

**ACTION PLAN FOR RESTORATION OF POLLUTED STRETCH OF
MAHANADI RIVER ALONG SAMBALPUR TO PARADEEP
UNDER PRIORITY CATEGORY-V**

EXECUTIVE SUMMARY ON PROPOSED ACTION PLANS

Sl. No.	DESCRIPTION OF ITEM	Details
1.	Name of the identified polluted river and its tributaries	: Mahanadi River Major Tributaries are Ib, Ong, Tel etc.
2.	Is river is perennial and total length of the polluted river	: Perennial . Total length of Mahanadi River in the State of Odisha is 494 Km.
3.	No of drains contributing to pollution and names of major drains	: Sambalpur : Four natural drains Cuttack : one drain Paradeep : One drain
4.	Whether 'River Rejuvenation Committee (RRC) constituted by the State Govt./UT Administration and If so, Date of constitution of 'RRC'	: Yes. Constituted by the State Government vide letter No. 24426 dated 12.11.2018
5.	Whether 'River Rejuvenation Committee (RRC) have approved the Action Plan :	Yes. RRC have approved the Action Plan in its 3 rd meeting held on 04.06.2018.
6.	Major Towns on the banks of the river with population	: Sambalpur Municipal Corporation : Population : 3,35,761 Sonepur Municipality : Population : 20,770 Cuttack Municipal Corporation : Population : 606,007 Paradeep Municipality Population : 68,585 (as per 2011 census).
7.	a. Total no. of existing STPs and the total capacities in MLD	: Sambalpur Municipal Corporation : One STP of 40 MLD capacity Sonepur Municipality : No STP Cuttack Municipal Corporation : One STP of 16 MLD Paradeep Municipality One STP of 2 MLD
	b. Total MSW generation in TPA	: Sambalpur Municipal Corporation : 115 TPD (41,975 TPA) Cuttack Municipal Corporation : 230 TPD (83,950 TPA) Paradeep Municipality 57 TPD (20,805 TPA)
	c. Existing treatment and disposal facilities and total capacity	: Total MSW is being disposed in the earmarked dumping yard. And

			remote chance of contamination to the river water
8.	a. Major industrial estates located with total no. of industries	:	<p>Sambalpur Municipal Corporation : One major water intensive industry</p> <p>Cuttack Municipal Corporation : One Industrial Estate constituting only two major water intensive industries</p> <p>Paradeep Municipality Six major water intensive industries</p>
	b. No of CETP's and their treatment capacity	:	Nil
	c. Gaps in treatment of industrial effluent	:	Nil
	d. Existing HW Treatment and Disposal Facilities and total capacity with life span	:	Hazardous waste are either disposed in secured landfill area within the industry premises or disposed to the Common Hazardous Waste Treatment, Storage and Disposal Facility situate in Jajpur district.

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1.0 Background

Water quality assessment of Mahanadi river has been carried out by the State Pollution Control Board, Odisha under the project “National Water Quality Monitoring Programme” at fourteen locations from Sambalpur to its confluence with Bay of Bengal at Paradeep. The Biochemical Oxygen Demand (BOD) range in this stretch of Mahanadi river during 2017 was observed to be in between 0.3-2.9 mg/l. BOD has not exceeded the tolerance limit of 3.0 mg/l at any water quality monitoring station in the stretch of Mahanadi river during the year 2017.

The polluted river stretches are categorized under five different priorities based on the BOD values as per Central Pollution Control Board (CPCB) classification. Monitoring locations with BOD concentration exceeding 30 mg/l have been categorized as Priority-I. Monitoring locations with BOD concentrations in the range 20-30 mg/l, 10-20 mg/l, 6-10 mg/l and 3-6 mg/l are categorized as Priority-II, Priority-III, Priority-IV and Priority-V respectively. Based on this classification, the river stretch of Mahanadi river has been categorized by CPCB under Priority-V with the maximum BOD value being 3.2 mg/l with the identified polluted stretch being Sambalpur to Paradeep.. However, based on State Board’s reported water quality data during 2017, the stretch should not be identified as polluted because BOD has not exceeded the tolerance limit of 3.0 mg/l during 2017 at any of the monitoring location on Mahanadi river.

2.0 Water quality of Mahanadi river

River Mahanadi, an interstate river, rises from a small pool located at about 6 km from Pharsiya village in the Amarkantak hills of Bastar plateau, which lies to the extreme south east of Raipur district of Chhattisgarh State. Out of its total length of 851 km, it covers 494 km in Odisha state. Ib, Ong, Tel, Hariharjore and Jeera are the main tributaries and Kathajodi, Kuakhai, Devi and Birupa are the major distributaries of Mahanadi in Odisha. The multipurpose Hirakud Dam over the Mahanadi at Sambalpur is located exactly at the midpoint of the trunk stream. In Odisha, the river stretch of Mahanadi starts from Hirakud reservoir at the upstream of Sambalpur town. From Sambalpur, the river flows southwards till it joins with Ong river and Tel river. Tel is biggest tributary of Mahanadi at Sonapur, from where again the river flows eastwards to join the Bay of Bengal. Before entering into

the coastal plain and forming the delta, the river traverses through the Eastern Ghats cutting across a 60 km long “Satkosia Gorge”. Finally the river emerges out of the Eastern Ghats near Naraj, about 10 km to the west of Cuttack city. The deltaic action starts near Naraj from where the river starts dividing into several distributaries.

Water quality of Mahanadi river is being monitored by the Board on regular basis at fourteen locations. The details of monitoring locations are given in Table-1. Map of Mahanadi river system and water quality monitoring stations on Mahanadi river are shown in Figure-1 .

