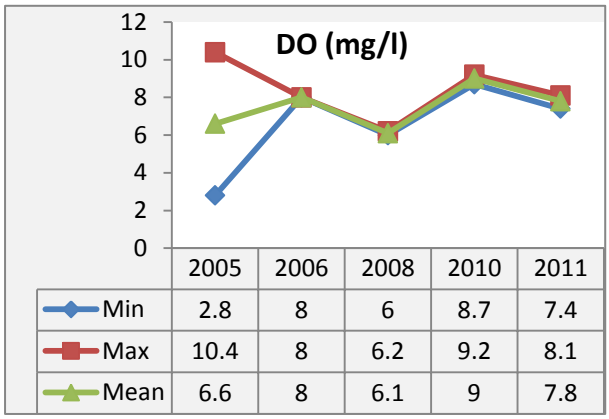


Figure 358

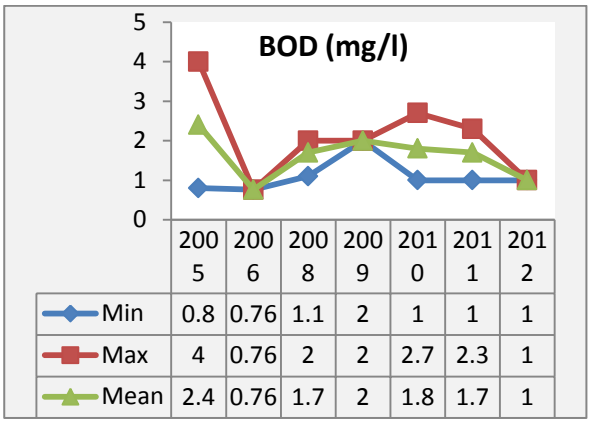


Figure 359

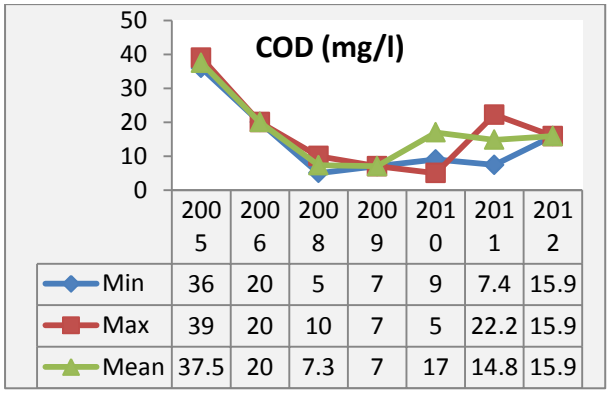


Figure 360

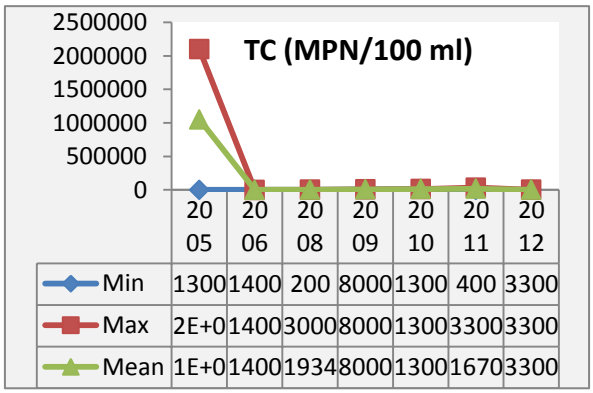


Figure 361

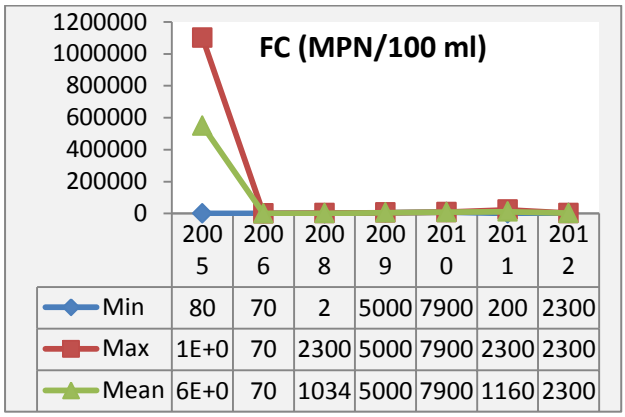


Figure 362

Close examination of figures 358 to 362 shows that:

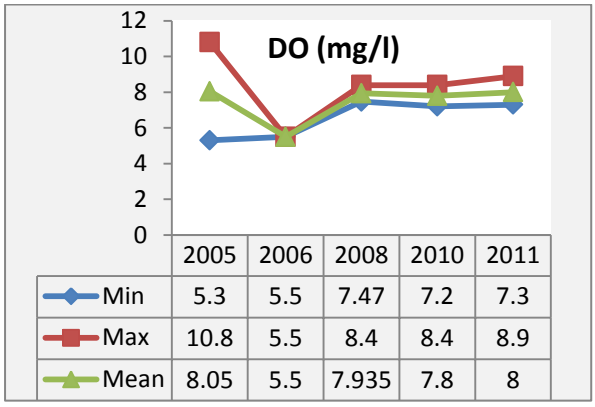
DO concentration ranges between 2.8 mg/l and 10.4 mg/l during year 2005 BOD concentration ranges between 0.76 mg/l and 4.0 mg/l during year 2006 and 2005 respectively. COD concentration ranges between 5 mg/l and 39.0 mg/l during year 2008 and 2005 respectively. TC count 200 MPN/100 ml and 2100000 MPN/100 ml during year 2008 and 2005. FC count ranges 2 MPN/100 ml and 1100000 MPN/100 ml during 2008 and 2005 respectively.

7.44.2 River Betwa at D/S Dukwan Dam at Babina, Birdha Road, Distt. Lalitpur (U.P.)

Water Quality of River Betwa at D/S Dukwan Dam at Babina, Birdha Road, Distt. Lalitpur (U.P.) is monitored for 2005-12 having 13 Numbers of observations at the interstate boundaries of Uttar Pradesh and Madhya Pradesh.

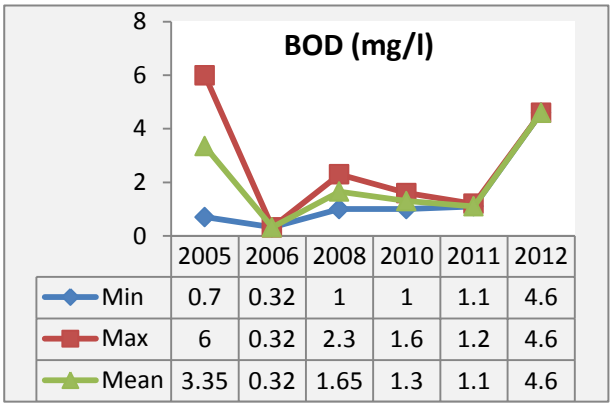
Year	2005	2006	2008	2010	2011	2012	Total
Observations	2	1	2	4	3	1	13

Water Quality of River Betwa at D/S Dukwan Dam at Babina, Birdha Road, Distt. Lalitpur (U.P.) 2005-2012 is depicted in graphs (from figures 363-367):



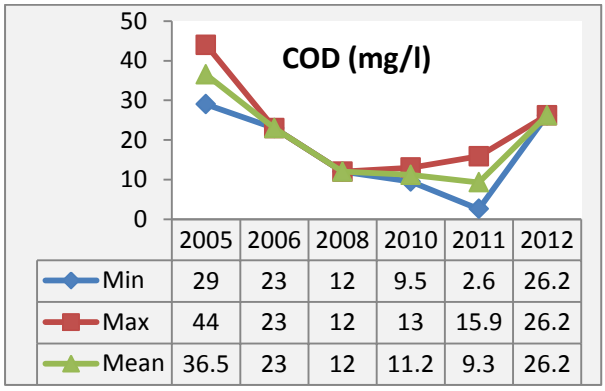
	2005	2006	2008	2010	2011
Min	5.3	5.5	7.47	7.2	7.3
Max	10.8	5.5	8.4	8.4	8.9
Mean	8.05	5.5	7.935	7.8	8

Figure 363



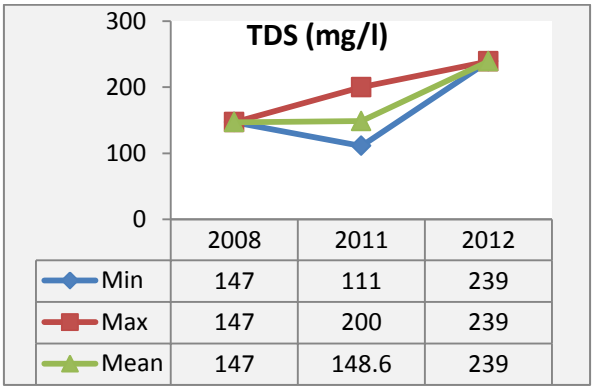
	2005	2006	2008	2010	2011	2012
Min	0.7	0.32	1	1	1.1	4.6
Max	6	0.32	2.3	1.6	1.2	4.6
Mean	3.35	0.32	1.65	1.3	1.1	4.6

