

**8.1 DRAINAGE**

The city has an undulating ridge and valley topology and is covered by number of natural drainage channels. The drainage is controlled by the Kuakhai and Daya rivers, girdling the city on the north and the south. Apart from this a number of open drains running west to east criss-cross the city, some of which finally joins to form Gangua Nallah. Gangua nallah meets River Daya, a distributary of River Kuakhai.

The city is in the western side of River Kuakhai and to the northern part of River Daya. The land on which the city stands slopes from the north - west of the city area to the Kuakhai river in the east and Daya River in the south.

The water requirement for Bhubaneswar city is mainly met from River Kuakhai, River Daya and Spring Tanks and from ground water sources. River Kuakhai and River Daya are the major surface water source. Both the rivers receive industrial and domestic discharges. The major sources of water pollution in Bhubaneswar city are the industrial and domestic discharges. The discharges are through wastewater drains, overflow of the septic tanks and oxidation ponds.

There are 88 industries and 2 industrial clusters, of which 34 are water pollution potential industries, which discharge their effluent into the drains. The detailed list of industries, their location, type of products manufactured and the pollution potential is given in Annexure IX. Most of the sewage from the city reaches River Khuakai and River Daya through open drains. There are about 10 open drains in the city of Bhubaneswar discharging wastewater.

The entire city has not been covered with surface water drain. The drains cover an area of about 103.43 sq km with the drainage length of 37.18 km. Drain No 1 (Patia) outfalls into Kukhai River directly and drain no 2 to 10 outfalls in Gangua nallah, which is the main drain between Daya West Branch Canal and Daya River. All the drains have to cut across the South Eastern Railway line, NH-203, Daya West Branch Canal and NH-5. The major drains

**Chapter 8**  
**WATER**  
**POLLUTION**

## DRAFT REPORT

(Nallahs) in the city, the starting point, the outfall, the length and the area covered by each of them is given in Table 8.1. The wards and areas partly or fully covered by the drains and the average flow of each drain is given in Table 8.2. The catchment areas of some of the major drains are shown in Map 12.

**Table 8.1**  
**Major Drain (Nallah) in Bhubaneswar City**

| Drain No.    | Drain name      | Starting point                         | Outfall point   | Length in sq km | Drainage Area in sq km |
|--------------|-----------------|--|---|-----------------|------------------------|
| 1.           | Patia           | Forest lake Chandrashekharpur          | Daya West Canal Crossing to River Kuakhai                     | 4.32            | 16.93                  |
| 2.           | Sainik School   | Sainik School Road Culvert             | Railway Bridges (Confluence with Drain no 3) to Gangua Nallah | 1.13            | 1.44                   |
| 3.           | OAP Area        | Near Sainik School                     | Railway Bridges (Confluence with Drain no 2) to Gangua Nallah | 2.42            | 3.31                   |
| 4.           | Vanivihar       | Culvert near Reserve Forest, Bharatpur | Daya West Canal Crossing to Gangua Nallah                     | 5.63            | 13.67                  |
| 5.           | Laxmisagar Area | Culvert in Janpath Road                | Gangua Nallah   | 3.13            | 3.66                   |
| 6.           | Baragada Area   | Railway Bridges                        | Gangua Nallah   | 2.16            | 2.89                   |
| 7.           | Kedargouri      | Culvert in Air port Road               | Gangua Nallah   | 4.34            | 9.46                   |
| 8.           | Airport Area    | Joklandi Road                          | Confluence with Drain no 8 to Gangua Nallah                   | 4.33            | 12.99                  |
| 9.           | Ghatikia        | Culvert on NH-5                        | Pokhariput Railway Bridge to Gangua Nallah                    | 4.24            | 12.55                  |
| 10.          | Nicco Park      | Lake near CRP Colony                   | Gangua Nallah   | 5.48            | 10.28                  |
| <b>TOTAL</b> |                 |  |   | <b>37.18</b>    | <b>103.23</b>          |

**Table 8.2**  
**Major Drain (Nallahs) in Bhubaneswar City**

| Drain No | Major Drain     | Major Areas  | Ward No             | Average Discharge (MLD) |
|----------|-----------------|--|---------------------|-------------------------|
| 1        | Patia           | Chander Shekharpur, Damana, Garkhana, Patia, Rokata, Mancheswar,     | 1                   | 17.00                   |
| 2        | Sainik School   | Garkana,   | 2                   | 1.55                    |
| 3        | OAP Area        | Samanta Vihar, Vani Vihar, Garkana,                                  | 2, 3, 5, 6, 7, 8    | 3.55                    |
| 4        | Vanivihar       | Nayapalli, Madhusudan Nagar, Vani Vihar, Pandar, Garkana, Bhoi Nagar | 4, 6, 7, 17         | 16.40                   |
| 5        | Laxmisagar Area | Kesari Nagar, Charbatia, East Bargada,                               | 24, 23,             | 4.45                    |
| 6        | Baragada Area   | East bargada,, Laxmi Sagar, Ashok Nagar,                             | 25, 26, 10          | 3.45                    |
| 7        | Kedargouri      | Goutam Nagar, West Bargada, Nuagaon,                                 | 26, 23              | 5.45                    |
| 8        | Airport Area    | Baramunda, Jokolandi, Jagmara  | 13,14, 15, 16, 17   | 14.30                   |
| 9        | Ghatikia        | Aiginia, Dumduma, Jagamara, Begunia, Kochilaput, Ransnghpur,         | 18, 19, 20, 15, 16, | 28.8                    |