Table-1 Water quality monitoring stations on Mahanadi river

Sl. No.	Water quality monitoring station	Latitude	Longitude
1.	Sambalpur U/s	21 ⁰ 29'47.11"N	83 ⁰ 55'02.00"E
2.	Sambalpur D/s	21 ⁰ 27'44.04"N	83 ⁰ 58'13.62"E
3.	Sambalpur FD/s at Shankarmath	21 ⁰ 23'27.60"N	83 ⁰ 58'40.40"E
4.	Sambalpur FD/s at Huma	21 ⁰ 22'27.52"N	83 ⁰ 57'53.02"E
5.	Sonepur U/s	20 ⁰ 51'40.30"N	83 ⁰ 54'02.80"E
6.	Sonepur D/s	20 ⁰ 50'71.30"N	84 ⁰ 00'08.90"E
7.	Tikarpada	20 ⁰ 35'33.37"N	84 ⁰ 47'00.34"E
8.	Narsinghpur	20 ⁰ 22'04.30"N	85 ⁰ 16'17.83"E
9.	Mundali	20 ⁰ 28'13.04"N	85 ⁰ 45'50.52"E
10.	Cuttack U/s	20 ⁰ 29'45.62"N	85 ⁰ 48'35.37"E
11.	Cuttack D/s	20 ⁰ 27'26.35"N	85 ⁰ 56'23.21"E
12.	Cuttack FD/s at Gatirautapatna	20 ⁰ 26'16.51"N	85 ⁰ 58'43.89"E
13.	Paradeep U/s	20 ⁰ 19'57.02"N	86 ⁰ 34'25.61"E
14.	Paradeep D/s	20 ⁰ 17'31.37"N	86 ⁰ 42'55.36"E

Monthwise water quality data of Mahanadi river with respect to Biochemical Oxygen Demand (BOD) during the year 2016, 2017 and 2018 are given in Table-2,3 and 4 respectively.

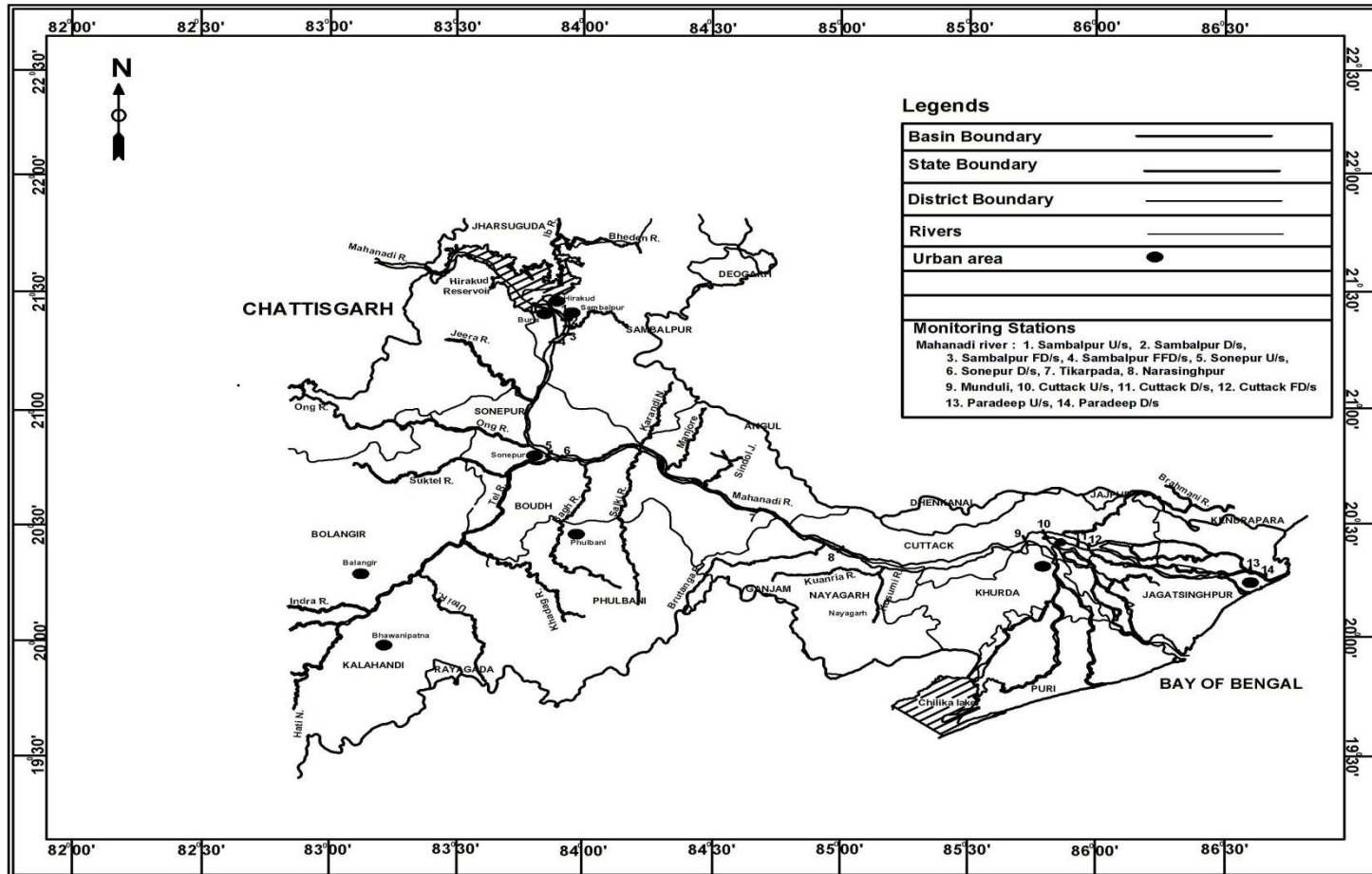


Fig. 1 Map of Mahanadi river system and Water quality monitoring stations on Mahanadi river