Figure 364



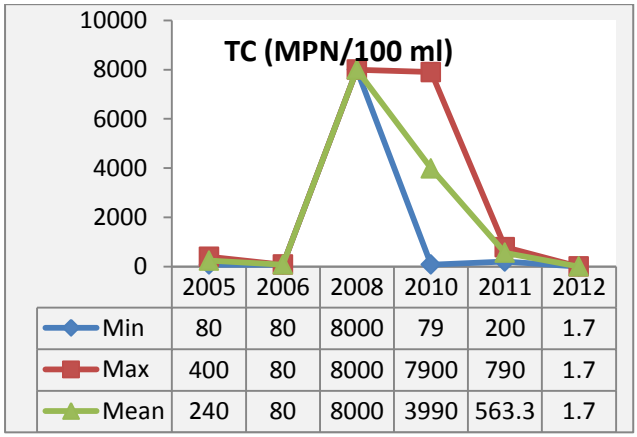
	2005	2006	2008	2010	2011	2012
Min	29	23	12	9.5	2.6	26.2
Max	44	23	12	13	15.9	26.2
Mean	36.5	23	12	11.2	9.3	26.2

Figure 365



	2008	2011	2012
Min	147	111	239
Max	147	200	239
Mean	147	148.6	239

Figure 366



	2005	2006	2008	2010	2011	2012
Min	80	80	8000	79	200	1.7
Max	400	80	8000	7900	790	1.7
Mean	240	80	8000	3990	563.3	1.7

Figure 367

Close examination of figures 363 to 367 shows that:

DO concentration ranges between 5.3 mg/l and 10.8 mg/l during the year 2005 only. BOD concentration ranges between 0.7 mg/l and 6.0 mg/l during year 2005 only. COD concentration ranges between 2.6 mg/l and 44.0 mg/l during year 2011 and 2005 respectively. TDS ranges

between 111 mg/l and 239 mg/l during year 2011 and 2012 respectively. TC count ranges between 1.7 MPN/100 ml and 8000 MPN/100 ml during year 2012 and 2008 respectively.

7.45.1 Water Quality of River Sone at Chopan (U.P.)

Water Quality of River Sone at Chopan (U.P.) is monitored for 2005-12 having 15 Numbers of observations at the interstate boundaries of Uttar Pradesh and Madhya Pradesh.

Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	2	1	3	1	4	3	1	15

Water Quality of River Sone at Chopan (U.P.) during 2005-2012 is depicted in graphs (from figures 368-373):

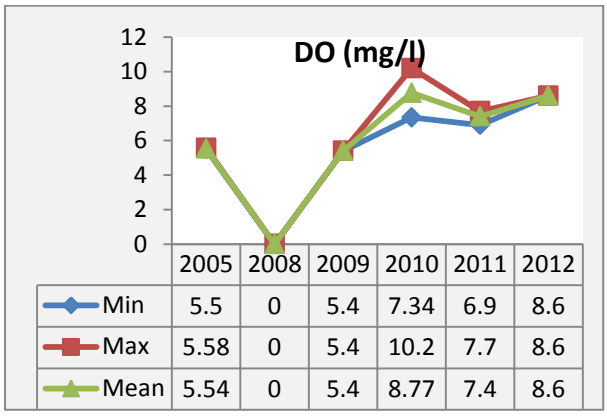


Figure 368

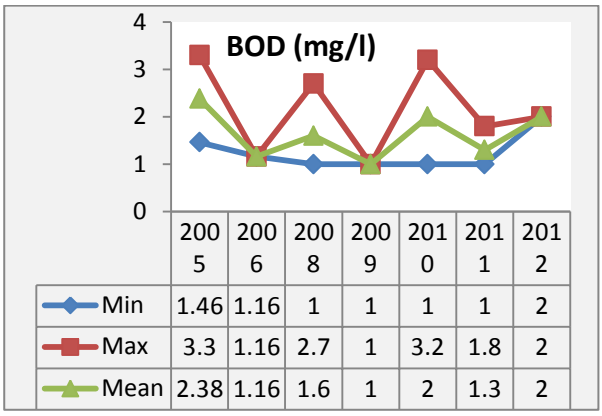


Figure 369

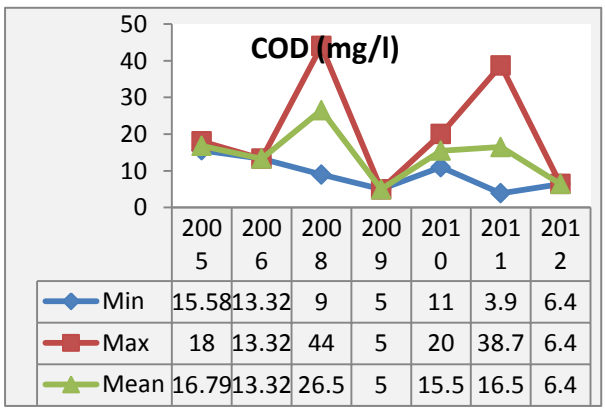


Figure 370

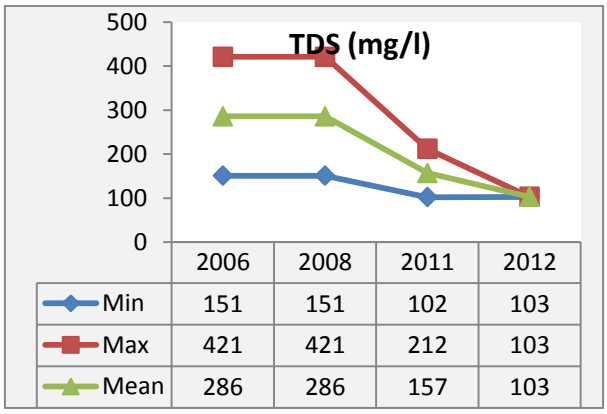


Figure 371

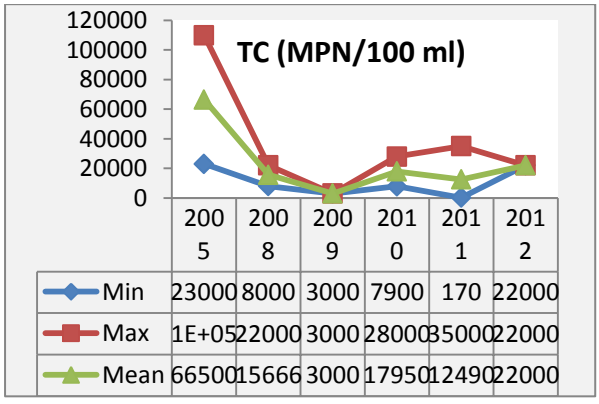


Figure 372

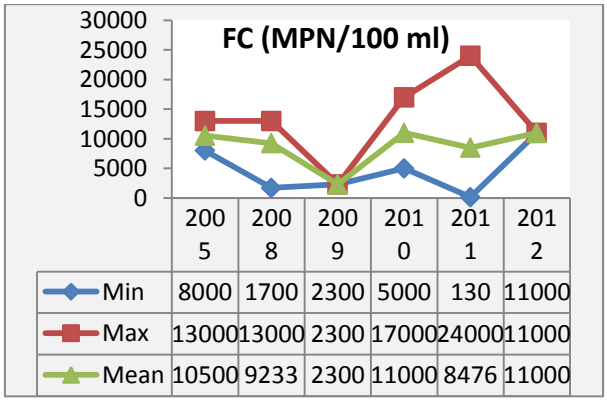


Figure 373

Close examination of figures 368 to 373 shows that:

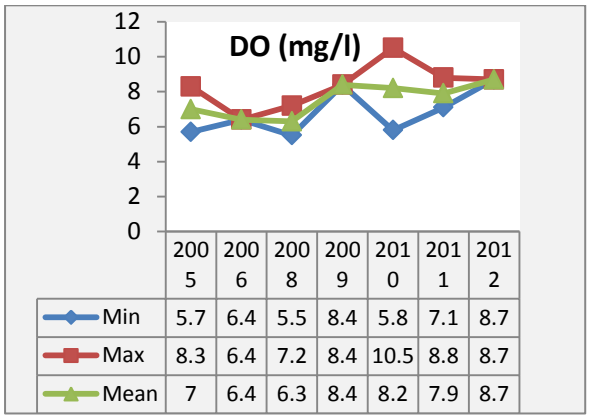
DO concentration ranges between 0 mg/l and 10.2 mg/l during year 2008 and 2010 respectively. BOD concentration ranges 1 mg/l and 3.3 mg/l. COD concentration ranges between 3.9 mg/l and 44 mg/l during year 2011 and 2008. TDS concentration ranges between 102 mg/l and 421 mg/l in year 2011 and 2008. TC count ranges between 170 MPN/100 ml and 110000 MPN/100 ml during year 2011 and 2005. FC count ranges between 130 MPN/100 ml and 17000 MPN/100 ml during year 2011 and 2010 respectively.

7.45.2 River Sone at U/S of Deora before Reservoir, Rihand (U.P.)

Water Quality of River Sone at Chopan (U.P.) is monitored for 2005-12 having 15 Numbers of observations at the interstate boundaries of Uttar Pradesh and Madhya Pradesh.