| Drain No | Major Drain | Major Areas   | Ward No               | Average Discharge (MLD) |
|----------|-------------|---|-----------------------|-------------------------|
|          |             | Ebaranga, Pokhariput, Ghatika, Sankarpur,   |                       |                         |
| 10       | Nicco Park  | Madhusudan Nagr, Bhoinagar, Satyanagr, GovindPrasd, Kardakanta, Jharpada, Nilkanthanagar, Madhusudan Nagar, | 9, 12, 11, 10, 21, 22 | 12.3                    |

The waste water generated from the Municipal area of the city finds its way to the drains, but the waste water falling under the wards 17, 18, 19, 29 do not have easy access to the drains and the spill out in the nearby roads.

## 8.2 WASTEWATER GENERATION

In absence of sewerage system, people are using septic tanks and soak pits. In most of the places sewage is discharged in to open drains without any treatment, which joins to form Gangua Nallah and ultimately discharges to river Daya. The Gangua Nallah joins river Daya near Birimula Village about one kilometer down Stream of Kukuria Bridge. The wastewater quality of the drains are presented in the Table 8.3.

**Table 8.3**  
**Wastewater Quality Of Drains Of Bhubaneswar City**

| Parameters<br>▼        | Monitoring Sites |     |     |     |     |     |     |     |     |     |     |
|------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                        | Drain no. ▶      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
| PH                     |                  | 7.4 | 6.1 | 7.5 | 7.6 | 6.9 | 7.2 | 7.2 | 5.9 | 6.9 | 6.9 |
| SS (mg/l)              |                  | 120 | 20  | 160 | 100 | 140 | 180 | 60  | 160 | 200 | 200 |
| TDS (mg/l)             |                  | 180 | 200 | 200 | 200 | 400 | 300 | 400 | 200 | 400 | 400 |
| BOD (mg/l)             |                  | 100 | 160 | 120 | 60  | 140 | 120 | 140 | 24  | 100 | 100 |
| COD (mg/l)             |                  | 130 | 208 | 160 | 120 | 208 | 176 | 176 | 52  | 160 | 160 |
| Cl <sup>-</sup> (mg/l) |                  | 36  | 50  | 66  | 34  | 72  | 64  | 88  | 28  | 72  | 72  |

1. Acharya Vihar, 2. Sahid Nagar, 3. Kedargouri, 4. Chandrasekharpur, 5. Nayapalli, 6. Unit – II, 7. Satyanagar, 8. Mancheswar, 9. Baragada 10- Laxmisagar

Gangua nallah which finally meets River Daya serves as the ultimate for the wastewater discharges of Bhubaneswar city. River Kuakhai and Gangua receive about 107.25 mld of wastewater within the city of which 47.6 mld is from domestic sources, 29.3 mld from industrial areas (mainly from Drain No-1 which discharges the waste water from the Patia and Chandaka industrial estate) and 30.35 mld from mixed sources. The wastewater discharged into Kuakhai and Daya rivers from various drains and the pollution load carried by them is shown in Table 8.4.

The total organic load (BOD) discharged through these drains is 100.64 t/day and that of solids is 127 t/day. The major contributor to the water pollution for BOD Load is Patia drain followed by Sainik School These drains discharge both domestic and industrial wastewater from densely populated old city areas. These drains discharge both domestic and industrial wastewater from densely populated old city areas.

**Table 8.4**  
**Pollution Load Discharges through Surface Drains in Bhubaneswar City**

| Drain No     | Major Drain     | Avg. BOD (mg/l) | Avg. BOD (t/d) | Avg. COD (mg/l) | Avg. COD (t/d) | Avg. COD (mg/l) | Avg. COD (t/d) | Avg. SS (mg/l) | Avg. SS (t/d) | Avg. TDS (mg/l) | Avg. TDS (t/d) |
|--------------|-----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|----------------|---------------|-----------------|----------------|
| 1            | Patia           | 160             | 27.20          | 208             | 35.36          | 208             | 35.36          | 20             | 3.40          | 200             | 34.00          |
| 2            | Sainik School   | 127             | 1.97           | 100             | 1.55           | 100             | 1.55           | 124            | 1.92          | 300             | 4.65           |
| 3            | OAP Area        | 120             | 4.26           | 176             | 6.25           | 176             | 6.25           | 180            | 6.39          | 300             | 10.65          |
| 4            | Vanivihar       | 100             | 16.40          | 160             | 26.24          | 160             | 26.24          | 200            | 32.80         | 400             | 65.60          |
| 5            | Laxmisagar Area | 120             | 5.34           | 160             | 7.12           | 160             | 7.12           | 160            | 7.12          | 200             | 8.90           |
| 6            | Baragada Area   | 140             | 4.83           | 176             | 6.07           | 176             | 6.07           | 60             | 2.07          | 400             | 13.80          |
| 7            | Kedargouri      | 140             | 7.63           | 208             | 11.34          | 208             | 11.34          | 140            | 7.63          | 400             | 21.80          |
| 8            | Airport Area    | 24              | 3.43           | 52              | 7.44           | 52              | 7.44           | 160            | 22.88         | 200             | 28.60          |
| 9            | Ghatikia        | 60              | 17.28          | 120             | 34.56          | 120             | 34.56          | 100            | 28.80         | 200             | 57.60          |
| 10           | Nicco Park      | 100             | 12.30          | 130             | 15.99          | 130             | 15.99          | 120            | 14.76         | 180             | 22.14          |
| <b>TOTAL</b> |                 |                 | <b>100.64</b>  |                 | <b>151.91</b>  |                 | <b>151.91</b>  |                | <b>127.77</b> |                 | <b>267.74</b>  |