Table-2 Water quality of Mahanadi river with respect to BOD during 2016

Sl. No.	Monitoring station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
		BOD (mg/l)														
1.	Sambalpur U/s	0.8	1.1	0.6	0.5	1.2	0.7	0.8	1.2	1.7	1.3	0.6	1.5	0.5	1.7	1.0
2.	Sambalpur D/s	2.0	3.2	2.4	1.6	2.2	2.1	2.6	3.6	2.0	1.3	1.9	1.8	1.3	3.6	2.2
3.	Sambalpur FD/s	1.8	2.2	1.7	0.7	1.8	1.4	2.0	1.3	1.6	1.0	1.1	1.5	0.7	2.2	1.5
4.	Sambalpur FFD/s	1.2	1.6	1.2	0.7	1.5	0.8	1.6	0.4	1.4	1.8	0.7	0.7	0.4	1.8	1.1
5.	Sonepur U/s	0.8	0.9	0.8	0.8	0.6	0.8	0.3	0.9	1.3	0.4	0.7	0.7	0.3	1.3	0.7
6.	Sonepur D/s	0.9	1.4	1.1	1.4	0.8	1.0	0.7	1.2	2.0	0.8	0.9	0.8	0.7	2.0	1.1
7.	Tikarpada	0.5	0.4	0.6	0.9	0.4	0.5	0.9	1.6	0.8	1.1	0.6	0.4	0.4	1.6	0.7
8.	Narasinghpur	0.4	1.4	0.9	0.6	0.6	0.7	0.6	0.5	0.6	1.1	0.7	0.5	0.4	1.4	0.7
9.	Munduli	0.6	1.5	1.1	0.6	0.9	0.6	0.8	1.2	0.5	0.5	0.7	0.7	0.5	1.5	0.8
10.	Cuttack U/s	1.9	1.6	1.3	0.7	1.2	0.8	1.4	1.0	0.6	0.7	0.9	0.5	0.5	1.9	1.0
11.	Cuttack D/s	2.2	2.5	2.2	1.6	2.1	1.6	1.7	1.6	1.5	1.6	1.8	1.4	1.4	2.5	1.8
12.	Cuttack FD/s	1.3	1.8	1.0	0.6	1.6	0.9	1.2	1.0	1.1	1.2	1.0	0.6	0.6	1.8	1.1
13.	Paradeep U/s	1.3	1.0	1.4	0.6	1.0	0.4	0.6	1.9	0.8	1.5	0.6	1.9	0.4	1.9	1.1
14.	Paradeep D/s	2.1	1.6	1.9	0.8	0.8	0.9	1.3	0.9	2.1	2.0	0.8	1.4	0.8	2.1	1.4

Table-3 Water quality of Mahanadi river with respect to BOD during 2017

Sl. No.	Monitoring station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
		BOD (mg/l)														
1.	Sambalpur U/s	0.7	1.3	0.6	1.6	1.5	0.9	0.4	1.1	1.3	0.8	1.4	1.0	0.4	1.6	1.1
2.	Sambalpur D/s	2.3	2.4	1.7	2.9	2	2.1	1.6	2.3	1.5	1.5	2.2	2.5	1.5	2.9	2.1
3.	Sambalpur FD/s	1.5	1.9	1.6	2.3	0.8	1.2	1.8	1.3	1.5	0.9	0.8	1.8	0.8	2.3	1.5
4.	Sambalpur FFD/s	1.0	1.1	0.5	0.8	0.9	0.7	0.6	0.8	1.7	0.9	0.7	0.6	0.5	1.7	0.9
5.	Sonepur U/s	0.6	0.8	0.3	0.5	0.9	0.4	0.8	1.2	1.2	0.8	0.5	0.5	0.3	1.2	0.7
6.	Sonepur D/s	0.6	1.0	0.8	0.7	1.3	0.8	0.8	1.3	1.5	0.9	1.2	0.8	0.6	1.5	1.0
7.	Tikarpada	0.6	0.5	0.5	1.0	0.8	0.8	0.6	0.3	0.8	1.2	0.8	1.0	0.3	1.2	0.7
8.	Narasinghpur	0.8	0.5	1.2	0.8	1.0	0.8	0.9	0.4	1.0	0.5	0.3	1.0	0.3	1.2	0.8
9.	Munduli	0.6	1.0	0.6	0.6	1.0	0.4	0.8	0.5	0.9	0.8	0.4	0.5	0.4	1.0	0.7
10.	Cuttack U/s	0.4	1.2	0.8	0.7	1.2	0.5	0.9	0.6	1.0	0.7	0.6	0.7	0.4	1.2	0.8
11.	Cuttack D/s	1.6	2.1	1.3	1.2	2.0	1.0	1.2	0.8	1.1	0.7	1.2	1.8	0.7	2.1	1.3
12.	Cuttack FD/s	0.7	-	1.0	1.0	1.2	0.6	1.2	0.6	1.1	1.0	0.8	1.4	0.6	1.4	1.0
13.	Paradeep U/s	1.0	0.4	0.8	0.5	0.9	0.4	0.8	0.8	1.6	1.2	1.0	1.1	0.4	1.6	0.9
14.	Paradeep D/s	0.5	2.3	1.2	0.5	0.7	0.8	0.3	0.7	1.5	1.4	0.8	1.8	0.3	2.3	1.0