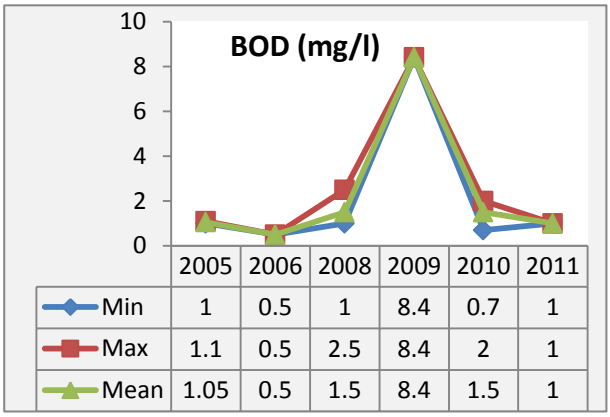
Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	2	1	3	1	4	3	1	15

Water Quality of River Sone at U/S of Deora before Reservoir, Rihand (U.P.) during 2005-2012 is depicted in graphs (from figures 374-379):



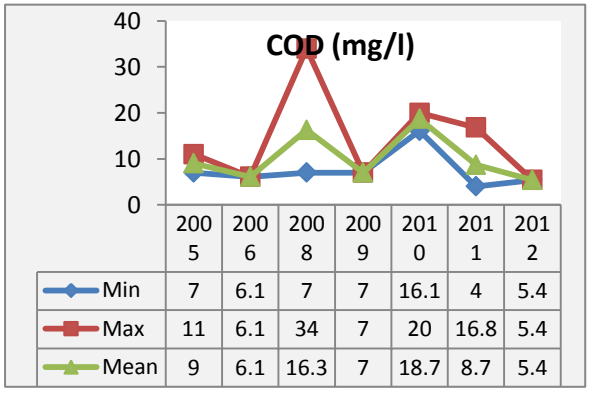
	2005	2006	2008	2009	2010	2011	2012
Min	5.7	6.4	5.5	8.4	5.8	7.1	8.7
Max	8.3	6.4	7.2	8.4	10.5	8.8	8.7
Mean	7	6.4	6.3	8.4	8.2	7.9	8.7

Figure 374



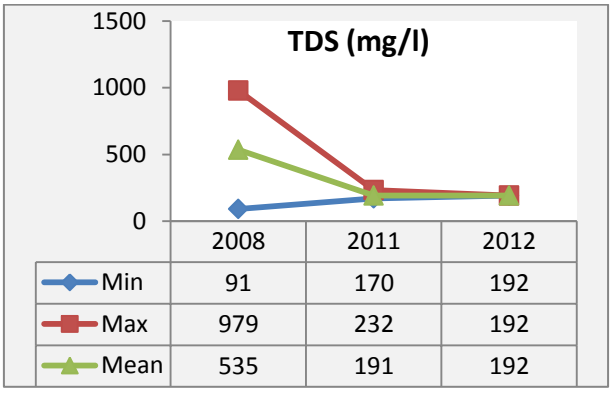
	2005	2006	2008	2009	2010	2011
Min	1	0.5	1	8.4	0.7	1
Max	1.1	0.5	2.5	8.4	2	1
Mean	1.05	0.5	1.5	8.4	1.5	1

Figure 375



	2005	2006	2008	2009	2010	2011	2012
Min	7	6.1	7	7	16.1	4	5.4
Max	11	6.1	34	7	20	16.8	5.4
Mean	9	6.1	16.3	7	18.7	8.7	5.4

Figure 376



	2008	2011	2012
Min	91	170	192
Max	979	232	192
Mean	535	191	192

Figure 377

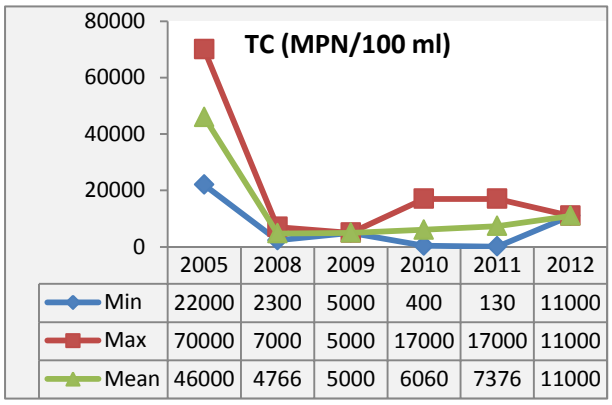


Figure 378

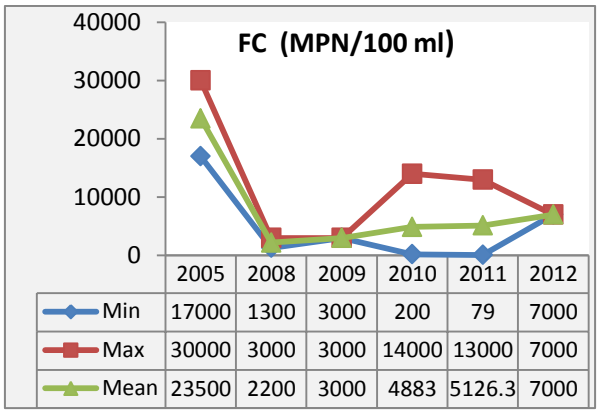


Figure 379

Close examination of figures 374 to 379 shows that:

DO concentration ranges between 5.5 mg/l and 10.5 mg/l during year 2008 and 2010 respectively. BOD concentration ranges between 0.53 mg/l and 8.4 mg/l during year 2006 and 2009 respectively. COD concentration ranges between 4 mg/l and 34 mg/l. TDS concentration ranges between 91 mg/l and 979 mg/l respectively in year 2008. Minimum TC count observed is 130 MPN/100 ml in year 2011 whereas maximum TC count observed is 70000 MPN/100 ml in year 2005. Minimum FC count observed is 79 MPN/100 ml in year 2011whereas maximum FC count observed is 14000 MPN/100 ml in year 2010.

7.46.1 River Ramganga at D/S Sherkot, Kalagarh (U.P.)

Water Quality of River Ramganga at D/S Sherkot, Kalagarh (U.P.) is monitored for 2005-12 having 12 Numbers of observations at the interstate boundaries of Uttar Pradesh and Uttrakhand.

Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	2	1	3	2	2	1	1	12

Water Quality of River Ramganga at D/S Sherkot, Kalagarh (U.P.) during 2005-2012 is depicted in graphs (from figures 380-384):

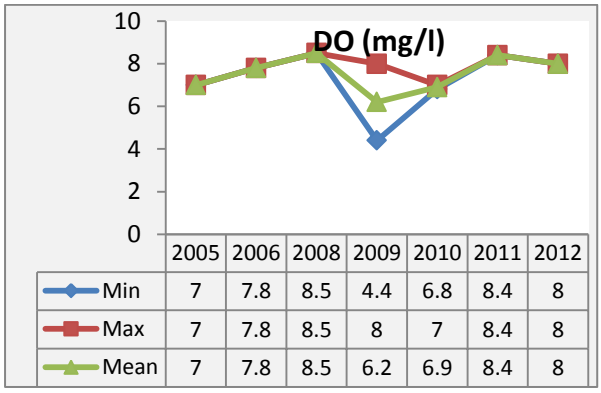


Figure 380

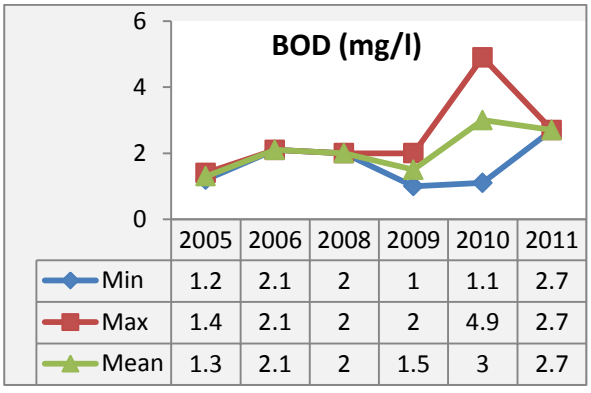


Figure 381

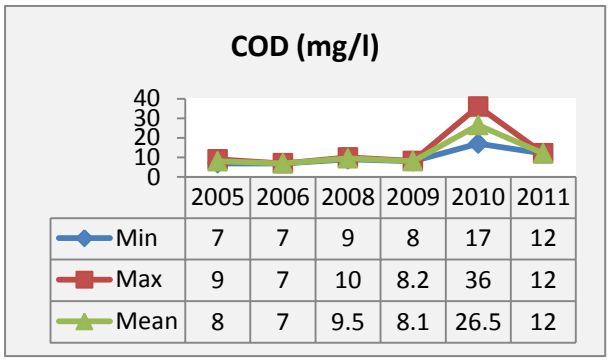


Figure 382

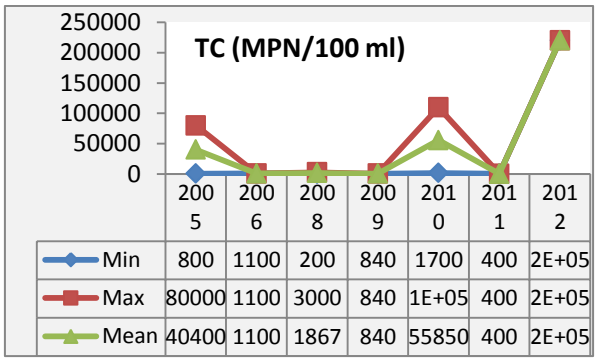


Figure 383

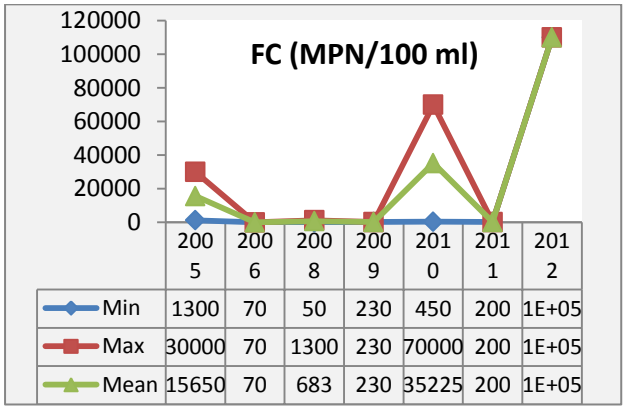


Figure 384

Close examination of figures 380 to 384 shows that:

DO concentration ranges between 4.4 mg/l and 8.5 mg/l during year 2009 and 2008. BOD concentration ranges between 1.0 mg/l and 4.9 mg/l during year 2009 and 2010. COD concentration ranges between 7 mg/l and 36 mg/l during year 2005 and 2010 respectively. TC count ranges between 200 MPN/100 ml and 220000 MPN/100 ml during year 2008 and 2012 respectively. FC count ranges between 50 MPN/100 ml and 110000 MPN/100 ml during year 2008 and 2012 respectively.