As out of the 10 drains flowing in the city almost 9 of them meets the Gangua nallah at different locations the flow of the Gangua nallah is well maintained. Drain No 1 (Patia) outfalls into Kuakhai River directly and drain number 2 to 10 outfalls in Gangua, the total BOD load discharged to River Kuakhai is 27.20 t/d and to the Gangua nallah (100.64 – 27.20 = 73.44) t/d.

The flow in the river Kuakhai and Daya helps in achieving the required dilutions for the wastewater. The flows in the rivers at various points are shown in fig 8.1 and Table 8.5. River Kuakhai is a tributary of River Mahanadi and water remains throughout the year. The flow in Kuakhai during lean season varies from 85 m<sup>3</sup>/s to 105 m<sup>3</sup>/s. River Daya is also a large seasonal river and water remains throughout the river with considerable flow. The flow in Daya river varies from 55 m<sup>3</sup>/s to 90 m<sup>3</sup>/s. The flow of the Gangua nallah is ranges from 8m<sup>3</sup>/s to 60m<sup>3</sup>/s at different locations. High flow in Gangua offers approx. 9-10 times dilution making the BOD 7.00 before the confluence at River Daya.

**Table 8.5**  
**Bathymetry Of The Rivers/Drains In Bhubaneswar City**

| Parameters | Unit              | SP1   | SP2    | SP3 | SP4   | SP5  | SP6   |
|------------|-------------------|-------|--------|-----|-------|------|-------|
| Flow rate  | m <sup>3</sup> /s | 84.46 | 105.02 | 55  | 88.90 | 7.58 | 54.06 |

Source: State Pollution Control Board Orissa October, 2002

SP 1 on Kuakhai River – At u/s of Bhubaneswar.  
 SP 2 on Kuakhai River – Before confluence of Daya River  
 SP 3 on Daya River - After confluence of Kuakhai River  
 SP 4 on Daya River – After confluence of Gangua Nallah.  
 SP 5 on Gangua nallah –At u/s before the meeting of any drain  
 SP 6 on Gangua nallah – In between the city after meeting of some of the drains

**Observations:**

1. Most of the area under the Municipal boundary is covered by the drains (103.23 sq km), but the waste water falling under the wards 17, 18, 19, 29 do not have easy access to the drains and the spill out in the nearby roads.
2. The total BOD load discharged from the drains is 103.23 t/d out of which of which 47.6 mld is from domestic sources, 29.3 mld from industrial areas and 30.35 mld from mixed sources.
3. The Gangua Nallah servers as the ultimate discharge for the wastewater of the city receiving 73.44 t/d of BOD. Out of the 10 drains flowing in the city almost 9 of them meets the Gangua nallah at different locations. River Kuakhai receives 27.20 t/d of BOD.
4. The major contributor to the water pollution for BOD Load is Patia drain followed by Sainik School These drains discharge both domestic and industrial wastewater from densely populated old city areas. These drains discharge both domestic and industrial wastewater from densely populated old city areas.
5. There is sufficient flow in the River Kuakhai and Gangua nallah, which helps in achieving the required dilutions for the wastewater.
6. The intake point for public water supply for Bhubaneswar city is at 500 m from the NH-5. The discharge of the Patia Drain (Drain No-1) is 500 m upstream of the water supply intake point.

**8.3. WATER QUALITY CRITERIA**

The river water quality criteria applicable for River Kuakhai are given in Table 8.6.

**Table 8.6  
WATER QUALITY CRITERIA**

| Sl. No. | Parameters  | Requirement for Waters of Class |                    |                    |
|---------|---|---------------------------------|--------------------|--------------------|
|         |   | A-Excellent                     | B-Desirable        | C-Acceptable       |
| 1       | Ph  | 7.0 to 8.5                      | 6.5 to 9.0         | 6.5 to 9.0         |
| 2       | DO (% saturation)                                   | 90-110                          | 80-120             | 60-140             |
| 3       | BOD (mg/l)  | Below 2                         | Below 5            | Below 8            |
| 4       | EC (*mhos/cm)                                       | <1000                           | <2250              | <15                |
| 5       | (NO <sub>2</sub> =NO <sub>3</sub> )-Nitrogen (mg/l) | <5                              | <10                | <15                |
| 6       | Suspended solid (mg/l)                              | <25                             | <50                | <100               |
| 7       | Fecal Coliform (MPN/100 ml)                         | <20 per 100 ml                  | <200 per 100 ml    | <2000 per 100 ml   |
| 8       | Bio-assay (Zebra fish)                              | No death in 5 days              | No death in 3 days | No death in 2 days |

Note:

1. Dissolve oxygen (DO) not applicable for ground waters
2. Dissolved oxygen in eutrophicated waters should include measurement for diurnal variation
3. Suspended solid limit is applicable only during non-monsoon period
4. Fecal coliform values should meet for 90% times
5. Static Bio-assay method may be adopted
6. Failure to comply with one or more of the above limits shall imply assignment of the next lower class

### 8.3.1 River Kuakhai Water Quality

The month-wise monitored data for the years 1991 to 2001 monitored under the MINARS is given in Table 8.7 and Table 8.8. The data has been taken from the Status report for Bhubneswar prepared by SPCB, Orissa.