Table-4 Water quality of Mahanadi river with respect to BOD during 2018

Sl. No.	Monitoring station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
		BOD (mg/l)														
1.	Sambalpur U/s	1.5	1.5	0.8	1.2	1.7	1.4	0.8	1.2	0.6	1.1	1.3	1.1	0.6	1.7	1.2
2.	Sambalpur D/s	2.1	1.2	1.1	1.5	2.2	1.8	2.2	2.2	0.7	2.2	0.6	1.2	0.6	2.2	1.6
3.	Sambalpur FD/s	1.0	1.3	1.1	0.5	1.1	1.1	1.8	1.6	0.6	1.7	0.6	0.9	0.5	1.8	1.1
4.	Sambalpur FFD/s	0.5	0.7	1.4	1.0	1.3	0.4	0.9	1.1	0.8	1.0	0.8	0.6	0.4	1.4	0.9
5.	Sonepur U/s	0.6	1.5	0.9	0.7	0.6	0.2	1.1	0.9	0.6	1.0	0.4	0.6	0.2	1.5	0.8
6.	Sonepur D/s	1.2	2.1	2.1	1.2	0.8	0.4	1.4	1.5	0.7	1.8	0.8	0.6	0.4	2.1	1.2
7.	Tikarpada	1.2	0.9	0.5	1.5	0.2	0.6	0.5	0.5	0.8	0.8	0.8	0.2	0.2	1.5	0.7
8.	Narasinghpur	0.7	0.5	0.4	0.6	0.8	0.6	0.5	0.6	0.6	0.5	0.5	0.9	0.4	0.9	0.6
9.	Munduli	0.7	0.5	1.1	0.3	0.6	0.6	0.6	0.7	0.8	0.9	0.4	0.8	0.3	1.1	0.7
10.	Cuttack U/s	0.7	0.5	0.8	0.6	0.3	0.8	0.5	0.5	0.8	1.0	0.4	0.9	0.3	1.0	0.7
11.	Cuttack D/s	2.3	0.9	1.0	1.1	1.0	1.3	1.8	0.6	1.2	1.6	0.8	1.5	0.6	2.3	1.3
12.	Cuttack FD/s	1.7	0.8	1.1	0.8	1.0	1.1	1.2	0.7	1.0	0.9	0.6	0.6	0.6	1.7	1.0
13.	Paradeep U/s	0.4	1.4	0.4	1.5	1.3	1.3	0.9	0.8	0.8	1.3	0.5	0.9	0.4	1.5	1.0
14.	Paradeep D/s	0.5	0.3	0.5	1.2	1.3	1.7	1.2	1.8	0.7	1.3	1.0	0.4	0.3	1.8	1.0

The data shows that BOD has exceeded the tolerance limit of 3.0 mg/l marginally only twice during February, 2016 and August, 2016 at Sambalpur D/s out of total observation during the period 2016-2018.

3.0 Sources of Pollution

There are four major urban local bodies, such as Sambalpur Municipal Corporation, Sonepur Municipality, Cuttack Municipal Corporation and Paradeep Municipality situated on the bank of Mahanadi river (Fig. 1). Approximate distance (by road) between these Municipal areas are as follows.

Sambalpur to Sonepur : 80 Km

Sonepur to Cuttack : 261 Km

Cuttack to Paradeep : 85 Km

As these four municipal areas are quite far from each other, Mahanadi river stretch may be better discussed in terms of the stretch along each major municipal area rather than as a whole stretch from Sambalpur to Paradeep as identified by CPCB.

(A) Sambalpur Municipal Corporation

Sambalpur Municipal Corporation covers an area of 303 sq. kms and is located at the downstream of Hirakud reservoir, the largest reservoir in Asia built on Mahanadi river. The Sambalpur Municipal Corporation has a population of 3,35,761 lakhs as per Census 2011. Both surface water from Mahanadi river and underground water source are presently utilized for water supply at a rate of 185.60 liter per capita per day. Out of total quantity 65.32 MLD of water being supplied, surface water source is 57.50 MLD, and from underground water source is 7.82 MLD.

- **Municipal wastewater**

The domestic wastewater of Sambalpur Municipal Corporation flows through storm water drains which ultimately leads to four natural streams such as Tangana nallah, Dhobijhore, Haradajhor and Malatijhor. These streams finally open to Mahanadi river at

different locations of Sambalpur. A total of 49.88 MLD domestic wastewater (@ 80% of supply) is generated from the city.

- **Industrial wastewater**

There is only one major water intensive industrial unit situated in Sambalpur area and the unit is being regulated under the consent administration of the State Board. As per the condition laid down in Consent order, the industry is not permitted to discharge the treated wastewater outside its premises. The industry reuse the treated waste water in its captive power plant and smelter plant. Therefore, there is remote chance of contamination of Mahanadi river by industrial wastewater from Sambalpur Municipal Corporation.

- **Biomedical waste**

Around 88 Kg of biomedical waste per day is generated from 53 health care units existing in the Sambalpur Municipal Corporation. The biomedical waste generated by the respective health care units are dumped in earthen pits constructed within its premises as per deep burial disposal practice suggested under Biomedical Waste (Management and Handling) Rule, 2016. Therefore, there is remote possibility of contamination of Mahanadi river by bio-medical waste generated in the city.

- **Municipal solid waste**

Approximately 115 tonne per day municipal solid waste is being generated in Sambalpur Municipal Corporation. Solid waste is collected through both door to door collection and from community bins and then transported to earmarked landfill sites for disposal. Therefore, there is remote chance of contamination of Mahanadi river by municipal solid waste disposal from Sambalpur Municipal Corporation.