7.46.2 River Ramganga at D/S Kalagarh, Dam (Uttrankhand)

Water Quality of River Ramganga at D/S Kalagarh, Dam (Uttrankhand) is monitored for 2005-12 having 12 Numbers of observations at the interstate boundaries of Uttar Pradesh and Uttrakhand.

Year	2005	2006	2008	2009	2010	2011	2012	Total
Observations	2	1	3	2	2	1	1	12

Water Quality of River Ramganga at D/S Kalagarh, Dam (Uttrankhand) during 2005-2012 is depicted in graphs (from figures 385-390):

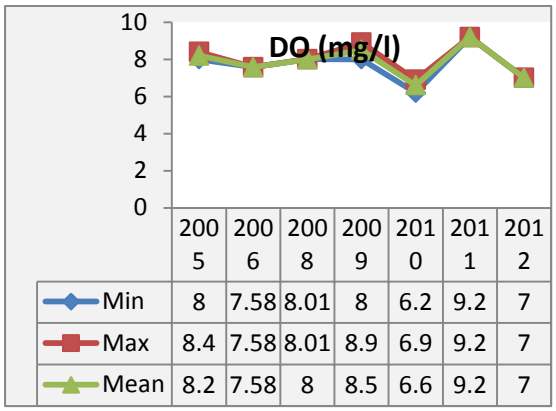


Figure 385

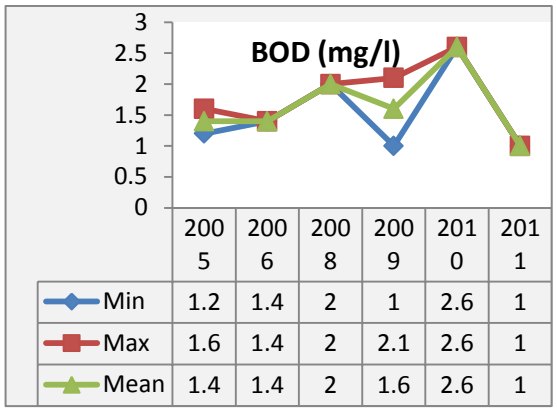


Figure 386

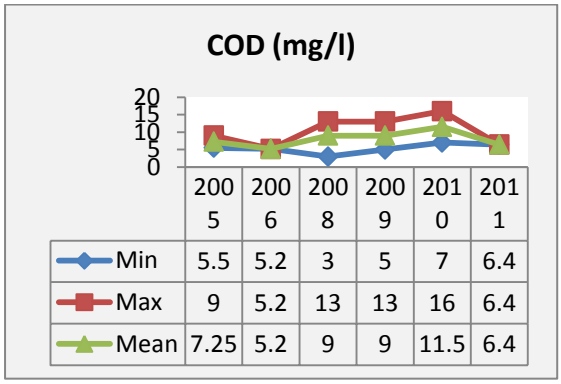


Figure 387

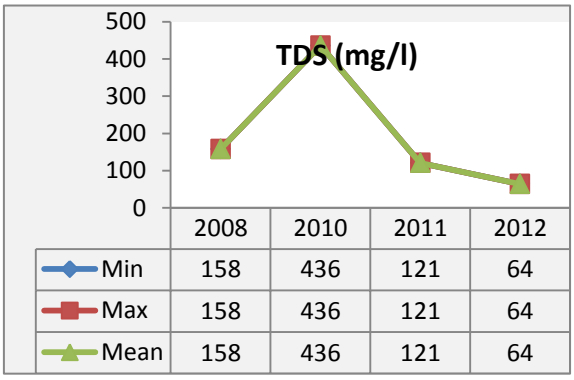


Figure 388

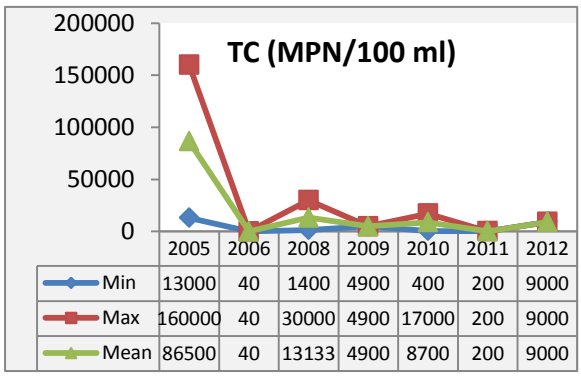


Figure 389

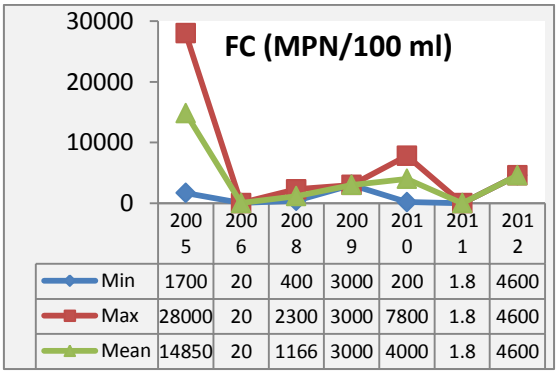


Figure 390

Close examination of figures 385 to 390 shows that:

DO concentration ranges between 6.2 mg/l and 9.2 mg/l during year 2010 and 2011 respectively. BOD concentration ranges between 1.0 mg/l and 2.6 mg/l during year 2009 and 2010. COD concentration ranges between 3.0 mg/l and 16.0 mg/l during year 2008 and 2010 respectively. TDS concentration ranges between 64 mg/l and 436 mg/l during year 2012 and 2010 respectively. TC count ranges between 40 MPN/100 ml and 160000 MPN/100 ml during year 2006 and 2005 respectively. FC count ranges between 1.8 MPN/100 ml and 28000 MPN/100 ml during year 2011 and 2005 respectively.

7.47 Ganga at Dariganj, Distt. Sonepur, Bihar

Water Quality of River Ganga at Dariganj, Distt. Sonepur, Bihar is monitored for 2005-12 having 10 Numbers of observations at the interstate boundaries of Uttar Pradesh and Bihar.

Year	2008	2009	2010	2011	2012	Total

Observations	3	1	2	3	1	10

Water Quality of River Ganga at Dariganj, Distt. Sonepur, Bihar during 2008-2012 is depicted in graphs (from figures 391-395):

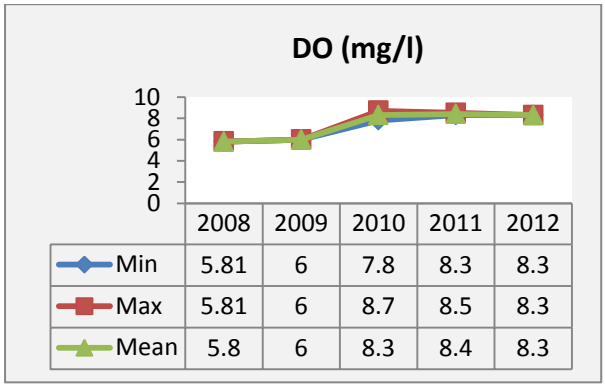


Figure 391

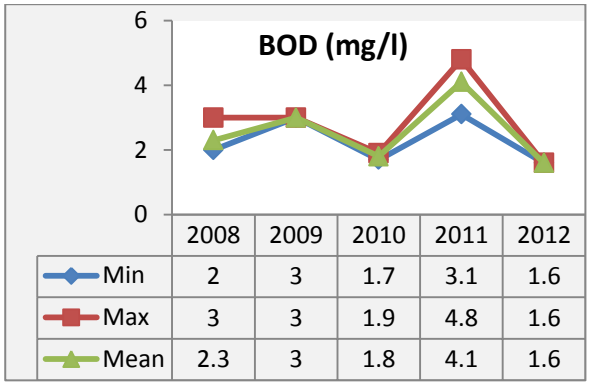


Figure 392

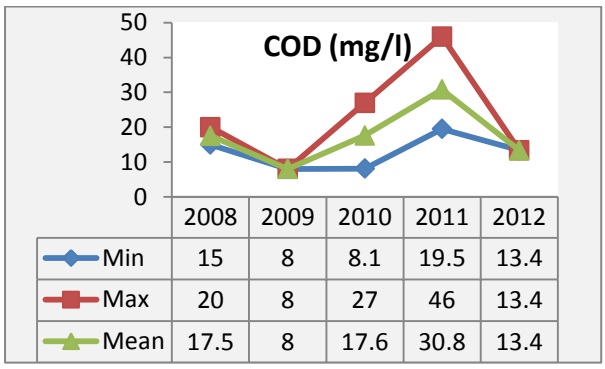


Figure 393

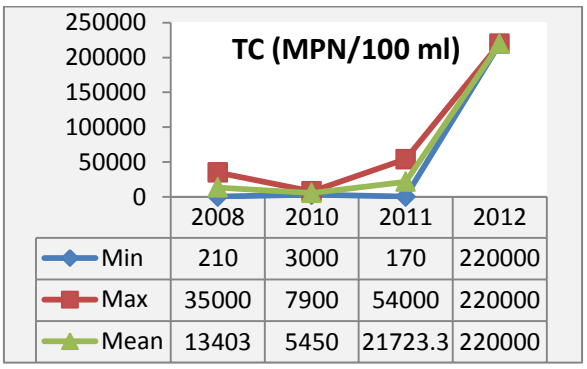


Figure 394

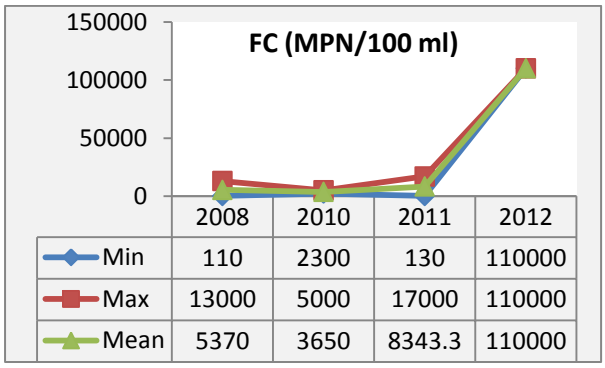


Figure 395

Close examination of figures 391 to 395 shows that:

DO concentration is meeting to the minimum prescribed limit of 5.0 mg/l. DO concentration ranges between 5.81 mg/l and 8.3 mg/l during year 2008 and 2012 respectively. BOD concentration ranges between 1.7 mg/l and 4.8 mg/l during year 2010 and 2011. COD concentration 8 mg/l and 46.0 mg/l during year 2009 and 2011 respectively. TC count ranges between 170 MPN/100 ml and 220000 MPN/100 ml respectively. FC count ranges between 110 MPN/100 ml and 110000 MPN/100 ml respectively.