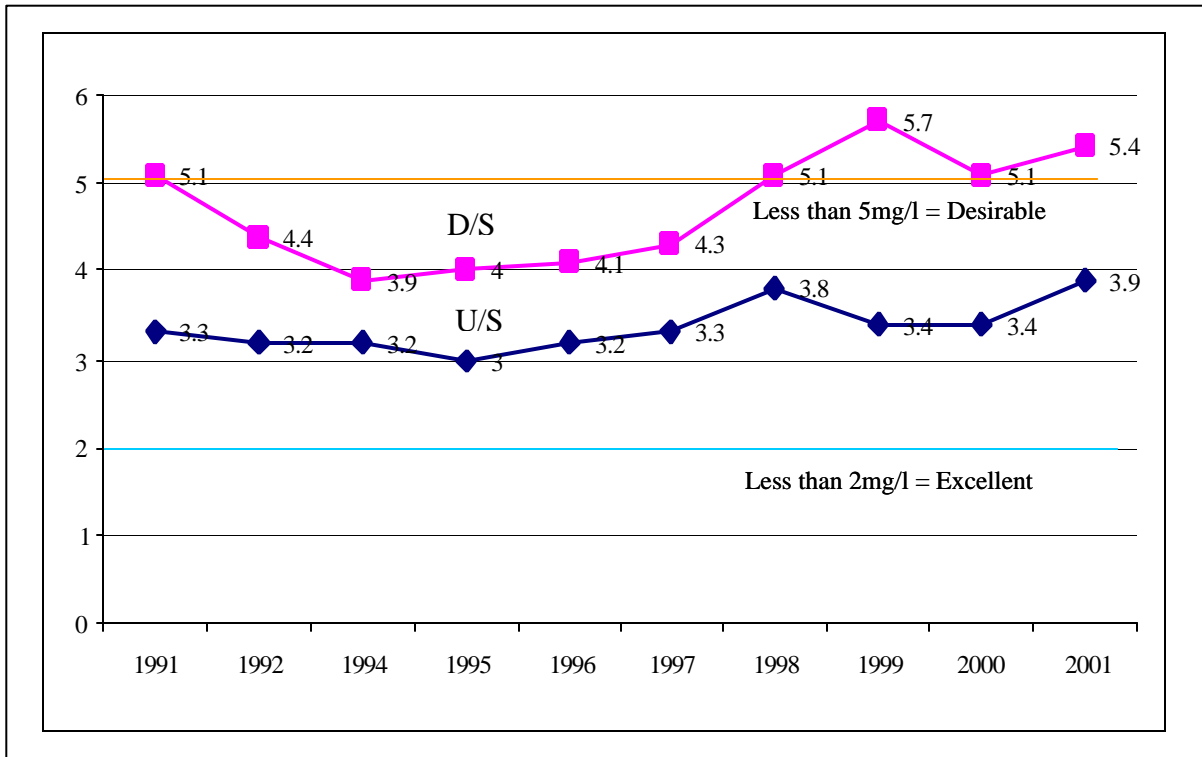
**Table - 8.7**  
**River Water Quality Of Kuakhai & Daya In Bhubaneswar**

| Year | pH  |     | DO (mg/l) |      | BOD (mg/l) |     | COD   |      | F COL |      | TC (MPN/ml) |        |
|------|-----|-----|-----------|------|------------|-----|-------|------|-------|------|-------------|--------|
|      | A   | B   | A         | B    | A          | B   | A     | B    | A     | B    | A           | B      |
| 1991 | 7.6 | 7.5 | 7.9       | 7.4  | 3.3        | 5.1 | 6.3   | 9.5  | 6     | 6    | 277         | 954    |
| 1992 | 7.7 | 7.8 | 9         | 8    | 3.2        | 4.4 | 9.3   | 12.9 | 5     | 6    | 410         | 1062   |
| 1993 | NA  |     |           |      |            |     |       |      |       |      |             |        |
| 1994 | 7.6 | 7.9 | 11        | 10.3 | 3.2        | 3.9 | 13.1  | 15.6 | 5     | 6    | NA          | NA     |
| 1995 | 7.5 | 7.8 | 9.5       | 8.5  | 3          | 4   | 11    | 13.5 | 450   | 1125 | 594         | 1664   |
| 1996 | 7.5 | 7.8 | 9.1       | 8    | 3.2        | 4.1 | 11.67 | 16.3 | 421   | 846  | 709         | 1209   |
| 1997 | 7.5 | 7.7 | 8.5       | 7.4  | 3.3        | 4.3 | 11.5  | 17.0 | 328   | 521  | 484         | 927    |
| 1998 | 7.7 | 8.0 | 7.7       | 6.8  | 3.8        | 5.1 | 12.3  | 17.0 | 215   | 304  | 288         | 451    |
| 1999 | 7.6 | 7.7 | 7.4       | 6.5  | 3.4        | 5.7 | 13.5  | 25.5 | 423   | 909  | 555         | 1114   |
| 2000 | 7.5 | 7.7 | 7.0       | 6.6  | 3.4        | 5.1 | 15.5  | 22.9 | 550   | 1483 | 1123        | 4040   |
| 2001 | 7.7 | 7.5 | 7.3       | 6.3  | 3.9        | 5.4 | 10.8  | 27.3 | 603   | 1502 | ≥11000      | ≥11000 |