To summarize, there is no significant impact from industrial wastewater, biomedical waste and municipal solid waste generated from Sambalpur Municipal Corporation on the water quality of Mahanadi river along the stretch of Sambalpur. However, the domestic wastewater of the municipal area discharged through four different drains have little or no impact on water quality of the river. As can be seen from the water quality data of Mahanadi river at Sambalpur D/s, BOD had exceeded the tolerance limit only twice during

2016 out of total observation during the period 2016-2018. Water quality of Mahanadi river at Sambalpur FD/s (at Shankarmath) has further been improved by inflow of water from Power Channel to Mahanadi river near Chiplima.

(B) Sonapur Municipality

From Sambalpur FFD/s (Huma) to Sonapur (about 70 km along the river course), the river travels through a region with no major urban settlement or wastewater outfall. Sonapur is the confluence point of Mahanadi with two of its important right bank tributaries namely Ong and Tel. Thus the water quality at Sonapur U/s, which is 10 Km downstream of the confluence of river Ong with river Mahanadi, is satisfactory. As can be seen from the water quality data, BOD at Sonapur U/s varied within 0.3-1.8 mg/l during the period 2016-2018 and therefore always remained within the tolerance limit.

Sonapur Municipality in Subarnapur district is located at approximately 70 Km from the downstream of Sambalpur Municipal area. Sonapur Municipality is having a population of 20,770 as per 2011 census.

Water demand of Sonapur Municipal area is 3.7 MLD which is being abstracted from Mahanadi river. Considering the wastewater generation at the rate of 80% of water demand, wastewater generation is 2.96 MLD which find its way partly into ponds existing in the municipal area and partly to Mahanadi river through small nallahs.. However, water quality deterioration of Mahanadi river at Sonapur D/s is not observed primarily because of the confluence of River Mahanadi with River Tel, which has a significant annual average flow. Moreover, in spite of being the district headquarter, Sonapur is still a small town with no noticeable growth in urban as well as industrial activities. Therefore, water quality of Mahanadi river at the downstream of Sonapur Municipality has not been observed to be polluted during the period 2016-2018. It is also reflected in the water quality data, wherein BOD varied within 0.4-2.1 mg/l during the period 2016-2018 and therefore always remained within the tolerance limit.

(C) From Sonepur Municipality to Cuttack Municipality

The 102 km stretch of the river from Sonepur D/s to Tikarapada does not have any industry or urban settlement on its banks (except two small sub-divisional towns – Boudh and Athamallick) and there is no major wastewater outfall. From Tikarapada to Narasinghpur (about 60 km), the river flows almost completely undisturbed. The Tikarapada – Narasinghpur sub-basin is neither agriculturally nor industrially prosperous and human activities on its banks are scarce. Hence relatively clean, unpolluted water is observed at Tikarapada and without much change in quality at Narasinghpur. BOD in Mahanadi river at Tikarapada and Narasinghpur during the period 2016-2018 varied within 0.2-1.6 mg/l and 0.3—1.4 mg/l respectively.

During its course from Narasinghpur to Munduli (about 56 km), the river also flows through less populated village areas. Industrial growth in the area is also not significant. No water intensive industries are located along this stretch of river. Therefore, BOD in river water in the stretch of river from Narasinghpur to Munduli always remained within the tolerance limit of 3.0 mg/l. As can be seen from Tables 2 to Table-4, BOD in Mahanadi river at Munduli varied within 0.5-1.5 mg/l during the period 2016- 2018.

After Munduli, Mahanadi river enters into its deltaic region, characterized by high population density and intense agriculture activities. At Naraj, Mahanadi river has been bifurcated into Kathajodi river and Mahanadi river. Major flow of the river is through Mahanadi river. Cuttack Municipal Corporation is situated at the downstream of this bifurcation point.

(D) Cuttack Municipal Corporation

Cuttack, the district headquarter, is the former capital city of Odisha state. It is the major hub for trading and business in and around the city. The city is surrounded by the Mahanadi River and Kathajodi river. The general topography of Cuttack city is gentle slope from west to east occupying the delta plains of the Mahanadi river in the east and hilly terrain on the west.

The population of the city, as per the Census 2011, is 606,007 (as per 2011 Census) which is 23.14% of the population of Cuttack district. The municipal area covers an area of

192.5 sq.km. The gross population density of the city is 7,769 persons per sq.km. Slum population is 223,619, which is 36.9% of the total population. Floating population of city is around 30,000 to 40,000 per day.

Mostly ground water source is presently utilized for water supply. Total water supply to the city is 115 MLD through 129 numbers of production tube wells.

- **Municipal wastewater**

The wastewater generation is 92.0 MLD (80 percent of water supply) from the city. Open surface drains exist in some portion of the town to discharge the storm and wastewater. These drains not only receive sewage from majority of residents but also septic tank effluent containing excreta and rain water runoff. Storm water drain known as drain No 1 runs from west to east direction and discharges into Kathajodi river while another drain runs from west to east direction and discharges into Mahanadi River. Topography of the Cuttack city is such that major wastewater flow of the city is towards Kathajodi river. Only a small fraction of the total wastewater generated in the city flows through the drain (Main Drain No. 2) towards Mahanadi river.

The Main Drain No. 2 originates from eastern part of Cuttack Railway Station near the railway track. It runs from OMP square to bank of Mahanadi river beyond Central rice Research Institute (C.R.R.I.) campus and thereafter inside the flood plain before joining the river. Guluguli sluice on Mahanadi right embankment, just on the eastern boundary of C.R.R.I, controls water flow of river Mahanadi and prevents back flow into the city.

- **Industrial wastewater**

There are only two major water intensive industries operating in Jagatpur Industrial Estate exist in catchment area of Mahandi river along Cuttack stretch. These industries discharge 2000 KLD treated waste water to river Mahanadi after complying to the discharge norms stipulated by the State Board.