7.48 Water Quality of River Dhansari

7.48.1 River Dhansari at Ganeshnagar (Nagaland)

Water Quality of River Dhansari at Ganeshnagar (Nagaland) is monitored for 2005-12 having 16 Numbers of observations at the interstate boundaries of Nagaland and Assam.

Year	2005	2006	2008	2009	2010	Total
Observations	4	4	3	3	2	16

Water Quality of River Dhansari at Ganeshnagar (Nagaland) during 2005-2010 is depicted in graphs (from figures 396-400):

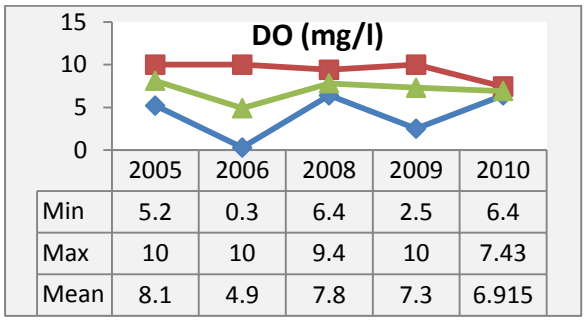


Figure 396

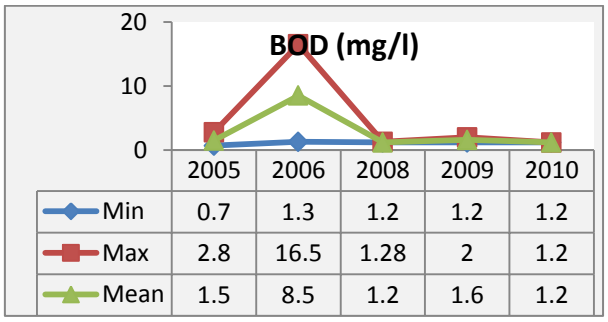


Figure 397

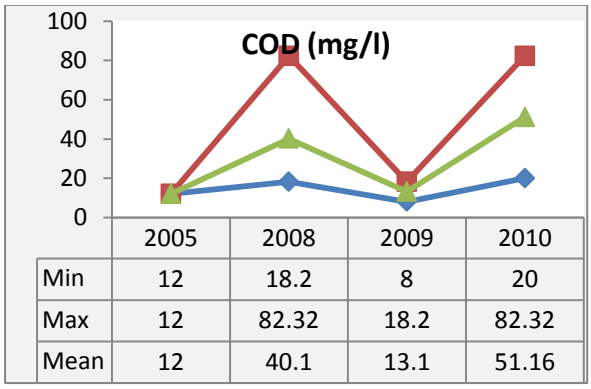


Figure 398

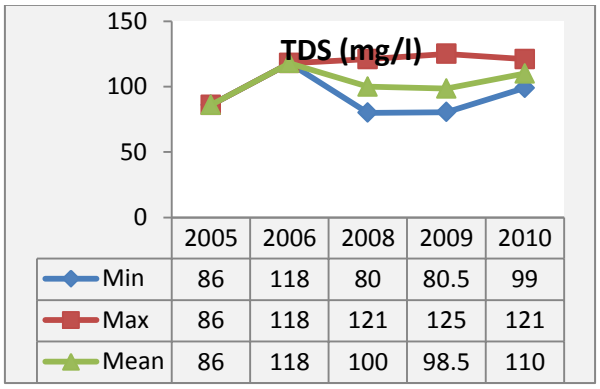


Figure 399

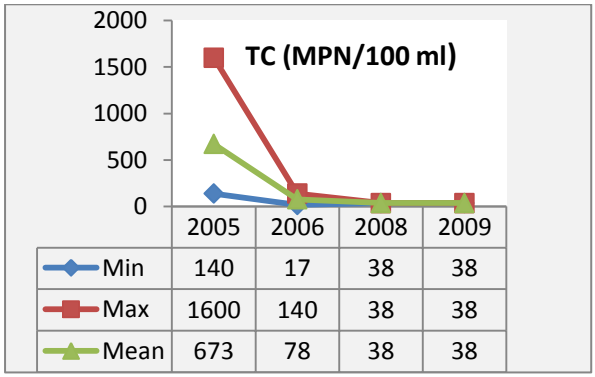


Figure 400

Close examination of figures 396 to 400 shows that:
DO concentration ranges between 0.3 mg/l and 10.0 mg/l during 2005-10. BOD concentration ranges between 0.7 mg/l and 16.5 mg/l during year 2005 and 2006 respectively. COD concentration ranges between 8mg/l and 82.32 mg/l during year 2009 and 2008 respectively. TDS ranges between 80 mg/l and 125 mg/l during year 2008 and 2009 respectively. TC count ranges between 17 MPN/100 ml and 1600 MPN/100 ml during year 2006 and 2005 respectively.

4.48.2 River Dhansari at Nagarjan Bridge

Water Quality of River Dhansari at Nagarjan Bridge is monitored for 2005-10 having 16 Numbers of observations at the interstate boundaries of Nagaland and Assam.

Year	2005	2006	2008	2009	2010	Total
Observations	4	4	3	3	2	16

Water Quality of River Dhansari at Nagarjan Bridge during 2005-2010 is depicted in graphs (from figures 401-405):

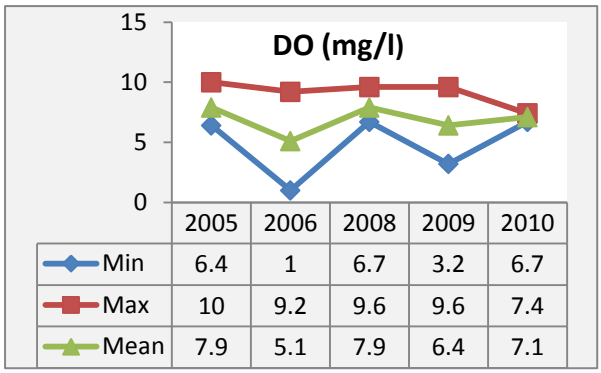


Figure 401

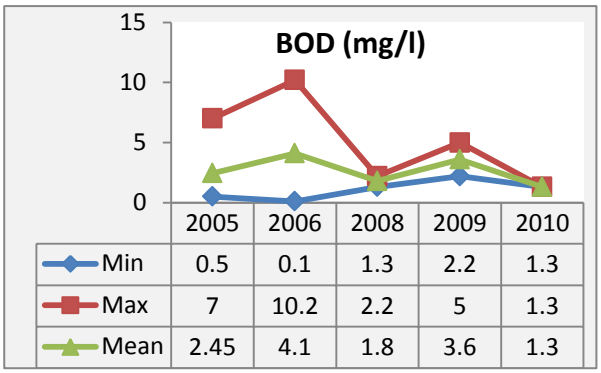


Figure 402

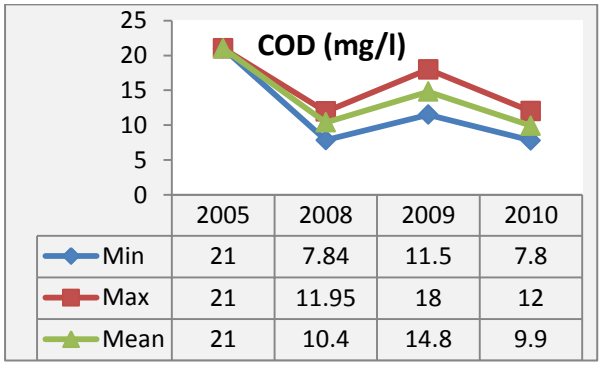


Figure 403

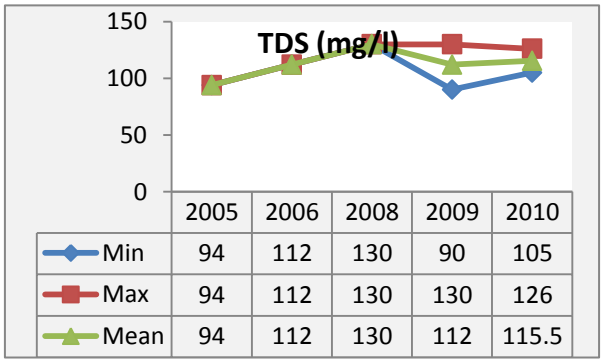


Figure 404

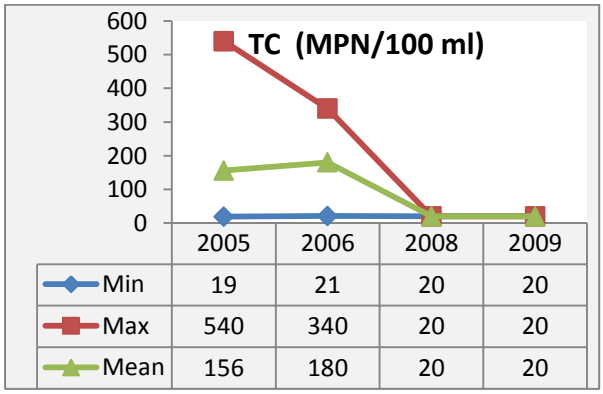


Figure 405

Close examination of figures 401 to 405 shows that:
DO concentration ranges between 1.0 mg/l and 10.0 mg/l during year 2006 and 2005 respectively. BOD concentration ranges between 0.1 mg/l and 10.2 mg/l in the same year 2006. COD concentration ranges between 7.8 mg/l and 21mg/l during year 2008 and 2005 respectively. TDS concentration ranges between 90 mg/l and 130mg/l during year 2009 and 2008. TC count ranges between 19 MPN/100 ml and 540 MPN/100 in the same year 2005.