- A – Kuakhai at U/S of water supply intake point,
- B – Kuakhai at D/S at River Daya

**Table - 8.8**  
**Surface Water Analysis Results Of Bhubaneswar Urban Area**

| Location      | Temp (°C) | PH   | Cond. ?mho /100ml | Parameters in mg/lit |      |     |         |        |     |                 |                 |    |          |     |
|---------------|-----------|------|-------------------|----------------------|------|-----|---------|--------|-----|-----------------|-----------------|----|----------|-----|
|               |           |      |                   | BOD                  | COD  | DO  | TC      | FC     | TSS | NO <sub>3</sub> | SO <sub>4</sub> | TH | Total Fe | Alk |
| River Kuakhai | 25        | 8.57 | 142.7             | 3.0                  | 10.8 | 6.2 | ≥11,000 | ≥11000 | 31  | 0.386           | 5.24            | 60 | 2.4      | 54  |
| River Daya    | 23        | 8.54 | 150.0             | 7.0                  | 14.5 | 9.5 | 46000   | 24000  | 27  | 0.795           | 3.23            | 52 | 1.8      | 60  |
| Gangua Nallah | 20        | 8.33 | 304.0             | 3.0                  | 8.6  | 5.8 | ≥110000 | 110000 | 19  | 0.370           | 5.5             | 84 | 2.4      | 98  |



The monitored data from MINARS shows that the average value of BOD at upstream is 3.9 mg/l (u/s) and at down stream is 5.4 mg/l (d/s) in 2001. The total coliform count and the fecal count is very high count ( $\geq 110000$ ) indicating the sewage discharges of the Bhubaneswar.

Over the year the trends shows that the water quality excellent category to the desirable category at the upstream of Bhubaneswar. But due the discharges from the city the water quality has deteriorated, although not alarming. The present water quality in River Kuakhai can be categorized under ' C ' class and falls under the 'Acceptable' category of the Water Quality Criteria.

### 8.3.2 Gangua Nallah Water Quality

Apart from the Rivers, Gangua Nallah receives the maximum discharges from the City. Gangua nallah is a natural stream that emanates from Gadakhan village and flows between Kuakhai and Daya River and confluence with Daya near Kanti village. Length of the nallah is 35.7 km. The bed width is 30 mts and the bed level at the mouth level at the mouth is 2.62 mts. Its independent catchment area is 75.6 sq. km in the city. It discharges approximately 652 cusecs of water into Daya. Table 8.9 presents the sampling locations of Gangua Nallah.

**Table 8.9**  
**Sampling Locations Of Gangua Nallah**

| Sl. No | Sampling location  | Reason for sampling location                                    |
|--------|--|---|
| 1      | Confluence point of Mancheswar Industrial estate and Gangua nallah | Impact of Industrial Effluent of the estate                     |
| 2      | Palasuni   | Impact of the first valley effluents                            |
| 3      | Gada Gopinath Colony (GGP)   | Impact of the domestic effluents of GGP colony on Gangua nallah |
| 4      | Confluence of Jharpada Mouza Rasulgarh drains and Gangua nallah    | Impact of the domestic effluents                                |
| 5      | Jharpada Mauza   | Impact of the second valley effluents                           |
| 6      | Tankpani Road  | Impact of the third valley effluents                            |
| 7      | Samantrapur  | Impact of the fourth valley effluents                           |

Table 8.10 presents the water quality of the Gangua Nallah. The water qualities at all the locations are very bad.

**Table 8.10**  
**Water Quality Of Gangua Nallah**

| Sl. No. | BOD | COD | DO   | Temp | pH   | Turbidity | TDS  | TSS | FDS | Cond | Cl     | Alk | TH | NO3     | Iron  |
|---------|-----|-----|------|------|------|-----------|------|-----|-----|------|--------|-----|----|---------|-------|
| 1       | 20  | 180 | 5    | 26   | 7.39 | 73        | 490  | 140 | 280 | 615  | 699.7  | 124 | 86 | 0.0592  | 0.319 |
| 2       | 40  | 160 | 6.66 | 26   | 8.45 | 90        | 210  | 60  | 139 | 352  | 399    | 76  | 60 | 1.43    | 0.22  |
| 3       | 120 | 220 | 4    | 27   | 8.58 | 187       | 1048 | 367 | 582 | 1839 | 3598.9 | 78  | 68 | 2.645   | 1.316 |
| 4       | 40  | 120 | 5.6  | 30   | 8.33 | 94        | 210  | 124 | 129 | 369  | 419.9  | 68  | 44 | 6.16    | 0.436 |
| 5       | 60  | 180 | 4    | 29   | 7.69 | 106       | 420  | 235 | 220 | 773  | 1049.9 | 68  | 68 | 1.535   | 0.293 |
| 6       | 38  | 120 | 6    | 29   | 8.25 | 65.6      | 220  | 146 | 203 | 390  | 449.8  | 64  | 64 | 482.035 | 0.310 |
| 7       | 32  | 110 | 5.5  | 30   | 8.26 | 84.3      | 260  | 170 | 170 | 405  | 499.8  | 64  | 64 | 1.4874  | 0.36  |