Therefore, there is remote chance of contamination of Mahanadi river by industrial wastewater from Cuttack Municipal Corporation.

- **Biomedical waste**

Approximately 2000 Kg of biomedical waste per day is generated from 471 health care units existing in Cuttack Municipal Corporation. Around 760 Kg of biomedical waste are being treated in the common biomedical waste treatment facility installed within SCB Medical, Cuttack. Rest biomedical waste are transported to the common biomedical waste treatment facility at Tangiapada in Khurdha district for disposal. Therefore, there is remote possibility of contamination of Mahanadi river along Cuttack stretch by biomedical waste generated in the city.

- **Municipal solid waste**

Approximately 230 tonne per day municipal solid waste is being generated in Cuttack Municipal Corporation. Solid waste is collected through both door to door collection and from community bins and then transported to earmarked transfer section at Brajabiharipur near Bidanasi development area and then to the landfill site at Chakradharpur, near Mundali. The dumping site has been chosen for its deep natural depression. Therefore, there is remote chance of contamination of Mahanadi river by municipal solid waste disposal from Cuttack Municipal Corporation.

To summarize, there is no significant impact from industrial wastewater, biomedical waste and municipal solid waste generated from Cuttack Municipal Corporation on the water quality of Mahanadi river along the stretch of Cuttack city. However, the domestic wastewater of the municipal area discharged through Main drain 2 has not been observed to increase the BOD in Mahanadi river monitored at Cuttack D/s beyond the tolerance limit. This is primarily because of availability of flow in Mahanadi river to dilute sufficiently the waste load discharged through wastewater drain. As can be seen from the water quality data of Mahanadi river at Cuttack D/s, BOD varied within 0.6-2.5 mg/l during the period 2016-2018 and always remained within the tolerance limit. BOD at Cuttack FD/s varied within 0.6-1.8 mg/l during the period 2016-2018 indicates further improvement in river water which is approximately 5 Km from the downstream station.

(E) Paradeep Municipality

Mahanadi river enters into coastal belt at Paradeep after traversing approximately 85 Km from Cuttack city. Paradeep municipality, a port area, is located in the district of Jagatsinghpur in the coast of the Bay of Bengal. Paradeep Municipality covers an area of 32.40 sq. Km. Population of Paradeep Municipality is 68,585 as per 2011 census. It is a growing city with the establishment of major industries like IFFCO, PPL, Kalinga Calciner, I.O.C.L. , Essar steels, etc. Being a coastal region, water quality of Mahanadi river is greatly influenced by the tidal impact.

- **Municipal wastewater**

Water supply to Paradeep Municipality is approximately 11.4 MLD. The domestic wastewater generation of Paradeep Municipality is 9.1 MLD (80 percent of water supply) which flows through storm water drains into Mahanadi river as well as to different creeks existing in the area. The domestic wastewater of industrial township existing in the area are being treated in the captive STPs with a combined capacity of 5815 KLD. There is one STP of 2 MLD capacity which treats the domestic wastewater of port township as well as part of wastewater generated from Paradeep Municipality.

- **Industrial wastewater**

There are six major water intensive industries (fertilizer, refine oil and petroleum refinery) operating in Paradeep. These industries discharge 13229 KLD treated waste water to river Mahanadi, Atharabanki Creek, and Sea after complying to the discharge norms stipulated by the State Board.

- **Biomedical waste**

Approximately 10 Kg of biomedical waste per day is generated from 10 health care units existing in Paradeep area. The biomedical waste are being buried in earthen pits constructed within the premises of the Health care units as suggested under Biomedical waste (Management and Handling) Rule, 2016. Therefore, there is remote possibility of

contamination of Mahanadi river along Cuttack stretch by biomedical waste generated in the city.

- **Municipal solid waste**

Approximately 57 tonne per day municipal solid waste is being generated in Paradeep Municipality. Solid waste is collected through both door to door collection and from community bins and then transported to earmarked landfill sites for disposal at Bangalipadia in Paradeep.

To summarize, there is no significant impact from industrial wastewater, biomedical waste and municipal solid waste generated from Paradeep Municipality on the water quality of Mahanadi river along the stretch of Paradeep. However, the river water quality at Paradeep is greatly influenced by tidal impact as it is very close to muhan of the river. As can be seen from the water quality data of Mahanadi river at Paradeep, at upstream of Paradeep, BOD varied within 0.4-1.9 mg/l during the period 2016-2018, whereas at the downstream of Paradeep BOD varied within 0.3-2.3 mg/l during the period 2016-2018 and always remained within the tolerance limit.

4.0 Ground water quality of Sambalpur, Cuttack and Paradeep

The State Pollution Control Board had monitored the ground water quality in the catchment of Mahanadi river at three locations in Sambalpur Municipal Corporation, two locations in Cuttack Municipal Corporation and two locations in Paradeep Municipality on half-yearly basis (April and October). Ground water quality at these monitoring locations during 2017 and 2018 is given in Table- 5 . The BOD values in ground water indicate no contamination of ground water from any domestic source of pollution.