7.48.3 River Dhansari at Khatkati Gate (Nagaland)

Water Quality of River Dhansari at Khatkati Gate (Nagaland) is monitored for 2005-10 having 16 Numbers of observations at the interstate boundaries of Nagaland and Assam.

Summary of observations:

Year	2005	2006	2008	2009	2010	Total
Observations	4	4	3	3	2	16

Water Quality of River Dhansari at Khatkati Gate (Nagaland) during 2005-2010 is depicted in graphs (from figures 406-410):

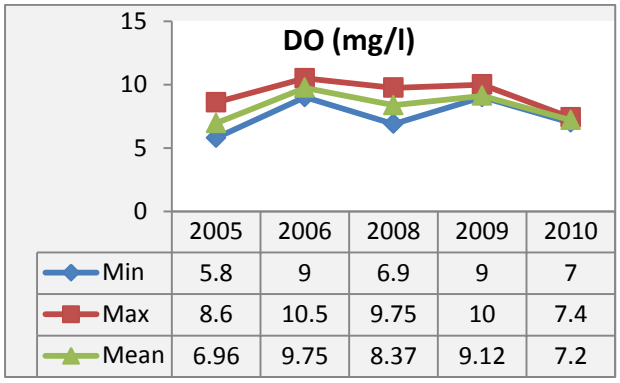


Figure 406

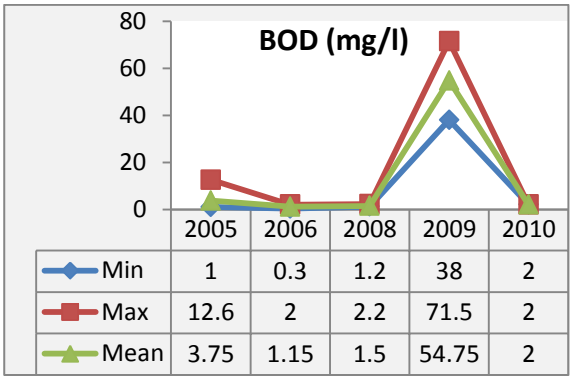


Figure 407

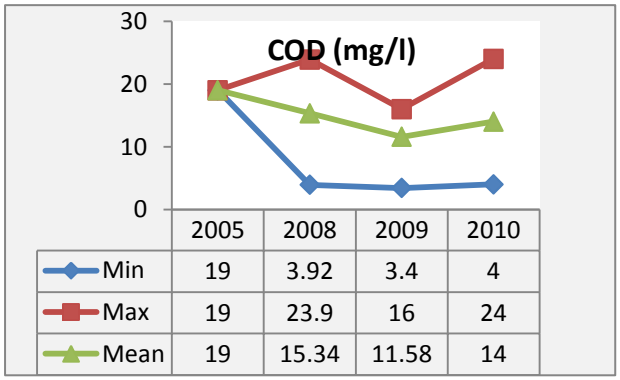


Figure 408

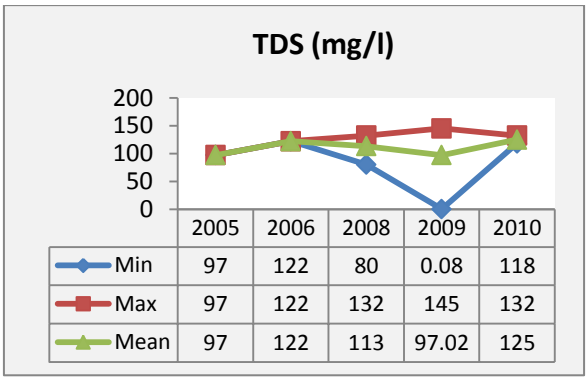


Figure 409

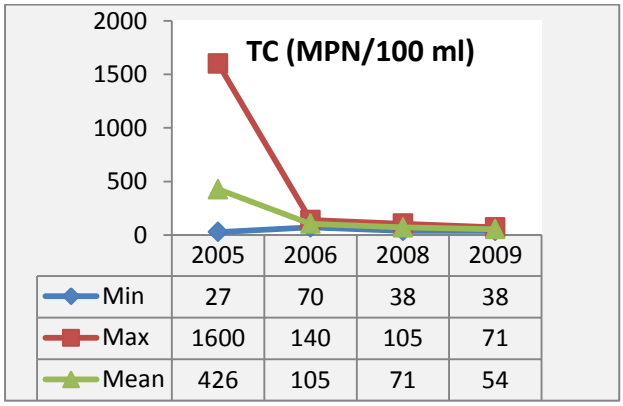


Figure 410

Close examination of figures 406 to 410 shows that:
DO concentration ranges between 5.8 mg/l and 10.5 mg/l during year 2005 and 2006 respectively. BOD concentration ranges between 0.3 mg/l and 71.5 mg/l during year 2006 and 2009 respectively. COD concentration ranges between 3.4 mg/l and 24 mg/l during year 2009 and 2010. TDS ranges between 0.08 mg/l and 145 mg/l. TC count ranges between 27 MPN/100 and 1600 MPN/100 ml in the year 2005.

7.48.4 River Dhansari at Bokajan (Assam)

Water Quality of River Dhansari at Bokajan (Assam) is monitored for 2005-10 having 16 Numbers of observations at the interstate boundaries of Nagaland and Assam.

Summary of observations:

Year	2005	2006	2008	2009	2010	Total
Observations	4	4	3	3	2	16

Water Quality of River Dhansari at Bokajan (Assam) during 2005-2010 is depicted in graphs (from figures 411-415):