Following are the observations on the water quality in Gangua nallah:

1. The BOD level in all samples is higher than the standard level. Reason being the discharge of untreated/partially treated wastewater. BOD level is the lowest at MIE. This is due to least amount of sewage disposal. The results indicate that the areas where there is high level of disposal of domestic human waste, the BOD level is high. It is seen that towards Jharpada Mouza, the BOD level decreases. This is because these valleys carry effluents from a long distance, so some amount of the sewage settles down in the drain bed.
2. The chemical effluents of industries, and fertilizers from crop fields are responsible for high levels of COD. In case of Jharpada Mouza some automobile garages are also responsible for contributing to COD.
3. Turbidity is high at GGP colony. The effluent mainly consisting of household wastes, like soaps, detergents and organic matter. It is seen that GGP Colony and Jharpada Mouza have very high chloride contents. It is very high due to high levels of animal refuse from these parts.
4. Total hardness is high at MIE The wastewater disposed from MIE maximum amount total hardness as it primarily industrial effluent and consists of soap, detergents, organic etc. The relationship between calcium hardness and total hardness.
5. The presence of TC and FC values, is 1,60,000 MPN/100ml, at all points. This is very high when considering the permissible limit recommended by ICMR & WHO, which is nil for drinking purpose and 5000 MPN/100ml for irrigation purposes.



Alternatively since the analysis reports clearly suggest a good deal of self-purification of the sewage water entering into it before discharge to Daya River. Gangua can be conceived as a natural STP instead of a natural stream receiving the city sewage.

Different meeting places of the valleys with Gangua can be aesthetically developed with gardens and similarly the lower stretch of the nallah (Downstream Samantrapur to Baramunda) can be developed to provide extended aeration and long detention for a more efficient reduction of organic load before discharge to Daya. Installation of a few surface aerators at suitable points can help further in the treatment of the organic load.

**8.3.3 Lakes/Ponds Water Quality**

Table 8.11 presents the water quality of some of the lakes and ponds in the city.

**Table 8.11  
Pond Water Monitoring Results**

| SI | Location               | pH  | PARAMETER |      |                       |                       |                               |                  |                               |                               |
|----|------------------------|-----|-----------|------|-----------------------|-----------------------|-------------------------------|------------------|-------------------------------|-------------------------------|
|    |                        |     | DO        | BOD  | T.C.<br>MPN/<br>100ml | F.C.<br>MPN/<br>100ml | SO <sub>4</sub> <sup>-2</sup> | Cl <sup>-1</sup> | PO <sub>4</sub> <sup>-3</sup> | NO <sub>3</sub> <sup>-1</sup> |
| 1  | VaniVihar Lake         | 7.5 | 5.4       | 14.0 | 1900                  | 1650                  | 164.09                        | 37               | 0.118                         | 4.31                          |
| 2  | Baramunda Bus stand    | 7.4 | 5.7       | 13.0 | 700                   | 260                   | 56.93                         | 66               | 0.035                         | 11.18                         |
| 3  | Unit-IV Lake           | 7.2 | 4.2       | 24.0 | 900                   | 260                   | 60.46                         | 63               | 0.480                         | 28.9                          |
| 4  | Brahmeswar Temple Pond | 7.1 | 7.1       | 14.0 | 700                   | 190                   | 71.70                         | 63               | 0.223                         | 2.24                          |
| 5  | Mausima Temple Pond    | 7.1 | 6.4       | 2.0  | 290                   | 145                   | 24.40                         | 92               | 0.027                         | 8.71                          |
| 6  | Bindusagar Temple Pond | 7.0 | 6.3       | 6.0  | 9000                  | 1200                  | 57.30                         | 64               | 0.119                         | 4.37                          |
| 7  | Kedargouri Pond        | 6.5 | 4.9       | 2.7  | 500                   | 100                   | 17.25                         | 61               | 0.028                         | 25.08                         |

*Source: Central Laboratory, State Pollution Control Board Orissa, Bhubaneswar*

From the above table a comparison of the prevailing water quality with the best designated water quality of Class B shows that the water quality in all most all these ponds is not suitable for bathing. The high levels of BOD, chloride, nitrate, TC and FC counts recorded in all these water bodies indicate their polluted nature. However, in view of the socio-economic considerations added with religious sentiments, bathing in these public ponds is likely to continue for time to come.