Table- 5 Ground water quality at Sambalpur, Cuttack and Paradeep during 2017 and 2018

Ground Water Quality Monitoring Station	Year	BOD, mg/l		TC, MPN/ 100 ml		FC, MPN/ 100 ml	
		April	Oct	April	Oct	April	Oct
Sambalpur Municipal Corporation							
1. Near Panthanivas	2017	0.5	0.5	350	130	49	17
	2018	0.6	0.4	<1.8	<1.8	<1.8	<1.8
2. Near Railway station	2017	1.1	0.4	140	<1.8	140	<1.8
	2018	0.4	0.2	<1.8	<1.8	<1.8	<1.8
3. Near VSS Medical College	2017	0.9	0.2	540	49	130	<1.8
	2018	1.3	0.4	<1.8	23	<1.8	<1.8
Cuttack Municipal Corporation							
1. Jagatpur Industrial Estate	2017	0.4	0.5	<1.8	<1.8	<1.8	<1.8
	2018	0.2	0.3	<1.8	<1.8	<1.8	<1.8
2. CDA Bidanasi area	2017	0.2	0.5	<1.8	<1.8	<1.8	<1.8
	2018	0.6	0.4	<1.8	<1.8	<1.8	<1.8
Paradeep Municipality							
1. Musadiha	2017	0.5	0.7	>1600	70	540	<1.8
	2018	1.4	1.7	<1.8	<1.8	<1.8	<1.8
2. Badapadia	2017	1.7	1.6	<1.8	4.5	<1.8	<1.8
	2018	1.6	1.3	<1.8	13	<1.8	<1.8
IS : 10500 (2012) Drinking Water Specification	Acceptable limit	-	-	Absent		Absent	
	Permissible limit	-	-	No relax		No relax	

5.0 Action plan for restoration of Water quality of Mahanadi river

In Para 42 of the order of the case No. 673/2018 (More river stretches are now critically polluted), Hon'ble NGT has suggested a two-fold concept for restoration of polluted river stretches as follows.

1st concept : To target enhancement of river flow through interventions on the water sheds/ catchment areas for conservation and recharge of rainwater for subsequent release during lean flow period in year. This concept will work on dilutions of pollutants in the rivers and streams to reduce concentration to meet the desired level of water quality.

2nd concept : Regulation and enforcement of standards in conjunction with the available flow in rivers/ streams and allocation of discharges with stipulated norms.

BOD values of Mahanadi river from Sambalpur U/s to Paradeep D/s always remained within the tolerance limit 3.0 mg/l during the period 2017 and 2018 with only two marginal deviations at Sambalpur D/s during the year 2016. Based on the water quality data with respect to BOD during the period 2016-2018, the total stretch may not be considered as polluted.

Further, the total stretch from Sambalpur to Paradeep of Mahanadi river covers a distance of 494 Km. Along this stretch four large urban areas exist and to address the restoration activities for maintaining the water quality of Mahanadi river, action taken in these municipal areas are discussed separately as below.

(a) Sambalpur Municipal Corporation

- Odisha Water Supply and Sewerage Board (OWSSB) under House and Urban Development Department in Govt. of Odisha has taken up the project work for establishment of a Sewage Treatment Plant (STP) of 40 MLD capacity at Dhanupali near Bhatra to serve all catchment areas of Sambalpur Municipal Corporation. The treatment plant will be augmented every fifteen years as the population grows to meet the additional capacity. The ultimate design period of the plant is 30 years. The technology adopted for the Sewerage Treatment Plant is Sequencing Batch Reactor (SBR). The quality of sewage after treatment for disposal in river shall comply with

Effluent Standards for STPs notified by Ministry of Environment, Forest and Climate Change vide Notification No. G.S.R. 1265 (E) dated 13.10.2017 . The total Project Cost sanctioned is Rs. 294.93 cr. Targeted completion date of the project is during January, 2020.

The scope of work broadly includes construction of Sewage Collection system consisting of around 253.9 km of SW/RCC gravity sewer network, 8 nos. of Intermediate Sewage Pumping Stations (SPS), 7.235 km of DI pipe Pumping Main and Construction of one 40 MLD capacity Sewage Treatment Plant (STP) based on SBR Technology.

- The cesspool emptier vehicle operators in Sambalpur Municipal Corporation have been instructed not to dump waste in drains or river. A comprehensive fecal sludge treatment programme is also being implemented by OWSSB in the municipal area under AMRUT programme. The project integrates a 20 KLD capacity faecal sludge treatment facility. The total Project Cost sanctioned is Rs.1.93 cr. The plant will treat the fecal sludge collected through cesspool emptier vehicles. After treatment, the effluent can be used for plantation and landscaping purpose. The sludge will be used as manure for agricultural purpose.
- Industries established along the river stretch of Sambalpur are being regulated under consent administration of the State Board. They have been instructed to adopt Zero Discharge Concept, to install Rain water harvesting structures and plantation programs.
- Municipal solid waste generated from Sambalpur city is being dumped at Durgapalli. Three decentralised compost plants across the city are being constructed to utilize municipal solid waste for production of compost. Sambalpur Municipal Corporation has submitted a detailed project proposal to the State Government for establishment of a solid waste treatment plant near Neeldungri in the outskirts of the Sambalpur city along Sambalpur-Deogarh road.
- Flow of Mahanadi river at Sambalpur is controlled at Hirakud reservoir. Therefore, from the pollution point of view, flow in the river is always available to sufficiently dilute the waste load discharged through municipal wastewater to the river.

- Implementation of Swachh Bharat Abhiyan and construction of individual household toilets and community/public toilets, provision of water supply and increase in awareness among local inhabitants have significantly reduced the open defecation practice of the local inhabitants in the stretch.