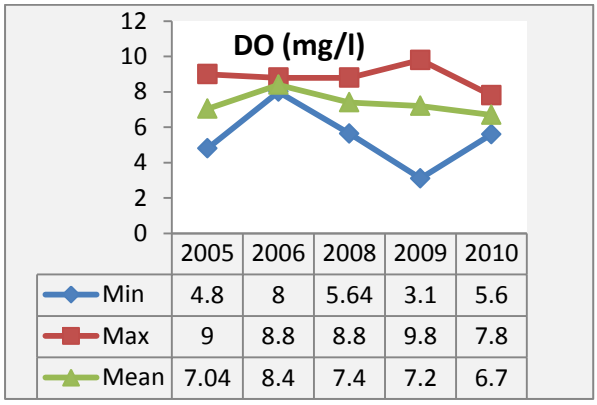


Figure 411

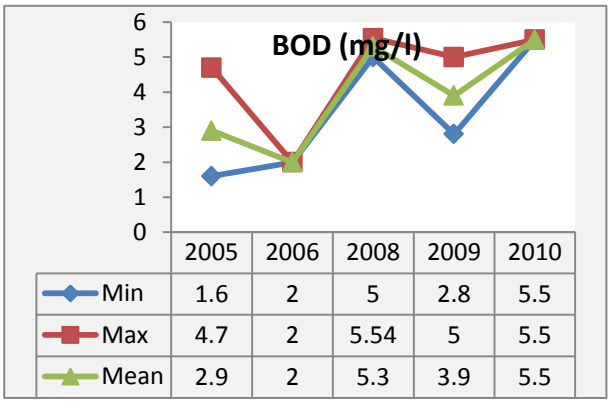


Figure 412

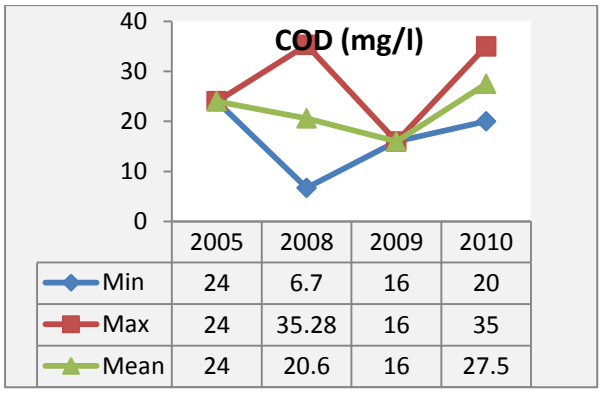


Figure 413

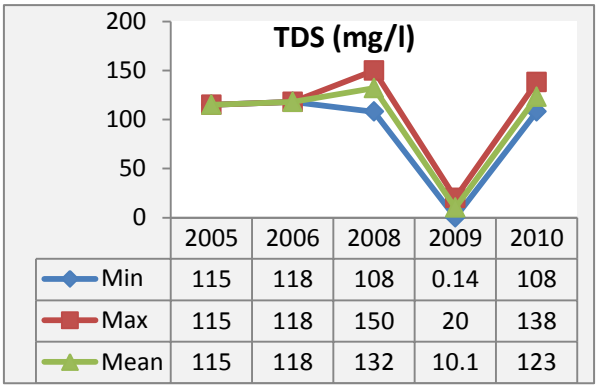


Figure 414

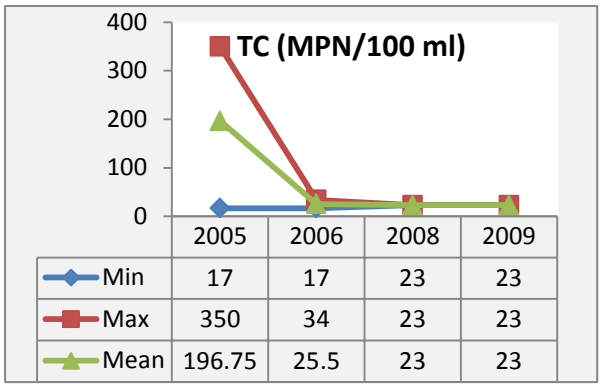


Figure 415

Close examination of figures 411 to 415 shows that:
DO concentration ranges between is 3.1 mg/l and 9.8 mg/l during 2005 and 2009 respectively. BOD concentration ranges between 1.6 mg/l and 5.5 mg/l during 2005 and 2010 respectively. COD concentration ranges between 6.7 mg/l and 35.28 mg/l respectively in the year 2008. TDS concentration ranges between 0.14mg/l and 150 mg/l during year 2009 and 2008 respectively. TC count ranges between 17 MPN/100 and 3500 MPN/100 ml in the year 2005.

7.48.5 River Dhansari at Numaligarh (Assam)

Water Quality of River Dhansari at Numaligarh (Assam) is monitored for 2005-10 having 16 Numbers of observations at the interstate boundaries of Nagaland and Assam.

Summary of observations:

Year	2005	2006	2008	2009	2010	Total
Observations	4	4	3	3	2	16

Water Quality of River Dhansari at Numaligarh (Assam) during 2005-2010 is depicted in graphs (from figures 416-420):

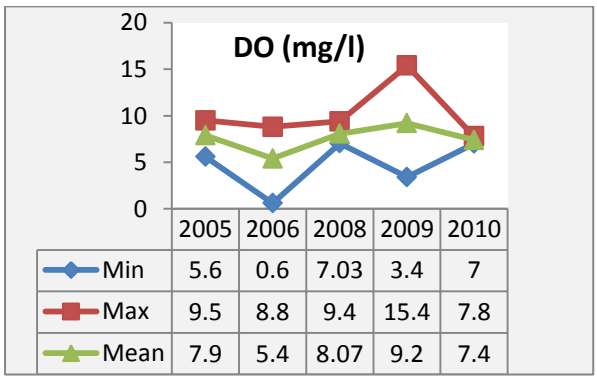


Figure 416

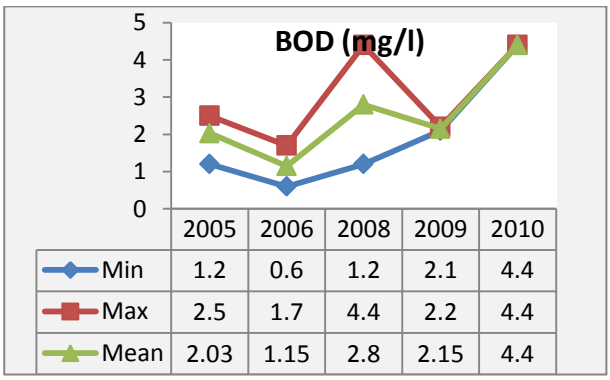
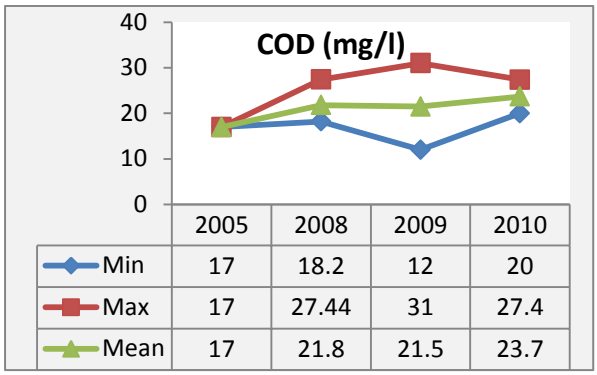
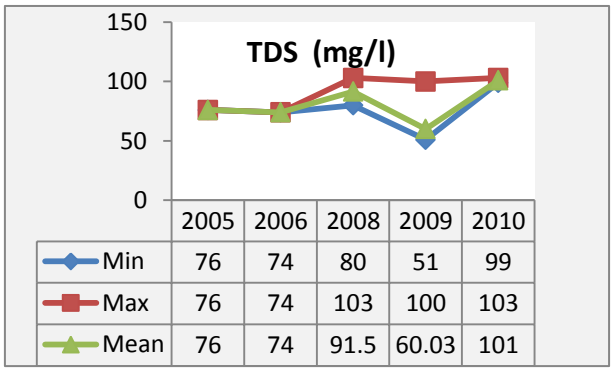


Figure 417



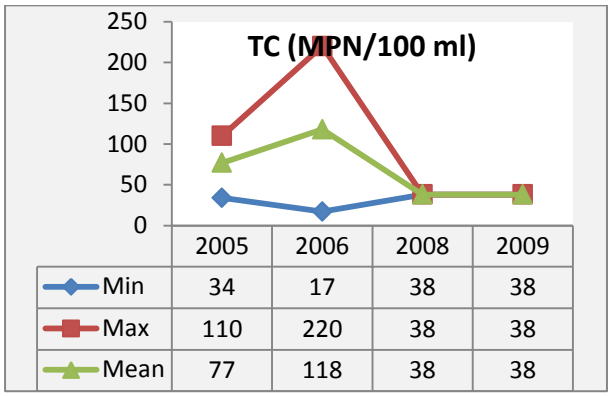
	2005	2008	2009	2010
Min	17	18.2	12	20
Max	17	27.44	31	27.4
Mean	17	21.8	21.5	23.7

Figure 418



	2005	2006	2008	2009	2010
Min	76	74	80	51	99
Max	76	74	103	100	103
Mean	76	74	91.5	60.03	101

Figure 419



	2005	2006	2008	2009
Min	34	17	38	38
Max	110	220	38	38
Mean	77	118	38	38

Figure 420

Close examination of figures 416 to 420 shows that:
DO concentration ranges between 0.6 mg/l and 15.4 mg/l during year 2006 and 2009. BOD concentration ranges 0.6 mg/l and 4.4 mg/l during year 2006 and 2010. COD concentrations ranges between 12 mg/l and 31 mg/l during the year 2009. TDS concentration ranges between 51 mg/l and 103 mg/l during year 2009 and 2010 respectively. TC count ranges between 17 MPN/100 and 220 MPN/100 ml in the year 2006.

CHAPTER 8: CONCLUSION

In this report, the rivers with polluted and poor water quality are differentiated out on the basis of the six water quality parameters i.e. DO, BOD, COD, TDS, TC, FC. Out of the total 40 rivers spread over 82 locations being monitored by Zonal Offices and Head offices, 16 rivers are estimated out to be polluted.

River Dhela at Adampur Village, Bhojpur is observed with the highest BOD value among all the polluted river locations i.e. 131 mg/l in 2012 with very high TC and FC count.

The most polluted river is Ghaggar having the lowest water quality at the 7 locations out of the 9 locations namely, (i) Ghaggar (i) at Mubarakpur (Punjab), (ii) at Tiwana village (Punjab), (iii) at Sirsa Dabwali Road (Haryana), (iv) at Chandrapur Siphon (Haryana), (v) at Sirdulgarh (Punjab), (vi) at Ottu Weir (Haryana) (vii) at Sirsa Hanumangarh Road (Rajasthan). Ghaggar at Mubarakpur (Punjab) is having the deteriorated water quality due the highest BOD range among all the polluted Ghaggar river locations. Ghaggar at Sirsa Dabwali road is observed with the highest TDS value among the 7 polluted river locations. Ghaggar at Chandrapur, Siphon is observed with the highest TC count.

Among the 09 locations of river Yamuna, 3 locations are observed having deteriorated water quality viz. (i)Yamuna at Mohena Palwal Road (Haryana), (ii) River Yamuna at Asgarpur village, (U.P.) and (iii)River Yamuna at Hasanpur, Mohali (Haryana). Yamuna at the location Asgarpur village is observed with the most deteriorated water quality having the highest BOD concentration, remaining two locations are also observed with high TC and FC count and having BOD concentration exceeding to the prescribed limit.

River Ganga being monitored at the four locations and the river Dhansari at 5 locations shows water quality meeting to prescribed standards with respect to BOD and DO conentration. The rivers being monitored at different locations and having good water quality at every location are Beas, Sarsa, Vardha, Mahi, Chambal, Betwa, Sone, Tapi, Bhima, Krishna, Damodar, Ramganga and Subarnrekha.

The other rivers being monitored under IRBM network and not meeting t prescribed standards with respect to BOD and DO are River Bahela at Badli Village, Tehseel - Tanda (U.P.), River Damanganga at at Jarry Causeway D/S of CETP discharge (Gujarat), River Churni at Bijoypur (West Bengal), River Thenpennai at Mugalur Bridge, Bangalore (Karnataka) and River Markanda at Narayangarh (Haryana).