**8.4 GROUND WATER QUALITY**

The groundwater condition in the area is mainly controlled by the geological set up. The lateritised, fractured and weathered Athgarh sandstones from the shallow phreatic zone, which is tapped by dug wells and shallow tube wells. Fractured, loosely cemented and friable Athgarh sandstones form the deeper aquifers and under semi confined to confined conditions in deeper aquifers.

The occurrence and distribution of shallow phreatic aquifers are studied, through hydrograph network stations and well inventory. The data indicated that the weathered zone is roughly up to 15m thick and the depth of the open wells is an average 10 m premonsoon and postmonsoon depth to water table values range from 2.07 to 11.50 m and 1.20 to 7.35 m respectively.

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The groundwater use is used in the city in the form of tube wells and dug wells. Ground water quality survey of different locations of Bhubaneswar city is also conducted under the Environment Management Plan study and is presented in Table 8.12.

**Table 8.12**  
**Ground Water Analysis Results Of Bhubaneswar Urban Area**

| SI | Location                   | Temp<br>°C | PH   | Conductance<br>Mmho/100ml | Parameters in mg/lit |        |        |                  |                |     |      |       |          |  |
|----|----------------------------|------------|------|---------------------------|----------------------|--------|--------|------------------|----------------|-----|------|-------|----------|--|
|    |                            |            |      |                           | COD                  | TC     | FC     | Cl <sup>-1</sup> | F <sup>1</sup> | TH  | Na   | Mn    | Total Fe |  |
| 1  | Utkal University Campus    | 22         | 8.98 | 112.8                     | ND                   | 2      | ?<br>2 | 2.99             | 0.12           | 56  | 2.0  | 0.52  | 6.2      |  |
| 2  | Unit-9, Flat Area          | 27         | 7.92 | 197.4                     | ND                   | ?<br>2 | ?<br>2 | 30.98            | 0.117          | 32  | 25.0 | 0.025 | 6.2      |  |
| 3  | Ram Madir Chhak            | 25         | 7.99 | 248.0                     | 1.4                  | ?<br>2 | ?<br>2 | 20.98            | 0.118          | 72  | 18.0 | 0.1   | 3.8      |  |
| 4  | Khandagiri Chhak           | 28         | 8.05 | 151.6                     | 5.7                  | ?<br>2 | ?<br>2 | 12.99            | 0.10           | 52  | 12.0 | 0.15  | 1.5      |  |
| 5  | Bhagabanpur IE             | 26         | 7.93 | 142.3                     | ND                   | 07     | ?<br>2 | 3.99             | 0.115          | 104 | 07   | 0.17  | 0.12     |  |
| 6  | Sibanagar, Brahmeswarpatna | 25         | 8.23 | 247.0                     | ND                   | 28     | 21     | 13.99            | 0.172          | 60  | 16   | ND    | 0.5      |  |
| 7  | Vivekananda Marg           | 28         | 7.78 | 196.8                     | 2.8                  | 09     | 07     | 18.99            | 0.174          | 76  | 17   | ND    | 0.64     |  |
| 8  | Capital Hospital           | 27         | 6.54 | 339.0                     | 2.8                  | ?<br>2 | ?<br>2 | 50.97            | 0.188          | 68  | 30   | 0.25  | 2.7      |  |
| 9  | Old Bus Stand              | 28         | 5.84 | 894.0                     | 4.3                  | ?<br>2 | ?<br>2 | 169.9            | 0.116          | 134 | 110  | 0.87  | 1.8      |  |
| 10 | Nayapalli Village          | 27         | 7.28 | 519.0                     | 6.5                  | 09     | ?<br>2 | 89.95            | 0.158          | 106 | 52   | 0.15  | 1.85     |  |

The Central Ground Water Board, Bhubaneswar has also studied the chemical quality of ground water of both shallow and deeper aquifers to access the suitability of water for various uses. Table 8.13 presents the ground water quality of the region.

**Table 8.13**  
**Dug Well & Tube Well Water Quality**

| S. No. | Location            | PH  | PARAMETER         |                   |                              |                  |                               |                              |      |
|--------|---------------------|-----|-------------------|-------------------|------------------------------|------------------|-------------------------------|------------------------------|------|
|        |                     |     | T.C.<br>MPN/100ml | F.C.<br>MPN/100ml | SO <sub>4</sub> <sup>-</sup> | Cl <sup>-1</sup> | PO <sub>4</sub> <sup>-3</sup> | NO <sub>3</sub> <sup>-</sup> | Iron |
| 1.     | Palasuni Village    | 7.9 | 20                | 8                 | 82                           | 68               | 0.024                         | 10.4                         | 1.8  |
| 2.     | Sainik School       | 6.8 | 8                 | 2                 | 75                           | 71               | 0.061                         | 3.9                          | 0.4  |
| 3.     | Baramunda Bus Stand | 7.0 | 22                | 15                | 24                           | 65               | ND                            | 26.5                         | 0.5  |
| 4.     | Khandagiri Chhak    | 7.5 | 52                | 27                | 33                           | 37               | ND                            | 2.3                          | 0.5  |
| 5.     | NiladriVihar        | 6.9 | 7                 | 2                 | 55                           | 31               | ND                            | 8.1                          | 0.05 |
| 6.     | Satyanagar          | 6.8 | 18                | 8                 | 156                          | 98               | ND                            | 5.3                          | 0.76 |
| 7.     | Sunderpada          | 6.5 | 55                | 32                | 41                           | 30               | 0.35                          | 5.5                          | 0.18 |
| 8.     | Baragarh Village    | 7.4 | 11                | 7                 | 28                           | 135              | 0.01                          | 9.2                          | 0.26 |