(b) Cuttack Municipal Corporation

- The topography of Cuttack is such that only a small fraction of total domestic wastewater generated in the city find its way to Mahanadi river. OWSSB under its Japan International Cooperation Agency JICA funded - Orissa Integrated Sanitation Improvement Project (OISIP) project, has made a provision to divert this wastewater flow to 16 MLD Sewage Treatment Plant at Mattagajpur for treatment. The sanctioned project cost of the treatment plant is Rs.62.52 crore. The treated water after complying the discharge norm will be discharged to Kathajodi river.
- Municipal solid waste generated in Cuttack Municipal Corporation is collected through both door to door collection and from community bins and then transported to earmarked transfer section at Brajabiharipur near Bidanasi development area and then to the landfill site at Chakradharpur, which is 15 Km from city limit. The landfill area spreads over an area of 25 acre.
- The cesspool emptier vehicle operators in Cuttack Municipal Corporation empty the vehicles in the earmarked area in the city. A fecal sludge treatment plant of 60 KLD at Mattagajpur with a sanctioned project cost of Rs. 2.28 crore is being set for treatment of fecal sludge collected through cesspool emptier vehicles.
- Industries established in Jagatpur Industrial Estate along the river stretch of Cuttack Sambalpur are being regulated under consent administration of the State Board. They have been instructed to adopt Zero Discharge Concept wherever possible, to discharge treated wastewater after complying to the discharge norm stipulated by the State Board, to install Rain water harvesting structures and plantation programs.
- Implementation of Swachh Bharat Abhiyan and construction of individual household toilets and community/public toilets, provision of water supply and increase in awareness among local inhabitants have significantly reduced the open defecation practice of the peoples living in slums along the river stretch.

(c) Paradeep Municipality

- The wastewater of Paradeep Municipality are being treated in the Sewage Treatment Plant installed by Paradeep Port Trust.
- Municipal solid waste generated in Paradeep Municipality is collected through both door to door collection and from community bins and then transported to Bangalipadia. The wastes are composted aerobically and rejects are sorted out for landfill purpose.

Under World Bank assisted Integrated Coastal Zone Management Project, an integrated municipal solid waste management programme is being operated by Paradeep Municipality for which an area of eight acres of land has been acquired at Kansaripatia, at a distance of 5 Km from Paradeep Municipality.

- Industries established in Paradeep Municipality along the river stretch Sambalpur are being regulated under consent administration of the State Board. They have been instructed to adopt Zero Discharge Concept wherever possible, to discharge treated wastewater to River Mahanadi after complying to the discharge norm stipulated by the State Board, to install Rain water harvesting structures and plantation programs.
- Implementation of Swachh Bharat Abhiyan and construction of individual household toilets and community/public toilets, provision of water supply and increase in awareness among local inhabitants have significantly reduced the open defecation practice of the peoples living in slums along the river stretch.

(d) Other areas along Mahanadi river stretch excluding Sambalpur, Cuttack and Paradeep

Besides the four urban agglomerates such as Sambalpur, Cuttack, Sonapur and Paradeep, a number of small villages exist along the river stretch. Implementation of Swachh Bharat Abhiyan, providing incentives for construction of individual household toilets, construction of community toilets through gram panchayats, construction of low cost sanitation units, river front development, provision of water supply has decreased the open defecation practices of riparian villagers. Awareness among villages are being created under several government programmes to make the villages open defecation free villages.

Plantation Programme along Mahanadi river

Forest Department in Govt. of Odisha has launched a massive plantation program under “Green Mahanadi Mission” on the banks of the Mahanadi river and its tributaries such as Tel and Ib river. The main objective of the scheme is to rejuvenate the rivers.

Under this Mission, the State has started a drive from the year 2018-19 to plant 2-crore saplings within 1-2 Km from the bank of the river. Such plantation shall be carried out over 75,760 hectare of government land and 47,470 hectare of private land. Funds under State Plan and MGNREGS are accesses for the purpose. During 2018-19 7375.75 hectare land has been covered under Block Plantation, Gap Plantation, Bamboo Plantation and Avenue Plantation. The proposed target for the financial year 2019-20 is to cover 9779.41 hectare land. The financial provision for 2018-19 for Green Mahanadi Mission is as follows.

Funds utilized under MGNREGS : Rs. 8.55 crore

Funds allocated in Budget under State Plan 2018-19 : Rs. 120 Crore

Funds utilized under State Plan : Rs. 120 Crore

Funds Required foe 2019-20 : Rs. 101.31 Crore

Construction of Rain Water Harvesting Structures

The Water Resource Department in State Government is providing subsidy for constructing rain water harvesting structure in houses across urban area to recharge ground water and creating public awareness for installation of roof top rain water harvesting structures.

Industries established in the catchment of the river have been instructed by the Board to install rain water harvesting structures for ground water recharge, to reuse/ recycle the treated water to minimize the fresh water demand.

6.0 Implementing Authority

Panchayati Raj and Drinking Water Department in Govt. of Odisha has the mandate to implement Swaach Bharat Abhiyan (Gramin) in all the village and make the people of peripheral villages of river aware to use toilets and to provide health sanitation facilities.

Odisha Water Supply and Sewerage Board (OWSSB) under Housing and Urban Development Department in Govt. of Odisha is the implementing authority for implementation of AMRUT yojana and wastewater management project in the urban local bodies situated along Mahanadi river.

Forest Department is the implementing authority for implementation of “Green Mahanadi Mission”.

7.0 Conclusion

From the discussions in the foregoing sections it may be concluded that the impact of municipal wastewater, industrial wastewater and solid waste on the water quality of Mahanadi river is insignificant. **Marginal deviation in BOD values from the tolerance limit of 3.0 mg/l observed in the year 2016 and no deviation during the two year span from 2017 to 2018 may be taken as the basis for considering the river stretch from Sambalpur to Mahanadi as not Polluted.**

On the above background, the categorization of the river stretch of Mahanadi River by CPCB under Priority category – V with the identified stretch “Sambalpur to Paradeep” and maximum BOD values in the range 3.2 mg/l needs reconsideration. Because of marginal deviation in BOD value (3.2 mg/l during February, 2016 and 3.6 mg/l during August, 2016) and no deviation over a two year of observation in 2017 and 2018, the **stretch may be deleted from the list of polluted river stretch.**