The rivers being monitored at single location and having water quality meeting to the prescribed standards are Satluj, Kosi, Kitcha, Swan, Pilakhar, Churni, Indravati, Cauvery, Tungabhadra, Pennar, Godavari, Mahanadi, Godavari, Wainganga, Sabarmati and Uttra Pinkhani.

Overall, 78% locations have DO value within the prescribed limit and 75% locations have BOD value within the prescribed range with 6% locations have very high BOD value indicating poor water quality. 76% locations have TDS range and 11% with TC range within the prescribed limit.

CHAPTER 9 : ACTION TAKEN BY CPCB TO IMPROVE WATER QUALITY

In order to resolve the interstate water quality problems and keep watch on water quality at interstate borders of different rivers, in 51st Chairman & Member Secretaries conference, it was decided that CPCB would monitor the water quality of the rivers at interstate borders.

As a follow-up of the decision, CPCB through its Zonal Offices and Head Office initiated monitoring of all the important rivers at interstate borders. The monitoring being carried out 4 times in a year following CPCB's guidelines & protocol notified by Ministry of Environment, Forests and Climate Change(MoEFCC). Following significant actions have been taken by CPCB to prevent water pollution in the rivers:

1. Action taken in the matter of Inter-State problem of rivers in Northern States

As a follow up the decision taken in 54th Chairmen and Member Secretaries conference, CPCB organized a meeting with concerned SPCBs/PCCs of Northern/ Eastern & North-Eastern states to discuss the issue of interstate water pollution problem in detail and compliance status of various polluting sources on 24, September, 2008 at MoEF, Delhi.

- Regarding contribution of pollution from domestic sources, Haryana SPCB were requested to issue notice either to municipal authorities or PHED to put up proper sewage treatment plants to take care of all the significant sewage outfalls.

- Punjab SPCB were requested to pursue the distilleries to achieve "Zero-discharge" limit, Since the Patiala Distillery and Chandigarh Distillery are major source of pollution of Ghaggar River in the territory of Punjab.

- Regarding contribution of pollution from domestic sources municipal authorities or PHED were communicated to put up proper sewage treatment plants to take care of all the significant sewage outfalls.

- It was decided to inform Delhi Jal Board to take sample whenever they found any abnormal condition in water quality of Yamuna River with intimation to CPCB and HSPCB.

- Untreated/partially treated discharge of effluents from Uttrakhand is polluting River Kosi & Ramganga and their tributaries like Bahela, Dehla. The pollution is so severe that it continues till Allahabad and cause colour in the river at Sangam. Monitoring being carried out on daily basis for river Dhela, river Kosi, river Bhela, river Gagan and river Ram Ganga by CPCB with co-ordination of SPCBs of Uttarakhand and U.P. in their respective monitoring locations.

2. Action taken in the matter of Inter-State problem of rivers in Eastern and North-Eastern States :

- As a follow up the decision taken in 54th Chairmen and Member Secretaries conference, CPCB organized a meeting with concerned SPCBs/PCCs of Northern/ Eastern & North-Eastern states to discuss the issue of interstate water pollution problem in detail and compliance status of various polluting sources on 25, September, 2008 at MoEF, Delhi.

- The major pollution of Ganga at Bihar border is due to discharge of sewage from Varanasi and Ghazipur. UPPCB informed that STPs are being augmented at Varanasi under Ganga Action Plan-II. CPCB requested that UPPCB to ensure full utilization of STP capacity.

- Regarding pollution from Singrauli area, UPPCB informed that the thermal power plants under NTPC and UPEB are being pursued to provide adequate control measures. CPCB requested UPPCB to regularly monitor the performance of the control measures adopted.

- Realizing the gravity of the problem, it was decided to monitored all the locations at least once in a year monitored even those rivers which are either small/seasonal or not causing any Interstate dispute.

- The concerned SPCBs have been requested to take remedial measures to restore water quality of the identified polluted river at interstate border.

3. Action taken in the matter of River Yamuna :

- Episodes on water quality degradation at Wazirabad were informed by Delhi Jal Board on several occasions since 2006. Similar episodes occurred in October and November, 2006 and Central Pollution Control Board has issue direction to Haryana State Pollution Control Board (HSPCB) u/s 18 1 (b) of Water (Prevention and Control of Pollution) Act, 1974 during 2006. Chairman, CPCB also wrote a DO letter to the Financial Commissioner & Principal Secretary to Govt. of Haryana who was also In-charge of Environment & Forests Department of Government of Haryana during 2006.
- CPCB again issued direction to Haryana State Pollution Control Board u/s 18 1 (b) of Water (Prevention and Control of Pollution) Act, 1974 on November 15, 2007 for taking immediate effective steps to contain pollution of the River Yamuna..
- CPCB again issued direction to Haryana, Uttar Pradesh, State Pollution Control Board (SPCB) and Delhi Pollution Control Committee (DPCC) u/s 18 1 (b) of Water (Prevention and Control of Pollution) Act, 1974 on 23/11/2007.
- CPCB made an exhaustive survey report on Polluting Sources of Yamuna river Upstream Wazirabad.
- A meeting was held on 29/06/2009 at CPCB, Head office on water quality problems of Yamuna river with Delhi Jal Board, Delhi Pollution Control Committee (DPCC), Uttar Pardesh SPCB, Haryana SPCB, UP Jal Nigam, Nagar Nigam Ghaziabad to contain pollution at the respective sources of the River Stretch of Yamuna.

- A meeting was held on 10/11/2009 in CPCB on issues of water quality of Yamuna River in Delhi Stretch.
- A meeting was held on 31/12/09 at CPCB to review the status of sewage treatment in Delhi & water Quality Problems in Delhi stretch of Yamuna River.
- DJB regularly complaint about increase in Ammonia and chloride level at river Yamuna upstream Wazirabad, Delhi.

- A meeting was held on 28/03/2011 at house of Hon'ble Chief Minister of Delhi to review the Water Quality Problem of River. Yamuna. Yamuna. Brief report on Yamuna river (Hathnikund to Okhla Barrage) is also prepared.
- CPCB recently conducted a survey of river Yamuna from Hathnikund to Agra to assess the water quality of river Yamuna.

- CPCB also monitor Sewage Treatment plant installed along the catchment of river Yamuna.
- CPCB also monitoring the status of drain joining river Yamuna.
- A review meeting on "Interstate Water Pollution Problem in Southern and Western States" was held on 18/07/08 at MoEF.

Action Taken in the matter of River Ghaggar :

- Pursuant to the decisions taken in the meeting held on August 19, 2009 chaired by the Secretary, Cabinet Coordination, Rashtrapati Bhawan, New Delhi and communication received from the Joint Secretary, Ministry of Environment and Forests (MoEF), Shri Rajiv Guaba vide letter no. M-12012/1/2002-NRCD-II (pt) dated 24/08/2009, a detailed field investigation on the aforesaid issued was conducted by CPCB. A detailed report on "Pollution Status of River Ghaggar" was compiled and submitted to MoEF on 14/12/2009.
- On the basis of report, MoEF requested CPCB to issue directions to the defaulter industries in order to address the problem of pollution load entering Jharmal Choe and other area vide DO. NO M-12012/1/2002-NRCD-II (pt) dated 12th February, 2010.
- CPCB issued direction to the Punjab, Haryana & Himachal Pradesh State Pollution Control Boards & Chandigarh PCC under section 18 (1)(b) of the water (PCP) Act 1974 in the matter of industrial effluent and sewage discharge into Ghaggar River vide letter no. A-19014/41/2001-mon/509-11 dated 15th April, 2010.
- Since, No reply was received therefore, CPCB issued reminder letter to the Punjab, Haryana & Himachal Pradesh State Pollution Control Boards & Chandigarh PCC on the same issues vide letter no. A-19014/41/2001-Mon/6719-6722 dated 17th August, 2010.
- Chandhigarh PCC (CPCC) has given show cause notice to the Municipal Corporation, Chandigarh and Superintending Engineer, Chandigarh Administration:
  - ✓ to ensure treatment of sewage to the prescribed norms with immediate effect.
  - ✓ to ensure that STP run on optimal capacity.
- Municipal Corporation was directed to lay down pipeline to carry sewage water of Chandigarh directly to STP Raipur Kalan.
- CPCB regularly submitting analysis report of the sewage treatment plants installed in Chandigarh.

CHAPTER10: RECOMMENDATIONS

The river pollution control needs consideration of the following aspects for clean-up:

- Industries should install the machineries to remove contaminants from their effluents and wastewater by installing Effluent Treatment Plant (ETP) , untreated effluent discharge into rivers should not be allowed and Immediate closure of all the unauthorized activities which discharge industrial effluents, sludge and chemicals.
- The cities and towns should also have facilities to clean sewage effluent. All towns and cities should have Sewage Treatment Plant to treat the sewage.
- Religious practices/activities which pollute river water. Idols should be made from natural materials as described in the holy scripts. It would be appropriate to use traditional clay for idol making rather than baked clay. Use of painted idols should be discouraged.
- In case painted idols are used, water soluble and non-toxic natural dyes may be used. Use of toxic and non- degradable chemical dyes should be strictly prohibited.
- Natural colors used in food products and permitted in Pharmaceuticals may be preferred.
- Proposals for creation of treatment capacity must be based and prioritized with reference to the estimated sewage generation in the relevant catchment areas which should be estimated after taking all factors into account including population trends and availability/supply of water.
- Systems and procedures need to be strengthened to ensure accurate measurement of both the quantity of treated sewage being discharged as well as its quality with reference to the prescribed parameters.
- Promoting communities participation in local river cleaning up
- Organizing awareness programs and meetings on the river pollution and its threats.
- Provide proper garbage collection system on both banks of the river, so that garbage is not dumped in the river.
- To improve flow pattern, it will improve its carrying capacity.