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| S. No. | Location                 | PH  | PARAMETER         |                   |                               |                  |                               |                              |      |  |
|--------|--------------------------|-----|-------------------|-------------------|-------------------------------|------------------|-------------------------------|------------------------------|------|--|
|        |                          |     | T.C.<br>MPN/100ml | F.C.<br>MPN/100ml | SO <sub>4</sub> <sup>-2</sup> | Cl <sup>-1</sup> | PO <sub>4</sub> <sup>-3</sup> | NO <sub>3</sub> <sup>-</sup> | Iron |  |
| 9.     | VaniVihar                | 6.2 | 9                 | 4                 | 7                             | 17               | 0.35                          | 10.9                         | 0.07 |  |
| 10.    | Baramunda Market Complex | 5.3 | 2                 | 2                 | 12                            | 41               | BDL                           | 31                           | 3.28 |  |
| 11.    | Khandagiri Chhak         | 5.4 | 2                 | 2                 | 29                            | 25               | BDL                           | 16                           | 0.08 |  |
| 12.    | RamMandir                | 7.4 | 2                 | 2                 | 10                            | --               | BDL                           | 29                           | 1.34 |  |
| 13.    | Capital Hospital         | 6.8 | 2                 | 2                 | 22                            | 61               | BDL                           | 31                           | 1.61 |  |
| 14.    | Sundarpada               | 6.7 | 2                 | 2                 | 44                            | 34               | BDL                           | 0.5                          | 0.97 |  |
| 15.    | Kalpana Area             | 6.2 | 6                 | 2                 | 58                            | 46               | BDL                           | 14                           | 3.5  |  |
| 16.    | Baragarh Brit Colony     | 7.4 | 4                 | 2                 | 14                            | 18               | BDL                           | 0.24                         | 1.4  |  |
| 17.    | Unit-IV Market           | 6.3 | 4                 | 2                 | 7                             | 74               | BDL                           | 33                           | 1.3  |  |
| 18.    | Vivekananda Marg         | 7.2 | 4                 | 2                 | 14                            | 83               | BDL                           | 31                           | 6.5  |  |

Source: Central Laboratory, State Pollution Control Board Orissa, Bhubaneswar, (Date for s.no 18 are for dug we;; and 918 are for tube wells)

As compared with standards for some parameters suggests that the water quality of both dug wells and tube wells are not much polluted excepting the lower pH recorded at Baramunda, Khandagiri, Kalpana and Unit – IV market and high iron content in almost all tube wells. The drinking water quality with conventional treatment (Class A) can be maintained with little management practice.

### 8.5 Conclusion:

- i. At present only the main city district is sewerage. Several areas in the city are not covered by sewerage system and these areas are severely affected due to stagnation of sewage on the roads and open plots adjoining the building blocks. Open drains carrying sewage across the city pose severe threat to health in addition to causing nuisance of bad odour and over flow during monsoon period.
- ii. In absence of sewerage system, people are using septic tanks and soak pits. In most of the places sewage is discharged in to open drains without any treatment, which ultimately discharge to Gangua Nallah. Gangua nallah in its course of 12 km in the city of Bhubaneswar receives wastewater discharges at 9 drains. River Kuakhai receives about 27.22 mld of wastewater from Patia drain.
- iii. Also, the old sewerage system is prone to frequent choking of sewerage lines leading to overflow of sewage into roads and creating bad sanitary conditions. Lack of periodic maintenance and renovation of old sewerage system is yet another problem.
- iv. The total organic load (BOD) discharged through these drains is 100.64 t/day and that of solids is 127 t/day. The major contributor to the water pollution for BOD Load is Patia drain followed by Sainik School These drains discharge both domestic and industrial wastewater from densely populated old city areas. These drains discharge both domestic and industrial wastewater from densely populated old city areas.
- v. The existing water quality in river Kuakhai is 'acceptable'. Over the year the trends shows that the water quality has deteriorated from the 'excellent' category to the 'desirable' category at the upstream of Bhubaneswar. But due the discharges from he city the water quality has deteriorated although not alarming. The present water quality in River Kuakhai

can be categorized under ' C ' class and falls under the 'Acceptable' category of the Water Quality Criteria.

- vi. The water quality in all most all the lakes and ponds is not suitable for bathing. The high levels of BOD, chloride, nitrate, TC and FC counts recorded in all these water bodies indicate their polluted nature. However, in view of the socio-economic considerations added with religious sentiments, bathing in these public ponds is likely to continue for time to come.
- vii. The ground water quality suggests that the water quality of both dug wells and tube wells are not much polluted excepting the lower pH recorded at Baramunda, Khandagiri, Kalpana and Unit – IV market and high iron content in almost all tube wells.
- viii. The existing water pollution levels, poor sanitation, lack of sewerage system, polluted drains and river, overflowing sewage are highly deterrent to the tourism activity and for the health of the local people.